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ENSURING AND ENHANCING U.S. COMPETITIVENESS WHILE MOVING TOWARD A CLEAN ENERGY ECONOMY

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

JULY 16, 2009

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ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

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C O N T E N T S

ENSURING AND ENHANCING U.S. COMPETITIVENESS WHILE MOVING TOWARD A CLEAN ENERGY ECONOMY

THURSDAY, JULY 16, 2009

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

The full committee met, pursuant to notice, at 9:30 a.m. in room 406, Dirksen Senate Office Building, Hon. Barbara Boxer (chairman of the full committee) presiding.

Present: Senators Boxer, Inhofe, Carper, Klobuchar, Whitehouse, Udall, Merkley, Voinovich, Barrasso, Bond, and Alexander.

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

Senator BOXER. Good morning, everyone.

Welcome to our distinguished panel. We are very happy that you could join us. Some of you have been here before. I am looking at Mr. Doerr, who has been just remarkably available to this committee. We are so grateful to all of you.

Today's hearing will focus on creating clean energy jobs right here in America and ensuring that this country is the world's economic and technological leader in the 21st century. Our witnesses today will testify about the powerful incentives for investment that well-crafted clean energy legislation will provide.

When we unleash the American innovative spirit, we will drive economic growth and create jobs and create whole new industries here at home. American entrepreneurs will create jobs, including jobs building wind turbines so that we can export those to the world, jobs installing solar panels on homes and businesses, and jobs producing energy efficient products and a new fleet of electric and hybrid vehicles.

At the same time, we must ensure that our existing industries receive fair treatment as we transition to a clean energy economy. We need to make sure that our industries that require a great deal of energy operate on a level playing field with manufacturers in other countries.

We also have to make sure that our consumers are kept whole during the transition. You are going to hear some wildly differing views on how much it is going to cost consumers. But we have the modeling, and we know what it is. We know what the Waxman-Markey bill shows. And in our Senate work we are going to do even more to protect consumers.

The legislation recently passed in the House contains several provisions to assist industries that are energy intensive and that are subject to internal competition. We are carefully reviewing these provisions as we do more work on that bill.

At the end of the day, our competitiveness in the world economy will depend on how we face the challenge of global warming. I believe strongly that Thomas Friedman got it right in his book when he wrote that the ability to develop clean power and energy efficient technologies is going to become the defining measure of a country's economic standing, environmental health, energy security and national security over the next 50 years.

Other countries, especially China and Germany, are already building their clean energy industries. I believe that when we pass strong clean energy legislation that cuts our dependence on foreign oil and protects our children from pollution, we will also provide the impetus that will restore American leadership in the world economy.

I alluded to the distinguished members of our panel. But I wanted to mention now that we will hear from, after we hear from colleagues, and colleagues I am asking you to keep your comments to 3 minutes if you can, as I did, John Doerr, Partner, Kleiner Perkins Caufield & Byers; John Krenicki, Vice Chairman, General Electric, President and Chief Executive Officer, General Electric Energy Infrastructure; Julian Wong, Senior Policy Analyst, Center for American Progress; and Harry Alford, President and Chief Executive Officer of the National Black Chamber of Commerce.

So, with that, I will turn to my Ranking Member.

Senator INHOFE. Thank you, Madam Chairman.

Do not start the clock yet because I want to clarify something. Our side wants to have a full 5 minutes, up to 5 minutes. I would ask, respectfully, that they be granted that. That has been kind of our tradition, that is what I did when I was chairing——

Senator BOXER. Well, I would debate that is what you did all of the time——

Senator INHOFE. Always.

Senator BOXER. Well, absolutely, they can have up to 5 minutes. I was just asking out of courtesy because, the last time we did this, we did not get, we had a problem and we had to——

Senator INHOFE. Yes, I think that the gravity of the nature of this hearing——

Senator BOXER. Right.

Senator INHOFE. I think it is important to——

Senator BOXER. Right. I think colleagues have to decide if they want to speak their opinion or hear some views and then ask questions. It is up to everybody to decide that.

Senator INHOFE. Thank you. That is very fair.

Senator BOXER. Absolutely. So, let us start the clock at 5 minutes.

Senator INHOFE. All right.

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

Senator INHOFE. I would welcome our witnesses today, particularly Harry Alford. We have met before, and you have been here, and you represent a very fine group.

I think Harry, as well as many in this country, would say that today's hearing rests on some faulty logic, which kind of goes as follows: If Government imposes taxes and mandates, increases bureaucracy and spends without restraint, then Government can transform the economy and create jobs. This is a faulty logic of cap-and-trade designed to hide in cap-and-trade what it truly is.

I have often said, and you have heard me say it, that if you want to do this, which is come out and get rid of, reduce the CO_2, just have a tax on it. That is straightforward, and you do not have to hide anything, and everybody would know what it is.

The Democrats should familiarize themselves with the work of Christina Romer, who is the Chairman of President Obama's Council of Economic Advisors. She has published multiple studies on the impact of tax policy changes over the past 100 years. What she found was straightforward. She concluded: "Tax increases appear to have a very large sustained and highly significant negative impact on output." In other words, as the Wall Street Journal stated, tax hikes are anti-stimulus.

Let us be clear. Waxman-Markey is a tax increase on the American people, and that is the whole point of cap-and-trade, which is to make energy more expensive so that we will use less of it. We have many quotes along that line.

With that in mind, I read an economic analysis of the Waxman-Markey Commission by Harry's group, the National Black Chamber of Commerce. The report found, and I am quoting from your report now, Mr. Alford, claims that greenhouse gas cap-and-trade can boost total employment have become commonplace. These claims are incorrect, and the hopes that spring from them are destined to lead to disappointment.

Waxman-Markey supporters say the bill will create green jobs. That is fine. I support such jobs. But, as the Black Chamber study found, the number of these new green jobs will be lower than the number of other jobs that might be created, in other words, the green jobs.

In total, the Waxman-Markey would cause a net reduction of somewhere between 2.3 million and 2.7 million jobs. Again, that is a net reduction. That is taking all of the green jobs that are out there, and then doing your math. So we will want to talk a little bit about that during the question time.

Now, this is a fact that the cap-and-traders do not want the public to know. In the final analysis, despite what its supporters say over and over again, Waxman-Markey is not a jobs bill, it is a big bloated Government spending program.

We heard claims about the Government creating jobs before, earlier this year. The Obama administration said, let us do a $787 billion stimulus bill, and it is going to create jobs. And at that time, they were saying that the jobs were going to be reducing by increments that actually were pretty well published, and at the time of the passage, Obama said the stimulus would create or save 3.5 mil-

lion. But since that promise, unemployment has increased from 8 to 9.5 percent, hitting a 26-week high.

As Morton Zuckerman wrote in the Wall Street Journal, the cumulative job losses over the last 6 month have been greater than for any half-year period since World War II, including the military demobilization after the war.

So, I think we need to take the analysis a little bit further. And the so-called jobs bill is a 1,000-page contradiction which its supporters implicitly acknowledge but do not want to talk about.

So, I ask, why does a jobs bill include the Unemployment Insurance Program? Why does a jobs bill include Federal assistance to relocate people who lose their jobs because of the legislation? It is written into the legislation. It presumes that is the case, and I believe it is. If the bill actually creates jobs, then there would be no need for any of this, no need for a section on unemployment benefits, job relocation and all the rest of that.

The Republican plan is different. It rejects new taxes and mandates and instead encourages open access to domestic energy resources, removes barriers to innovative clean energy and so forth.

We have taken the position that we want all of the above. We want renewables. We also want clean coal technology. We want nuclear. We want oil. We want gas. We want all of the above. And I would remind this panel, I do not think I have to, but we are the only country in the world that does not exploit its own resources. I think that is what is going to have to quit for us to become energy independent.

[The prepared statement of Senator Inhofe follows:]

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

I want to welcome our witnesses today, especially Harry Alford, president of the National Black Chamber of Commerce. It's good to see you again, Harry, and I look forward to your testimony.

I think Harry, as well as many in this country, would say that today's hearing rests on faulty logic, which goes as follows: if Government imposes taxes and mandates, increases bureaucracy, and spends without restraint, then Government can transform the economy and create jobs.

This is the faulty logic of cap-and-trade, designed to hide what cap-and-trade truly is—a massive new tax on American families—and what it would do—destroy jobs here at home and send them to China and India.

The faulty logic of cap-and-trade has no basis in history. The Democrats should familiarize themselves with the work of Christina Romer, who is chairman of President Obama's Council of Economic Advisors.

Before she became a White House economist, Romer published multiple studies on the impact of tax policy changes over the past 100 years. What she found was straightforward. She concluded that "tax increases appear to have a very large, sustained and highly significant negative impact on output." In other words, as the Wall Street Journal wrote, "tax hikes are an anti-stimulus."

Let's be clear: Waxman-Markey is a tax increase on the American people. That's the whole point of cap-and-trade, which is to make energy more expensive so we use less of it. You could call it tax and ration.

With that in mind, I read an economic analysis of Waxman-Markey commissioned by Harry's group, the National Black Chamber of Commerce. As the report found, "Claims that GHG cap-and-trade can boost total employment have become commonplace . . . these claims are incorrect, and the hopes that spring from them are destined to lead to disappointment."

Waxman-Markey supporters say the bill will create "green jobs." That's fine, I support such jobs, but as the Black Chamber study found, "the number of these new 'green jobs' will be lower than the number of the other jobs that [Waxman-Markey] would destroy elsewhere in the economy."

In total, Waxman-Markey would cause a net reduction of 2.3 million to 2.7 million jobs. Again, that's a net reduction, including green jobs.

This is a fact that cap-and-traders don't want the public to know. In the final analysis, despite what its supporters say over and over again, Waxman-Markey is not a jobs bill, it's a big Government pink slip.

We heard similar claims about Government creating jobs before. Earlier this year, the Obama administration and the Democrats said the $787 billion stimulus bill was desperately needed to create jobs. They sold a big Government spending bonanza as a jobs bill. So what's happened since the stimulus bill became law on February 17th?

Thanks to Vice President Biden, we know that the "Administration misread how bad the economy was." At the time of passage, President Obama said the stimulus would create or save 3.5 million jobs. But since that promise, unemployment has increased, from 8 percent to 9.5 percent, hitting a 26-week high.

As Mort Zuckerman wrote in the Wall Street Journal, "The cumulative job losses over the last 6 months have been greater than for any other half-year period since World War II, including the military demobilization after the war."

So the question is: how can you trust those who now talk about creating green jobs, when under their watch, and I would argue because of their policies, more and more people are losing their jobs? In the case of Waxman-Markey, the same advocates of the failed stimulus bill are pushing another big Government scheme to "create" jobs. It hasn't worked with the stimulus, and it won't work with cap-and-trade.

Let's take this analysis a step further. This so-called jobs bill is a 1,400-page contradiction, which its supporters implicitly acknowledge but don't want to talk about. So I ask: why does a jobs bill include an unemployment insurance program? Why does a jobs bill include Federal assistance for relocation and job searching?

This bill hands out pink slips to workers and then promises the unemployed that they will get assistance from the Government. Message to the Waxman-Markey unemployed: don't hold your breath.

If this bill actually created jobs, then there would be no need for any of this. The Republican plan is different; it rejects new taxes and mandates and instead encourages opening access to domestic energy resources, removing barriers to innovative clean energy technologies and allowing all forms of energy to power this great machine called America.

We don't have unemployment provisions in our plan because it puts people to work, right here at home. That means a stronger economy and a Nation less dependent on foreign energy.

Senator BOXER. Senator, you ended exactly at 5 minutes.

Senator INHOFE. I did.

Senator BOXER. Congratulations.

Senator Carper.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thanks, Madam Chair.

To our witnesses, good morning, everyone. Thank you very much for joining us. It is great to see some of you back again and others to be with us for the first time.

I must say, I step back just a moment and say that I find it ironic, as some of colleagues demonize cap-and-trade, that to the extent that I studied anything as an undergraduate at Ohio State, I studied economics. One of the things that has fascinated me for a long time, both in my time in the Navy, my time as Governor, and here in the Senate, was how to harness market forces to shape public policy behavior, the kind of public policy behavior that we want.

I am amused that sometimes people say, well, why do we not just have a tax, put a tax on carbon? A lot of times I think, would those people really vote for a tax on carbon? I do not think that they would. So, a lot of times I find that the people who call for a tax on carbon would not vote for one anyway.

I never heard much of cap-and-trade, in fact, until 1990 when a fellow named George Herbert Walker Bush, our President, in signing the Clean Air Act into law, called for establishing a cap-and-trade regimen to help deal with a problem called acid rain. We had a problem with too much sulfur dioxide largely coming out of coal-fired plants in the Midwest, putting a lot of sulfur dioxide into the air and destroying our forests and our rivers, lakes and streams in the Northeastern part of our country.

By golly, people said, well, we think it going to work. But we have to put a very big price on sulfur dioxide if we are going to put in a tax. So, it turns out we did not put in a tax. We used a cap-and-trade approach.

And we ended up with a price on sulfur dioxide that is less than half of what it was expected to be. It worked. It worked then, and I think it is regarded as maybe one of the most, maybe the most, successful environmental program that we have had in this country, certainly in my lifetime. So, I just ask my colleagues to keep that in mind.

We have a number of States who have in recent years, because of the inaction here in Congress, decided to take matters into their own hands. They have adopted, as part of RGGI, adopted cap-and-trade systems on their own. We have done that in Delaware. I do not think anyone has really noticed if you want to know the truth. But we are actually realizing several millions of dollars to be able to put into clean energy initiatives, and those are creating jobs and also doing good things for the quality of our air.

The last thing I would say, and I love to quote Albert Einstein, and I am the only person on this panel that ever quotes him for some reason. But among the things that he says is, in adversity lies opportunity.

We have plenty of adversity in this country today. As we all know, aside from our economic challenges and challenges in Iraq and Afghanistan and the Middle East and all, we face huge problems with people looking for jobs, losing jobs and not being able to provide for their healthcare and other needs of their families.

Where we face challenges is with a huge trade deficit, and about one-third of that is related to the consumption of oil. What we need to do is to turn that challenge into building vehicles that will dramatically reduce our dependence on foreign oil, vehicles that we can build here. We can build the components here. We do the R&D here. And we sell them here, and hopefully export that technology abroad. That is making sure that opportunity comes out of adversity.

We have problems, still, with too much sulfur dioxide, nitrogen oxide and mercury going up into our air. We have perfected technology that will enable us, over the next several years, to reduce by 90 percent the amount of mercury emitted from coal-fired power plants. Ninety percent.

Today, there are about 600,000 women carrying children onboard, and the moms have high levels of mercury in their bodies. They are going to give birth to babies with, in many cases, brain defects. We have the ability now, for about $1.20 a month on a family's utility bill, to cut in half that number of 600,000, bring it down to 300,000, and hopefully, further beyond that.

That is taking a challenge and making something good come out of it. And an economic opportunity that will enable us to take that technology for reducing mercury by 90 percent in emissions from coal-fired plants and sell that technology all over the world.

So, I would say to my colleagues, we are lucky to have this panel here. I do not know some of you well, but some of you I know pretty well. I especially look forward to hearing from John Doerr again. I am hoping that he will tell us, it is advice that I have heard him give before, what are the three most important things that we can do in order to make sure that we do find that opportunity, that pony in that pile of manure, if you will, and find that opportunity that we all looking for, the economic opportunity. It is here, if we are smart enough to find it.

Thank you so much.

Senator BOXER. Thank you so much, Senator.

Let us see. According to arrival, I have got this list. Let us see if this is right. I have got Barrasso, Bond, Alexander, and Voinovich. Does everyone agree?

Senator Barrasso.

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

Senator BARRASSO. Well, thank you very much, Madam Chairman.

I want to welcome our guests.

Madam Chairman, the Waxman-Markey bill has been entitled the American Clean Energy and Security Act. It is also known as ACES. And ACES to me is a bad bet, a bad bet for enhancing U.S. global competitiveness and for creating jobs.

The American people do not want Congress gambling with their future. With the so-called stimulus bill, taxpayer money, I thought, was gambled on the bet that 3.5 million jobs would be saved or created and unemployment would not exceed 8 percent.

The supporters of ACES claim that this bill is not so much a climate change bill, they claim it is more of a jobs package. They say it is going to create 1.7 million jobs, new jobs, green jobs.

Well, this might make sense to people inside Washington, but I think most folks outside the Beltway would find it odd that this so-called jobs package includes language that subsidizes and retrains workers who lose their jobs because of the bill.

The authors of this bill, to me, are overstating their case, and the taxpayers should be concerned about taking another major gamble in allowing for this massive energy tax scheme to pass.

The United States cannot be competitive with foreign countries if we increase the costs of doing business in the United States. China and India have not accepted the Administration's leadership on this issue, especially when binding limits were proposed by the Administration to the Chinese at the Group of Eight Summit last week. According to the New York Times yesterday, Chinese officials have strenuously opposed binding limits on emissions of greenhouse gases by developing countries.

Professor Pan Jiahua, one of China's top advisors on climate change diplomacy and economics, was quoted in the Sydney Herald in the weeks leading up to the summit as saying that China is not

at all impressed with Obama. Obama's statements are certainly insufficient, he says, and his demands for developing countries are unrealistic.

So to me, no action by the United States in slowing down and limiting our own economy through a cap-and-trade scheme is going to change China's position.

In the New York Times today, American Officials Press China on Efforts to Curb Greenhouse Gases. A little before this committee met, I visited with Governor Huntsman from Utah, who has been nominated to be Ambassador to China, about this specific article. There is a picture of Secretary of Energy Chu, who is in Beijing.

In today's New York Times, they talk about Secretary Chu. It says if China's emissions of global warming gases keep growing at the pace of the last 30 years, the country will emit more such gases in the next three decades than the United States has in its entire history. Now, this is not me. This is said by Mr. Chu, a winner of the Nobel Prize in Physics.

So that is what we are looking at. To me, our Nation must remain competitive globally. To do so, we need to make America's energy as clean as we can, as fast as we can, without raising energy prices on American businesses and on American families.

Our end goal must be to do everything we can to keep the jobs that we have now in the United States and then also find ways to add more green jobs. Americans want all of these jobs and more. We need them all.

Senator Carper left. He said no one on the committee ever quotes Einstein. You know, Einstein had his magic formula, E equals MC squared. I do not want to quote the specific formula, but to paraphrase, to me energy is the E and MC means my country. Energy for my country squared. That is the way we get energy independence.

Thank you.

Senator BOXER. OK. Let me put into the record the article that you quoted. I think that was really good that you brought it up. I will put that article into the record.

But, there is also an article in the Washington Post that talks about how the leaders of Asia are "pouring money into renewable energy." I think we will hear more about that from folks who have spent time over there. But I will address your other comments when I get a chance in my 5 minutes.

So, we will move now to Senator Bond.

[The referenced articles follow:]

The **New York Times**

July 16, 2009 Thursday
Late Edition - Final

American Officials Press **China** on Efforts to Curb Greenhouse Gases

BYLINE: By KEITH BRADSHER

SECTION: Section A; Column 0; Foreign Desk; Pg. 10

LENGTH: 947 words

DATELINE: BEIJING

The top American energy and commerce officials called in speeches here on Wednesday for **China** to do more to address global warming, contending that the country was particularly vulnerable to a changing climate.

Energy Secretary Steven Chu warned in a speech at Tsinghua University, **China's** top science university, that if humans did not reverse the rising pace of their **emissions** of greenhouse gases, more people would be displaced by rising sea levels in **China** than in any other country, even Bangladesh.

If **China's emissions** of global warming gases keep growing at the pace of the last **30 years,** the country will emit more such gases in the next three decades than the United States has in its entire history, said Mr. Chu, a winner of the Nobel Prize in Physics.

While Secretary of State Hillary Rodham Clinton and other Obama administration officials have mentioned **China's** contribution to global warming during visits here this year, the remarks by Mr. Chu and Commerce Secretary Gary Locke were by far the strongest public criticisms yet, and the clearest demands that **China** take action.

Mr. Locke said in a speech to the American Chamber of Commerce that **China** shared a special responsibility with the United States to address global warming. **China** passed the United States two years ago as the world's largest emitter of greenhouse gases, and together the two countries account for 42 percent of **emissions** caused by humans.

''Fifty years from now, we do not want the world to lay the blame for environmental catastrophe at the feet of **China,**'' Mr. Locke said.

Mr. Chu and Mr. Locke, who are both of Chinese heritage, called for the United States and **China** to work together to develop new technologies to generate clean energy and to improve energy efficiency.

After meeting Wednesday afternoon with senior Chinese officials, they announced that each country would put up $15 million for a joint research center on clean energy, with headquarters in each country at locations not yet decided.

They are to meet again with Chinese officials on Thursday.

Xinhua, **China's** official news agency, from which the other news media in **China** tend to take their cue, carried a long article on the two cabinet secretaries' speeches and a shorter one on the creation of the joint research center.

But while the long article included a quotation from Mr. Locke in which he acknowledged that the United States had been emitting greenhouse gases for 150 years, neither Xinhua article included any mention of **China's** role or of the American criticisms of that role.

The longer article made only a passing mention that **China** and the United States were the top two emitters, but did not say that **China** had surpassed the United States in that regard. Chinese officials issued no response to any of the secretaries' remarks.

In separate interviews, Mr. Chu and Mr. Locke also said they wanted **China** to show respect for American intellectual property and to remove trade barriers to American energy technologies.

As **China** seeks to develop and shelter its own energy industries, its growing trade restrictions are a potentially serious obstacle to such cooperation, a factor underlined by the signing of a General Electric contract that Mr. Locke attended in Beijing.

G.E. signed a contract with the Pucheng Clean Energy Chemical Company to license G.E.'s technology for turning coal into a gas for use in a Chinese chemical factory.

The Chinese government prefers technology licensing agreements, in which Western companies transfer technology to Chinese factories, to buying finished goods from factories abroad.

The chemical factory licensing agreement is also a small transaction, estimated at $20 million, compared with the construction of a $375 million power plant **China** recently started on the outskirts of Tianjin, 90 miles from Beijing, that will turn coal into a gas before burning it.

G.E. executives spent more than a decade trying to win a contract to build such a power plant in **China,** sharing extensive technical information with Chinese power engineers on how they would go about it.

But at a ceremony in Tianjin on July 6, Chinese officials announced that they were ready to build the 250-megawatt power plant themselves and that they would no longer need to buy Western technology.

Jack Wen, the president of G.E.'s **China** energy division, welcomed the Pucheng contract and said his company was interested in working with **China** to build a similar power plant even bigger than the one now under construction in Tianjin.

Chinese officials have strenuously opposed binding limits on **emissions** of greenhouse gases by developing countries, most recently at the Group of 8 meeting in Italy last week. They have emphasized that industrialized countries are responsible for most of the **emissions** already in the atmosphere, and that **emissions** per person remain higher in rich countries than in developing ones.

Mr. Chu acknowledged these points by presenting charts showing that Chinese **emissions** per person were still roughly a quarter of American **emissions** per person and showing that the United States had put three times the amount of greenhouse gases into the atmosphere as **China** since the beginning of the Industrial Revolution. He also acknowledged that **China** had more stringent automotive fuel economy standards than the United States.

But Mr. Chu and Mr. Locke were clearly trying to hone counterarguments, based mainly on the dangers to **China** and the world if Chinese **emissions** continued to rise quickly.

''We're not talking about their giving up prosperity; we're talking about their using energy in a more efficient way,'' Mr. Chu said in an interview.

URL: http://www.nytimes.com

LOAD-DATE: July 16, 2009

LANGUAGE: ENGLISH

GRAPHIC: PHOTO: Secretary of Energy Steven Chu spoke at Tsinghua University in Beijing Wednesday. (PHOTOGRAPH BY **CHINA** DAILY, VIA REUTERS)

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The Washington Post
washingtonpost.com
The **Washington Post**

July 16, 2009 Thursday
Suburban Edition

Asian Nations Could Outpace U.S. in Developing Clean Energy; American Markets' Slump Feeds Worry

BYLINE: Steven Mufson; **Washington Post** Staff Writer

SECTION: FINANCIAL; Pg. A14

LENGTH: 1048 words

President Obama has often described his push to fund "clean" energy technology as key to America's drive for international competitiveness as well as a way to combat climate change.

"There's no longer a question about whether the jobs and the industries of the 21st century will be centered around clean, renewable energy," he said on June 25. "The only question is: Which country will create these jobs and these industries? And I want that answer to be the United States of America."

But the leaders of India, South Korea, China and Japan may have different answers. Those Asian nations are **pouring money into renewable energy** industries, funding research and development and setting ambitious targets for renewable energy use. These plans could outpace the programs in Obama's economic stimulus package or in the House climate bill sponsored by Reps. Henry A. Waxman (D-Calif.) and Edward J. Markey (D-Mass.).

"If the Waxman-Markey climate bill is the United States' entry into the clean energy race, we'll be left in the dust by Asia's clean-tech tigers," said Jesse Jenkins, director of energy and climate policy at the Breakthrough Institute, an Oakland, Calif.-based think tank that favors massive government spending to address global warming.

Energy Secretary Steven Chu and Commerce Secretary Gary Locke are visiting China this week to discuss cooperation on energy efficiency, renewable energy and climate change. But even though developing nations refused to agree to an international ceiling for greenhouse gases last week, China and other Asian nations are already devoting more attention to cutting their use of traditional fossil fuels such as oil, natural gas and coal.

South Korea recently said it plans to invest about 2 percent of its GDP annually in environment-related and renewable energy industries over the next five years, for a total of $84.5 billion. The government said it would try to boost South Korea's international market share of "green technology" products to 8 percent by expanding

research and development spending and strengthening industries such as those that produce light-emitting diodes, solar batteries and hybrid cars.

China and India are kick-starting their solar industries. India aims to install 20 gigawatts of solar power by 2020, more than three times as much as the photovoltaic solar power installed by the entire world last year, the industry's best year ever. And China's new stimulus plan raises the nation's 2020 target for solar power from 1.8 gigawatts to 20 gigawatts. (A gigawatt is about what a new nuclear power plant might generate.)

"China is trying to catch up in a global race to find alternatives to fossil fuels," the official China Daily said in an article last week.

"A lot of people underestimate how focused China is on becoming a global leader in clean technology," said Brian Fan, senior director of research at the Cleantech Group, a market research firm. China now provides a $3-a-watt subsidy upfront for solar projects, he said, enough to cover about half the capital cost. Fan said it is "the most generous subsidy in the world" for solar power.

China is also expected to boost its long-term wind requirement to 150 gigawatts, up from the current 100 gigawatt target, by 2020, industry sources said. Jenkins said China could provide $44 billion to $66 billion for wind, solar, plug-in hybrid vehicles and other projects. Fan said China also plans to make sure that many of the orders go to its own firms, Gold Wind and Sinovel.

The big Asian research and investment initiatives come as U.S. policy makers boast about their own plans, giving ammunition to those who say this country needs to do more.

"That R&D represents America's chance to become the world's leader in the most important emerging economic sector: energy technology," said House Majority Leader Steny H. Hoyer (D-Md.) in a May 13 speech to the U.S. Chamber of Commerce. "In the years to come, I hope that America will be selling clean technology to China and India and not the other way around."

Confident that the United States will develop top-notch technology, the House voted overwhelmingly on June 10 to oppose any global climate change treaty that weakens the intellectual property rights of American green technology.

"We can cede the race for the 21st century, or we can embrace the reality that our competitors already have: The nation that leads the world in creating a new clean energy economy will be the nation that leads the 21st century global economy," Obama said on June 29.

But countries in Asia are not standing still waiting for U.S. advances.

That both excites and worries U.S. manufacturers torn between opportunity and fear of a boost for Asian competitors at a time when the world's biggest market, the United States, has slowed down sharply. "This is heavy manufacturing business. The U.S. has had a great position over the last several years," said Vic Abate, vice president of renewables at General Electric, the world's number two wind turbine company. "If it slows down and if investment doubles down in China, it will be a lot harder to catch up."

"We have already been left behind in some areas," said Mark Levine, director of the environmental energy technologies division at Lawrence Berkeley National Laboratory. "But . . . there remain many opportunities," he said, adding that "the U.S. can carve out key areas in clean energy technology."

Although GE is the only U.S. company among the world's top 10 wind turbine makers (China has two, Germany has three), Levine said "there are areas in wind energy where we are likely to develop crucial technologies that we will both exploit and likely

license to others." He cited advanced materials that would permit stronger rotors and techniques for taking advantage of higher wind speeds at greater heights.

Levine said the United States is unlikely to "become the or even a leading photovoltaic manufacturer. But our scientific talent . . . has a good chance of developing the next-generation PV systems which we could either manufacture in China or another country . . . or license to foreign companies. . . . Even if the manufacturing is done abroad, this will lead to very real and large benefits to the U.S. from licensing fees, not to say sales in the U.S. and elsewhere."

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GRAPHIC: IMAGE; Photos By Alexander F. Yuan -- Associated Press; Workers paint wind turbine blades at a factory of Guodian United Power Technology in Baoding, in China's Hebei province. China is among the Asian nations **pouring money into renewable energy** industries.
IMAGE; A worker checks solar-powered traffic lights at Victory Traffic Facilities Engineering in Baoding.

PUBLICATION-TYPE: Newspaper

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

Senator BOND. Thank you very much, Madam Chair, and thank you to our distinguished witnesses. I am particularly delighted to see a distant cousin, Mr. Doerr, as we pronounce it from the original German.

We will have other discussions about the investments that China is making, which is good, in clean energy, but I also agree with China that they are not going to accept something like our cap-and-trade.

We are here today to talk about jobs. We have a disturbing report that will be presented by Mr. Alford that cap-and-trade legislation will kill millions of U.S. jobs, even after including green job gains.

The National Black Chamber of Commerce, as the Ranking Member has outlined, commissioned an economic analysis of the House bill which found that "cap-and-trade would cut net employment by 2.5 million jobs per year, even after accounting for new green jobs." And next week we will have an opportunity to talk about jobs, green jobs that are productive and green jobs that are simply subsidized, to a great extent, by the U.S. taxpayer, us.

It is important because, no matter what you say about green jobs, we will have under Waxman-Markey significant job loss. The higher energy costs will make it desirable to have green jobs. There are green jobs that we must pursue. But we can only afford to buy so many.

The findings of the National Black Chamber of Commerce shows that there will be 2.5 million more jobs killed than created. Some have tried to question the integrity of the chamber, but I do not. What I do question is how we would even consider killing 2.5 million jobs in America when we are in the middle of the worst recession since World War II and suffering high unemployment.

The chart here shows the current unemployment rate in each State. The darker States are those suffering unemployment rates over 10 percent: Indiana, Michigan, Ohio, Florida, and North Carolina. My State of Missouri, regrettably, is up there at 9 percent. We see the Midwest and the South are currently suffering some of the highest rates of unemployment in the Nation. Why would we hit that region with more job loss?

Cap-and-trade would hit the Midwest and South with higher power bills. Now, this chart calculates a State-by-State increase in power bills in 2015 from Waxman-Markey. It is based on data from the U.S. Energy Information Administration, as well as the National Black Chamber of Commerce. The darker States represent those States which will suffer power bill hikes of over $500 million per year, States across the Midwest and South.

Cap-and-trade is a double-barreled shotgun of lost jobs and higher energy taxes pointed at the Midwest and the South. We must ask ourselves, who will we hurt when you take their jobs and raise energy costs? Who are these Midwestern manufacturing workers suffering now and who will suffer more?

Here is the cover of the New York Times Magazine from June 28th. It is a picture of Augustine Powell and his son, Marvin. Their story is entitled, GM: Detroit and the Fall of the Black Middle

Class. As the story describes, the Powell family left the South in the 1960s seeking better opportunities in the North in the auto industry. "Now the life that they built is in danger of slipping away."

A good paying manufacturing job in the auto industry gave the Powells a middle class way of life: healthcare, education, vacations. The Powells were able to leave the city of Detroit for a quiet, racially integrated suburb of modest middle-income homes north of the city. Now, families like the Powells and plenty of families like them at closing assembly plants in Missouri are threatened of falling out of the middle class and slipping down into the working, or even out-of-work, poor.

My fear is that what the recession and the faulty management decisions did to the auto industry the U.S. Congress is planning to intentionally do to the rest of the U.S. manufacturing in the Midwest, killing our jobs and driving many overseas to China.

For the sake of the Powells and millions of threatened blue collar workers like them, I urge my colleagues to oppose job killing and energy tax raising cap-and-trade legislation.

I thank the Chair.

Senator BOXER. Thank you, Senator Bond.

Senator Whitehouse.

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

Senator WHITEHOUSE. Thank you very much.

I appreciate very much my friend from Missouri's passionate defense of union wage scales and the kind of middle class life that unionized employment can bring to the middle class. I am very glad to hear him make that point.

We are in the middle of a very interesting debate here. There is an underlying premise to many of my colleagues' questions, which is that if we would just leave well enough alone, let the polluters continue to pollute for free, listen to the sweet nothings that the oil companies are dribbling into our ears, and continue the happy hemorrhage of billions and billions and billions of U.S. taxpayer dollars into the pockets of foreign nations that run oil economies, everything will be just fine.

And it is only the dreaded interference in the economy by trying to impose some form of cost on companies that are now polluting for free that presents any downside to us.

I wonder, starting with Mr. Doerr, if I may, if you have any thoughts on what the baseline proposition is here. Is the baseline proposition just a happy continuance of the status quo with no harm or cost to anyone and the downside on our side——

Senator INHOFE. Is this an opening statement?

Senator BOXER. This is an opening statement.

Senator WHITEHOUSE. I am sorry. I thought we are still on opening statements.

Senator INHOFE. We are.

Senator WHITEHOUSE. Well, make that my opening statement. It is a tee up for the question to come.

[Laughter.]

Senator BOXER. Thank you very much, Senator.

Now, next on our list is Senator Alexander.

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

Senator ALEXANDER. Thanks, Madam Chairman. Thanks for having the hearing. And thanks to the four of you for coming.

I am glad to have this discussion about jobs and to try to put it in some perspective. When I think of jobs, I think of my State. So here is what is going on in my State: people are looking for cheap energy.

Alcoa shut down its smelter where my dad worked all his life. They are waiting for a cheaper electricity contract from TVA. A major air conditioning company in Fayetteville, they make a large percentage of all the air conditioners in the United States, tells me that if their electricity prices go up, they go overseas.

Eastman Chemical has hired 10,000, 12,000, 14,000 people in the upper east Tennessee area for a long, long time. Natural gas is their feedstock. If their electricity and energy costs go up, overseas those jobs go.

We are lucky to have big new computers coming into Tennessee, affiliated with the Oakridge National Laboratory. One reason they are there is that we have lots of low cost, reliable, cheap electricity. I believe computers are probably 5 percent of our electricity use today.

We are making solar power a major objective of our State. Our Governor is, which I totally agree with, trying to focus on research and development. And we have attracted two plants that make polysilicon. Each of those plants uses 120 megawatts of electricity. They are huge users of electricity. They would not be in a State or country where electricity costs are high. They want to be a place where they have cheap electricity.

A third of our manufacturing jobs are auto jobs. They tell me, the suppliers, that every day they are looking at costs, and there are many costs, but if electricity costs go up a lot, energy costs go up much more, they will be in Mexico and Japan building cars instead of Tennessee and Michigan.

And last December, 10 percent of Nashvillians, even with TVA's relatively low electric rate, said they could not pay their bills because the rates were too high.

Somewhere in this debate I think we have overlooked the importance of cheap energy. Because high priced energy means jobs, which we are discussing today, go overseas looking for cheap energy. Also, we now are especially looking at clean energy. Senator Carper and I have introduced legislation several times to remove mercury and sulfur and nitrogen, and I believe we need to slow the use of carbon.

Is there some way we can have carbon free as well as cheap energy? And I am wondering, and I hope to hear from the four of you, why the strange silence about nuclear power? Nuclear power produces 70 percent of our carbon-free electricity and solar and wind, and all of the things that you are writing about produce 3 or 4 percent of our carbon-free electricity. Oh, 6 percent, excuse me.

Mr. Doerr, I read your testimony. You went all the way through it without mentioning nuclear power. And I read the GE testimony, and GE has been a leader in nuclear power, and you do talk about it, but not about the future. It is all about wind. And I read the

testimony about China, and it overlooks the fact that China is creating more new nuclear power plants than the rest of the world combined.

So, if we are really serious about clean energy, as well as cheap energy, why this strange silence about nuclear energy when it is 70 percent of our carbon-free electricity?

Maybe we need a nuclear power mandate for States. If it is not a renewable power, I mean, if it were included in the renewable power definition of the renewable mandate, Tennessee would be 40 percent clean. Not 20, but 40. So maybe we need a definition of clean energy that is 40 percent or 50 percent and includes nuclear power. And if it not a renewable power, maybe we need a clean energy mandate for base load power.

But why the strange silence about this? We invented it. France is 80 percent nuclear. They have the lowest carbon emission rates, almost the lowest, and among the lowest electrical rates in the European Union. I am all for doubling our energy R&D, or even more. But I wonder why we seem to have a national windmill policy instead of a national clean energy policy, and I hope to hear more about that as we go.

I have expired, Madam Chairman.

[Laughter.]

Senator BOXER. You have not expired.

Senator Voinovich.

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

Senator VOINOVICH. Thank you, Madam Chairman.

I would apologize, right from the beginning, that I am going to leave, after my words, because I am the Ranking Member on another committee, and we have two of the Administration's nominees up for confirmation. I just want you to understand that.

The impact this legislation will have on jobs, workers and families is the heart of my concern with the Waxman proposal. Indeed, few regions of the country will be impacted more than the Midwest. Ohio gets 87 percent of its energy from coal.

That this bill will cost my State and the country jobs, I think, is without dispute. Despite wild claims of green job creation, there is no credible analysis that suggests that this bill will be a net job creator. I think that Senator Inhofe did a good job and said the bill includes a provision called the Climate Change Worker Assistance Program which basically anticipates that we are going to lose jobs, and they are going to try to compensate for those lost jobs.

It is interesting that we had a hearing with all of the coal producers yesterday, Senator Carper and I did, and they said that they are really concerned about the impact of this on manufacturing. We have got residential taxpayers whose energy bills will be impacted, but they are really concerned about the manufacturers.

GE, you know, a lot of jobs are gone from Ohio. In 2007, 425 jobs were eliminated. The company decided to close six of its U.S. lighting factories. Where are they making the products now? They are making them in China. It is our fault. Quite simply, we are not fostering an environment that is friendly to business.

I saw what happened with the poorly calibrated energy policy we had toward natural gas. The spike in natural gas in 2001 was the beginning of the recession in Ohio. And we definitely, I can show you thousands of jobs that we lost in chemical and plastic industries because of the increase in natural gas costs. And many of us believe that we are going to see a continuing increase in those costs because of this legislation, where many companies will be shifting from coal over to natural gas.

The other thing that I think that we need to talk about, candidly, is that unless we can bring China and India and the other developing nations in to this new regime, no matter what we do, it will not matter. We asked the question yesterday of the six people that were at our hearing. I said if the United States shut down completely and had no greenhouse gas emissions and the developing countries continued to do what they were doing, what impact would we have? And the answer to that was zippo, nothing.

And I think Senator Barrasso did a really good job today of quoting what is going on today in the world. In other words, we are in the real world. We are in a competitive environment, and we need to look at it.

My feeling is that until we can sit down with the WTO and work out something in terms of folding in emissions in terms of the consideration of the WTO, our going ahead without that is just foolhardy.

The other thing that I want to mention is this. The biggest problem that we have today in terms of emissions is coal. We have coal; the Chinese have coal. If we really wanted to do something about greenhouse gas emissions, we would have a, what did we call it when we developed the atomic bomb? What's the word? We would have a Manhattan Project that would get the best and the brightest people the world together to try to come up with technology that would capture and sequester coal, because I think that if we do not do that, we are finished.

With the Chinese putting two coal-fired plants on a week, we are in trouble. And I think we need to reevaluate our priorities as to where we are putting our money. I am all for wind. I am for solar power. But by golly, we know that coal is going to continue to be a major producer of energy in this world, and unless we get it under control, we are in deep trouble.

I want to thank you very much for your being here today, and I apologize for not being here to hear what you have to say. Hopefully, I will get back so I can hear some of the questions.

Thank you.

[The prepared statement of Senator Voinovich follows:]

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

Madam Chairman, the impact this legislation will have on jobs, workers and families is at the heart of my concerns with the Waxman proposal. Indeed, few regions of the country will be impacted more than the Midwest. Ohio, which relies on coal for more than 87 percent of its electricity demand and has a large manufacturing base, has much to lose under this proposal.

That this bill will cost my State of Ohio and the country jobs is without dispute. Despite wild claims of green job creation, there is no credible analysis that suggests that this bill will be a net job creator. In fact, the authors of the legislation included in the proposal numerous provisions to provide assistance to workers who will lose

their jobs as a result of the program. For example, the bill includes provisions called "Climate Change Worker Adjustment Assistance (CCWAA)," which provides a form of unemployment insurance for those who are going to lose their jobs because of Waxman-Markey. I find it very disturbing that this provision is included in what proponents are calling a "jobs bill."

The job losses that will come from this legislation stem from the bill's overlapping and redundant requirements, including cap-and-trade provisions, an RES, and numerous other source specific requirements, many of which are unachievable with today's technologies. Recognizing the disconnect between what technology can deliver and the bill's objectives, the authors allow for up to 2 billion offsets annually to meet the targets. And because 1 billion of these offsets can be obtained from outside the U.S., what we're looking at is transferring tens of billions of U.S. dollars overseas to meet the bill's compliance obligations. Indeed, a simple calculation based on the bill's allocation formula and Ohio emissions reveals that Ohio families and workers would be subsidizing their competitors to the tune of $688 million (assuming a modest carbon price of $15 per ton) in the first year of the program alone. Perhaps the green jobs that the Waxman-Markey proponents are referencing aren't actually U.S. jobs, but jobs in China.

I note that GE is here today to discuss competitiveness issues associated with this bill. Unfortunately because of increased globalization and ever complex and increasing environmental compliance, companies such as GE are shuttering many of their U.S. facilities, including some in Ohio, and are relocating to developing countries. Indeed, in 2007 about 425 jobs were eliminated in Ohio when the company decided to close 6 of its 26 U.S. lighting factories. And where is GE now making those products? China. I don't fault GE for this move. It's our fault: quite simply, we are not fostering an environment that is friendly to business. And this trend is nothing new. It is the continuation of a disturbing pattern that I fear will be exacerbated by the many overlapping mandates contained in the Waxman bill.

Residential consumers, small businesses, manufacturers and industrial operations all depend on reliable and affordable energy. Poorly calibrated environmental policies have already resulted in sharp increases in energy and natural gas prices, impairing the competitive position of U.S. manufacturing companies in domestic and world markets. According to the Department of Labor, these increases have contributed to a loss of over 3.1 million U.S. manufacturing jobs.

Many people engaged in this debate down-play the impacts that climate policy will have on our economy. And although the "green jobs" movement as advanced by the environmental establishment is trying to convince us that rationing energy resources will save the world and our economy, there is little to support these claims. Cap-and-trade will not result in net job creation any more than it will result in reduced energy costs.

Recognizing that the bill will put U.S. manufacturers at a disadvantage to overseas competition, proponents seek to offset compliance and fuel and input costs through a system of rebates and border tariff provisions. Yet many manufacturers from my State tell me that they don't qualify for the rebates and that the bill's costly requirements will force plant closures and relocation overseas. In fact, the president of US Steel, John Surma, representing a company supposedly protected by these provisions, recently told me that if the bill passes, no more steel plants would be built in the U.S. and that existing facilities would be phased out and moved overseas. This is bad for the environment and the economy. Similarly, the border tariff provision, a holdover from last year's climate bill, is of dubious merit. Even if it is found to be consistent with WTO requirements—and many believe that it isn't—the Obama administration does not support the provision, and it is therefore likely to be stripped before final passage.

Yesterday, Senator Carper and I had a roundtable discussion on this bill and the future of coal. Witnesses included representatives from industry and environmental groups. There was much agreement, including recognition that the U.S. could eliminate all CO_2 emissions and global temperatures would not be impacted unless developing countries take similar measures. Meanwhile, China and India remain resistant to mandatory controls. This is not to say that we should do nothing. But the steps we take should be measured and consistent with the goals to be realized.

So, Madam Chairman, I think we have a lot of work to do to get this right. My goals throughout this process are to keep the Nation's economy, and that of Ohio, on a sure footing while decreasing emissions. Congressman Waxman's bill just doesn't get the job done and in fact is a threat to the economy when people are already hurting.

Senator BOXER. Thank you.

Well, now we are going to move to our distinguished panel. And by the way, we are going to each have 7-minute rounds to question because I think we have a lot to learn from this panel.

So, we are going to start with John Doerr, a partner of Kleiner Perkins Caufield & Byers. I would say, just for those who do not know Mr. Doerr, and most of you do, he has been involved in making decisions about the future that have proven right in a lot of very famous cases. I believe one was Google. Was one Amazon? So that is two.

I think that, as we sit here thinking about the future, this is a man who has put his money on the future and that of his clients. So, I think that his words should carry some weight in the business community and also to elected leaders and to working people.

With that, please go ahead Mr. Doerr.

STATEMENT OF JOHN DOERR, PARTNER, KLEINER PERKINS CAUFIELD & BYERS

Mr. DOERR. Thank you, Chairman Boxer, Ranking Member Inhofe and members of the committee.

My name is John Doerr. I am a partner at Kleiner Perkins Caufield & Byers. I am here because America confronts three interrelated crises today: an economic crisis, a climate crisis, and an energy security crisis. But my message is about a fourth, and that is a competitive crisis.

There is no topic of greater importance for America's economic future. The decisions you are going to be making are going to determine whether we lead or lag in tomorrow's global energy markets. And the difference between those two futures is really dramatic.

In the United States alone, our energy costs are more than $1 trillion per year. That is for oil, coal, natural gas, nuclear and renewable energies. That is on top, that $1 trillion is on top, of another $2 trillion that we spend on our homes, our shops, our factories and our cars. So, that is $2 trillion a year that is at stake in the United States of America, right here, every year.

Is that money that we want to send overseas to import oil? Are those goods we want to purchase from our competitors or make here in the United States? Do we want to produce that energy and make those goods and create those jobs here, or there? That is the question.

Do we want to be the worldwide winner in the next great global industry, which is clean energy? We are clearly not in the lead today, and that position is held by China. China understands clearly that controlling its energy future is fundamental, and its commitment to develop and own the clean energy technologies and markets is breathtaking to me.

China's cars are already more than one-third more fuel efficient than U.S. cars. China is investing 10 times more than the United States on clean power as a percent of GDP, 10 times more. And they are on track to deploy 120 gigawatts of wind by 2020. That is equal to the entire global total and 10 times that of the United States. And, incidentally, it will create 150,000 jobs.

As a result, they are curbing their emissions substantially today compared to business as usual. In fact, they are going to abate 350 million tons of CO_2, as much of all of Argentina emits.

Now here is the point. The United States led in the electronics, the biotechnology, the information technology, the Internet, the IT industry revolution. But as we sit here today, we are in danger of letting the energy technology revolution pass us right by.

What do Amazon, eBay, Google, Microsoft and Yahoo have in common? Those are the five global leaders in the IT industry, and every one of them is American. When you look at the global wind industry, look at the top five players, only one, General Electric, only one, is American. So, the United States is now home to only 1 of the 10 largest solar PD producers. Only 2 of the top 10 advanced battery manufacturers.

I want to bring this home and make it very personal, Senators. The question is: when our sons and daughters go get jobs in the world's great new clean energy companies, are those companies going to be headquartered in China or the United States?

I am an American engineer and businessman. My partners and I have helped build 500 new U.S. companies, creating 400,000 jobs. In fact, just last month we announced 1,500 new jobs for a new American low carbon car company in Louisiana, with the support of Senator Vitter and other members of the delegation.

So, I am trying to do my part. But I want to tell you, our Government's energy and climate policies are our principal obstacle to success. To repeat that, the current policies are the principal obstacle to creating even more new jobs in this next great global industry.

You have not given us any clear, long-term market signal, to our companies or our consumers, that we value low carbon energy. We have no policies to discourage sending hundreds of billions of dollars overseas every year for energy. We do not even have adequate R&D to compete in this huge industry. So, today's policies are stifling America's competitiveness and America's entrepreneurs.

Now, good policy can turn this around. We can turn this thing around and give us a fighting chance to lead in these industries. There are just four elements of really very good policies.

Yes, Senators, the top three policies are to put a cap in price on carbon, a cap in price on carbon, and a cap in price on carbon. Easy to say. Why? Without a long-term market signal, without a cap on carbon emissions and a price on carbon, we are not going to get serious innovation at scale in our domestic markets, we are not going to create local demand, and we are not going to have great American success stories.

There are other important policies. Let us get the rules of the road right for our utilities. Let us set smart standards that are steadily stronger so that America has the most efficient buildings, and the most efficient cars and appliances in the world. And let us be sure to take those savings and stuff them in the pockets of our consumers and our businesses. And as I have said before, let us get serious about research and development and deployment.

These policies, they are proven. There is no risk in these policies. We have seen them work in other States and in other countries. They unleash America's competitiveness, tempered by market

forces. They are broadly endorsed by multi-national companies and by the President's Economic Recovery Advisory Board.

There is still time for us to get in this global race, although I am here today to tell you that the window is closing, and it is closing really very fast. We have got to have low carbon policies to exploit America's strengths, our innovation and our entrepreneurs.

I understand that putting these policies in place is a pretty heavy political lift. But without a doubt, Senators, bad energy policy has cost our country dearly, and the costs of continuing it are incalculable. That is because our competitors have woken up. We need to do the same, or we are going to be buying our future from them.

Thank you.

[The prepared statement of Mr. Doerr follows:]

Statement by

John Doerr
Partner, Kleiner Perkins Caufield & Byers
Thursday, July 16, 2009

Submitted to
U.S. Senate Committee on Environment & Public Works

Hearing Regarding
"Ensuring and Enhancing U.S. Competitiveness while Moving toward a Clean Energy Economy"

INTRODUCTION

Chairman Boxer, Ranking Member Inhofe and Members of the Committee, I am John Doerr, Partner at Kleiner Perkins Caufield & Byers. I appreciate the opportunity to be here before the Environment and Public Works Committee to discuss energy and climate policy.

You have heard many times that America confronts three interrelated crises: an economic crisis, a climate crisis, and an energy security crisis. Well, my message today is there's a fourth: it's a competitiveness crisis. It is a looming crisis in America's worldwide standing in the next great global industry, green technology.

There is no topic of greater importance for America's economic future.

Your decisions will determine whether the US leads or lags in tomorrow's global energy markets. And the difference between those two futures is dramatic.

THE ENERGY CHOICE

In the U.S. alone, energy costs total more than $1 trillion per year -- for oil, coal, natural gas, nuclear and renewable energy.[a] (See Exhibit 1 for more detail.)

This is *on top of* a similar sum we spend each year on what uses energy — our homes, shops, factories, and cars. That means about $2 trillion per year is at stake right here in the United States.

We must ask ourselves:

- Is that money we want to send to hostile powers to import oil?
- Are those goods we want to purchase from competitors?
- Or, do we want to produce that energy, make those goods, and create those jobs here in America?

Do we want to be the world-wide winner in the race to lead the next great global industry, clean energy? That is the choice before us.

CHINA IS WINNING

Guess who is leading the race today? China.

China understands that controlling its energy future is fundamental. Its commitments to develop and own clean energy technologies and markets are breathtaking.

- China's cars are more than one-third more fuel efficient than US cars.[bc]
- China is investing ten times more than the US on clean power as a percentage of GDP.[dcfg]
- China's growth in renewable energy supplies is astonishing: In wind alone, China's capacity has doubled in *each* of the past four years, and China is expected to become the world's largest wind manufacturer this year.[h] China is on track to deploy 120 gigawatts of wind by 2020[i] — that's equivalent to today's *global* total and nearly 5 times more than America's.[j] And those GWs will create 444,000 jobs.[k]
- As a result, China is already curbing emissions substantially. This year alone, it will abate almost 350 Million Tons of CO2e compared to business as usual—which is as much as the country of Argentina emits in the course of a year.[lm]

AMERICA IS FALLING BEHIND

The U.S. led the world in the electronics revolution and they led in biotechnology and the Internet. But we are letting the energy technology revolution speed by us.

What do Amazon, Ebay, Google, Microsoft and Yahoo have in common? They are the five worldwide leaders in internet technology and they are all American. But when it comes to wind, the most mature of the clean energy sectors, of the top five manufacturers (Vestas, GE, Gamesa, Enercon and Suzlon) -- only one is American.

In a broader context, The U.S. is now home to only one of the ten largest solar PV producers in the world, one of the top ten wind turbine producers and two of the top ten advanced battery manufacturers.[n] (See Exhibit 2.)

THE POWER OF INNOVATION AND ENTREPRENEURSHIP

How can we possibly catch up? It is through the power of good old home-grown American innovations and the policies that encourage them.

One thing I have learned over the years is to never underestimate the power of entrepreneurs. The key to entrepreneurs is they *"do more than anyone thinks is possible with less than anyone thinks possible."*

America must bet more on its entrepreneurs. Here are five stories of the entrepreneurs who are trying to build the Amazons and Googles of energy and the jobs that come with them.

1. Entrepreneurs are converting our nation's coal into natural gas through a novel catalytic gasification process that dramatically lowers the cost of carbon capture and allows for advanced power plants to profitably reduce their carbon emissions by 50%-90%, and become a model for responsible use of fossil fuels.

2. Entrepreneurs are working today on advanced 3rd Generation thin film solar cells that meet or beat today's electricity costs ALL over the country instead of only working with subsidies in the sunny Southwest.

3. Entrepreneurs are designing new wind turbines that generate electricity more cheaply than today's cheapest power plants.

4. Entrepreneurs are using CO2 as a key ingredient in valuable products for roads and building materials, rather than trying to pump and sequester it underground.

5. Entrepreneurs are working to make advanced, high-performance biofuels at large volumes from available, inexpensive sources instead of importing overseas oil or relying on corn-based ethanol.

TODAY'S POLICIES

Members of the Committee, I am an American engineer and businessman. I am grateful and honored to appear before you as a witness on this important topic. Among all the witnesses from whom you will hear, I hope to make a unique contribution based on the fact that over the past 37 years my partners and I have helped build 500 new U.S. companies and 400,000 jobs -- including Amazon and Google, two of those top five internet companies. In fact just last month, with support from Senator Vitter and the Louisiana delegation, we announced the creation of 1,500 jobs in Louisiana for an American low-carbon car company.

We have reviewed over 1,000 new energy business plans and have invested $680 million in 48 of the most compelling new clean energy ventures, and we have $1.1 billion more to invest. So, we are trying to do our part.

But I am here to tell you that our government's energy and climate policies are our principal obstacle to success. To repeat: Our nation's current policies are the principal obstacle to creating even more new jobs in the next great industry, clean technology.

- We have no long term market signal that tells companies and consumers that we value low carbon energy.
- We have no policies to discourage sending hundreds of billions of dollars a year overseas for energy.
- We do not have adequate sustained R&D to be a serious competitor in this huge business.

Believe me, today's policies stifle American innovation and competitiveness.

OUR POLICY LEADERSHIP OPPORTUNITY

But good policy can flip this dynamic around, and give our country and companies a fighting chance in the new global energy economy. However, we cannot do this without you.

We need four basic policies:

1. Send a long-term signal that low carbon energy is valuable. We must put a price on carbon and a cap on carbon emissions. No long-term signal means no serious innovation at scale, which means fewer new American success stories.

2. Let's get the rules of the road for the utilities RIGHT. We must make our utilities a driving force for repowering America, driving efficiency through incentives, a renewable electricity standard, and a national unified smart grid.

3. Set smart standards that grow steadily stronger so America has the most efficient buildings, cars and appliances in the world--and so those savings land in the pockets of America's consumers and businesses.

4. Let's get serious about funding R&D and D, at scale. R&D and D – the second D is for deployment. The federal government currently spends only $2.5 billion on clean energy R&D each year—that's 0.25% of our annual energy bill.[o] Programs such as Senator Bingaman's Clean Energy Deployment Administration (CEDA) are a very good idea – it is fast, and flexible, but we will need more.

These policies are straightforward; we've seen them work in states and in other countries. In Denmark, policies, including prices on carbon and building and appliance efficiency standards, have made a huge difference since 1970. It started their wind industry. Today, one-third of all terrestrial wind turbines in the world come from Denmark.[p] And Denmark's energy technology exports were more than $10B.[q] That's from a country with a smaller population than Missouri, Tennessee or Michigan.[r] It has resulted in jobs; last year, the unemployment rate in Denmark last year was only 2%.[s]

What is best about these policies is that they unleash American competitiveness disciplined by market forces. They are widely endorsed by American companies that compete internationally, and by the broad-based President's Economic Recovery Advisory Board. (See Exhibit 3.)

We should carefully design policy to bring in other nations. Think of Copenhagen as an opportunity to create world markets and momentum for a low-carbon future, just as the internet set the world on information-rich future. Some say we shouldn't move until China moves. In fact, China is moving full speed ahead – with or without us.

CONCLUSION

Senators, there is still time for us to get into this global race. But we need low-carbon policies to exploit America's strengths—innovation and entrepreneurs. I know that building such a policy is a heavy political lift. But I can tell you, without doubt, that bad energy policy has cost our country dearly, and the costs of continuing it are incalculable.

Our competitors have woken up. We need to do the same, or we will be buying our future from them.

Thank you.

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[p] Friedman, Thomas. "Flush with Energy." New York Times. 10 Aug. 2008.

[q] Ibid.

[r] Denmark has 5.5 million people.. CIA World Factbook 2009. <https://www.cia.gov/library/publications/the-world-factbook/geos/DA.html>

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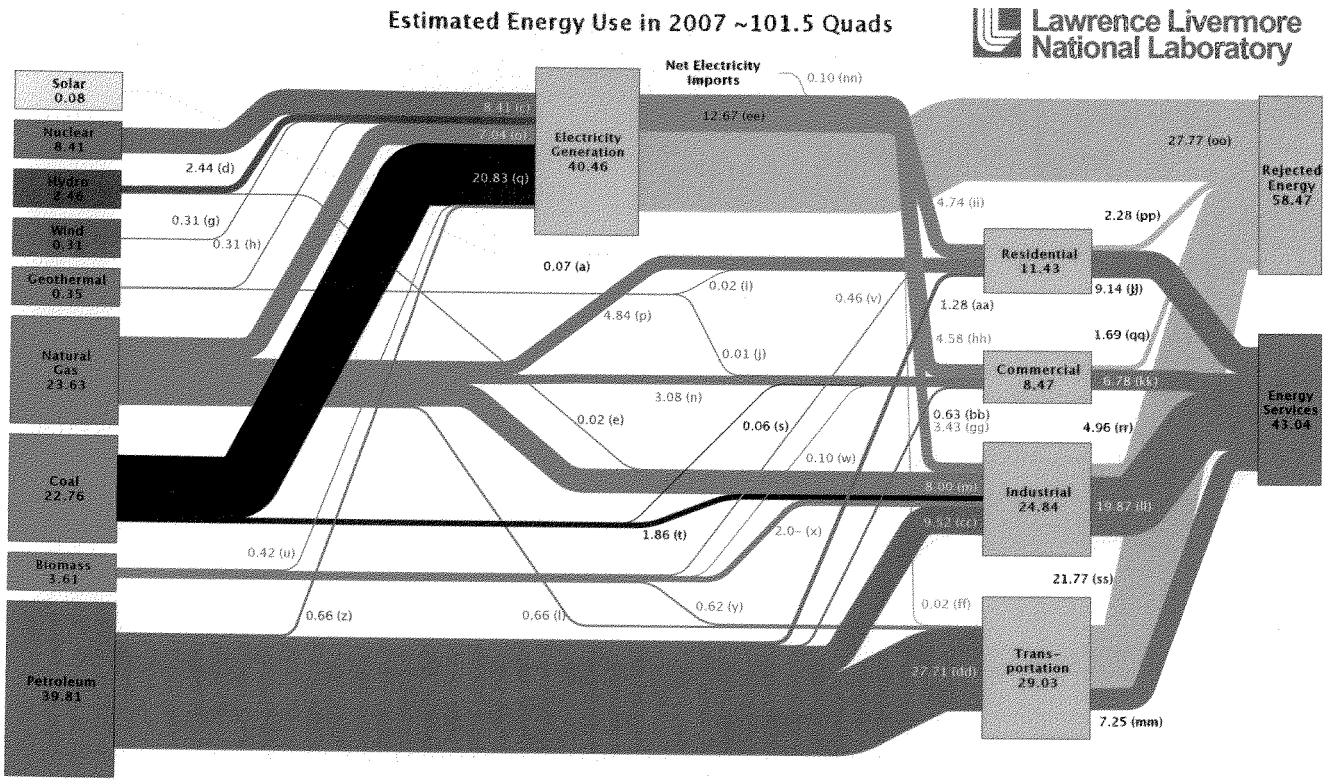

Source: LLNL 2008. Data is based on DOE/EIA-0384(2007), June 2008 If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

U.S. Energy Flowchart 2007
Lawrence Livermore National Laboratory
Release Notes

All energy flow statistics are quoted from the U.S. Department of Energy's Energy Information Administration. These statistics can be found in the Annual Energy Review 2007, report number DOE/EIA-0384(2007). The original document can be found at http://www.eia.doe.gov/emeu/aer/contents.html

(a) Consumption of Solar Energy in the Residential Sector
Table 2.1b, Column 7 (Solar/PV)

(b) Consumption of Solar Energy in the Production of Electricity
(Less than 0.01 Quads, not shown)
Table 2.1f, Column 9 (Solar/PV)

(c) Consumption of Nuclear Energy in the Production of Electricity
Table 2.1f, Column 6 (Nuclear Electric Power)

(d) Consumption of Hydropower in the Production of Electricity
Table 2.1f, Column 7 (Hydroelectric Power)

(e) Consumption of Hydropower in the Industrial Sector
Table 2.1d, Column 7 (Hydroelectric Power)

(f) Consumption of Hydropower in the Commercial Sector
(Less than 0.01 Quads, not shown)
Table 2.1c, Column 6 (Hydroelectric Power)

(g) Consumption of Wind Energy in the Production of Electricity
Table 2.1f, Column 10 (Wind)

(h) Consumption of Geothermal Energy in the Production of Electricity
Table 2.1f, Column 8 (Geothermal)

(i) Consumption of Geothermal Energy in the Residential Sector
Table 2.1b, Column 6 (Geothermal)

(j) Consumption of Geothermal Energy in the Commercial Sector
Table 2.1c, Column 7 (Geothermal)

(k) Consumption of Geothermal Energy in the Industrial Sector
(Less than 0.01 Quads, not shown)
Table 2.1d, Column 8 (Geothermal)

(l) Consumption of Natural Gas by the Transportation Sector
Table 2.1e, Column 3 (Natural Gas)

(m) Consumption of Natural Gas by the Industrial Sector
Table 2.1d, Column 4 (Natural Gas)

(n) Consumption of Natural Gas by the Commercial Sector
Table 2.1c, Column 3 (Natural Gas)

(o) Consumption of Natural Gas in the Production of Electricity
Table 2.1f, Column 3 (Natural Gas)

(p) Consumption of Natural Gas by the Residential Sector
Table 2.1b, Column 3 (Natural Gas)

(q) Consumption of Coal in the Production of Electricity
Table 2.1f, Column 2 (Coal)

(r) Consumption of Coal in the Residential Sector
(Less than 0.01 Quads, not shown)
Table 2.1b, Column 2 (Coal)

(s) Consumption of Coal in the Commercial Sector
Table 2.1c, Column 2 (Coal)

(t) Consumption of Coal in the Industrial Sector
Table 2.1d, Column 2 (Coal)

(u) Consumption of Biomass in the Production of Electricity
Table 2.1f, Column 11 (Biomass)

(v) Consumption of Biomass in the Residential Sector
Table 2.1b, Column 8 (Biomass)

(w) Consumption of Biomass in the Commercial Sector
Table 2.1c, Column 8 (Biomass)

(x) Consumption of Biomass in the Industrial Sector
Table 2.1d, Column 9 (Biomass)

(y) Consumption of Biomass in the Transportation Sector
Table 2.1e, Column 6 (Biomass)

(z) Consumption of Petroleum in the Production of Electricity
Table 2.1f, Column 4 (Petroleum)

(aa) Consumption of Petroleum in Residential Sector
Table 2.1b, Column 4 (Petroleum)

(bb) Consumption of Petroleum in the Commercial Sector
Table 2.1c, Column 4 (Petroleum)

(cc) Consumption of Petroleum in the Industrial Sector
Table 2.1d, Column 5 (Petroleum)

(dd) Consumption of Petroleum in the Transportation Sector
Table 2.1e, Column 4 (Petroleum)

(ee) Domestic Production of Electrical Power
+ Table 2.1e, Column 8 (Electricity Retail Sales)
+ Table 2.1d, Column 12 (Electricity Retail Sales)
+ Table 2.1c, Column 11 (Electricity Retail Sales)
+ Table 2.1b, Column 11 (Electricity Retail Sales)
- Table 2.1f, Column 13 (Electricity Net Imports)

(ff) Consumption of Electricity in the Transportation Sector
Table 2.1e, Column 8 (Electricity Retail Sales)

(gg) Consumption of Electricity in the Industrial Sector
Table 2.1d, Column 12 (Electricity Retail Sales)

(hh) Consumption of Electricity in the Commercial Sector
Table 2.1c, Column 11 (Electricity Retail Sales)

(ii) Consumption of Electricity in the Residential Sector
Table 2.1b, Column 11 (Electricity Retail Sales)

(jj) Useful Energy Services in the Residential Sector
80% of
+ Table 2.1b, Column 11 (Electricity Retail Sales)
+ Table 2.1b, Column 7 (Solar/PV)
+ Table 2.1b, Column 6 (Geothermal)
+ Table 2.1b, Column 3 (Natural Gas)
+ Table 2.1b, Column 2 (Coal)
+ Table 2.1b, Column 8 (Biomass)
+ Table 2.1b, Column 4 (Petroleum)

(kk) Useful Energy Services in the Commercial Sector
80% of
+ Table 2.1c, Column 11 (Electricity Retail Sales)
+ Table 2.1c, Column 6 (Hydroelectric Power)
+ Table 2.1c, Column 7 (Geothermal)
+ Table 2.1c, Column 3 (Natural Gas)
+ Table 2.1c, Column 2 (Coal)
+ Table 2.1c, Column 8 (Biomass)
+ Table 2.1c, Column 4 (Petroleum)

(ll) Useful Energy Services in the Industrial Sector
80% of
+ Table 2.1d, Column 12 (Electricity Retail Sales)
+ Table 2.1d, Column 7 (Hydroelectric Power)
+ Table 2.1d, Column 8 (Geothermal)
+ Table 2.1d, Column 4 (Natural Gas)
+ Table 2.1d, Column 2 (Coal)
+ Table 2.1d, Column 9 (Biomass)
+ Table 2.1d, Column 5 (Petroleum)

(mm) Useful Energy Services in the Transportation Sector
25% of
+ Table 2.1e, Column 8 (Electricity Retail Sales)
+ Table 2.1e, Column 3 (Natural Gas)
+ Table 2.1e, Column 6 (Biomass)
+ Table 2.1e, Column 4 (Petroleum)

(nn) Net Imports of Electricity
Table 2.1f, Column 13 (Electricity Net Imports)

(oo) Rejected Energy from Electricity Generation and Transmission
+ Table 2.1f, Column 9 (Solar/PV)
+ Table 2.1f, Column 6 (Nuclear Electric Power)
+ Table 2.1f, Column 7 (Hydroelectric Power)
+ Table 2.1f, Column 10 (Wind)
+ Table 2.1f, Column 8 (Geothermal)
+ Table 2.1f, Column 3 (Natural Gas)
+ Table 2.1f, Column 2 (Coal)
+ Table 2.1f, Column 11 (Biomass)
+ Table 2.1f, Column 4 (Petroleum)
+ Table 2.1f, Column 13 (Electricity Net Imports)
- Table 2.1e, Column 8 (Electricity Retail Sales)
- Table 2.1d, Column 12 (Electricity Retail Sales)
- Table 2.1c, Column 11 (Electricity Retail Sales)
- Table 2.1b, Column 11 (Electricity Retail Sales)

(pp) Rejected Energy from the Residential Sector
20% of
+ Table 2.1b, Column 11 (Electricity Retail Sales)
+ Table 2.1b, Column 7 (Solar/PV)
+ Table 2.1b, Column 6 (Geothermal)
+ Table 2.1b, Column 3 (Natural Gas)
+ Table 2.1b, Column 2 (Coal)
+ Table 2.1b, Column 8 (Biomass)
+ Table 2.1b, Column 4 (Petroleum)

(qq) Rejected Energy from the Commercial Sector
20% of
+ Table 2.1c, Column 11 (Electricity Retail Sales)
+ Table 2.1c, Column 6 (Hydroelectric Power)
+ Table 2.1c, Column 7 (Geothermal)
+ Table 2.1c, Column 3 (Natural Gas)
+ Table 2.1c, Column 2 (Coal)
+ Table 2.1c, Column 8 (Biomass)
+ Table 2.1c, Column 4 (Petroleum)

(rr) Rejected Energy from the Industrial Sector
20% of
+ Table 2.1d, Column 12 (Electricity Retail Sales)
+ Table 2.1d, Column 7 (Hydroelectric Power)
+ Table 2.1d, Column 8 (Geothermal)
+ Table 2.1d, Column 4 (Natural Gas)
+ Table 2.1d, Column 2 (Coal)
+ Table 2.1d, Column 9 (Biomass)
+ Table 2.1d, Column 5 (Petroleum)

(ss) Rejected Energy from the Transportation Sector
75% of
+ Table 2.1e, Column 8 (Electricity Retail Sales)
+ Table 2.1e, Column 3 (Natural Gas)
+ Table 2.1e, Column 6 (Biomass)
+ Table 2.1e, Column 4 (Petroleum)

TOP ALTERNATIVE ENERGY COMPANIES BY MARKET CAPITALIZATION

Solar PV Suppliers[(a)]: Top 10 by Market Capitalization

($ in millions)

Company Name	Market Cap	2008 Revenue	% Revenue from Renewable Activities	Employees	Domicile
Kyocera	$13,512	$11,882	< 11%	66,496	Japan
First Solar	12,087	1,246	100%	3,524	United States
Sharp	10,680	30,389	< 5%	55,864	Japan
Sanyo	4,267	18,788	< 23%	92,879	Japan
Suntech	2,237	1,924	100%	3,284	China
Q-Cells	2,006	1,658	100%	2,568	Germany
SunPower	1,925	1,435	100%	5,400	United States
Yingli Green Energy	1,305	1,107	100%	2,748	China
Motech	945	695	100%	469	Taiwan
JA Solar	635	800	100%	1,465	China

Note: Data as of July 10, 2009.
(a) Includes cell manufacturers and companies with integrated production capabilities.

Wind Turbine Manufacturers: Top 10 by Market Capitalization

($ in millions)

Company Name	Market Cap	2008 Revenue	% Revenue from Renewable Activities	Employees	Domicile
GE	$114,156	$182,515	~ 5% [a]	323,000	United States
Siemens	56,084	102,562	9%	425,000	Germany
Mitsubishi	28,364	233,376	< 3%	60,664	Japan
Vestas	12,728	7,997	100%	20,829	Denmark
Acciona	9,108	16,612	< 14%	35,385	Spain
Goldwind	7,128	944	100%	1,491	China
Gamesa	4,213	4,832	100%	6,945	Spain
Suzlon	2,543	3,518	100%	14,000	India
Nordex	981	1,505	100%	2,004	Germany
Clipper	228	788	100%	577	United Kingdom

Note: Data as of July 10, 2009. Enercon, a privately-held leading wind turbine manufacturer based in Germany, is not included due to lack of public information.
(a) Estimated based on public information.

Advanced Battery Manufacturers[(a)]: Top 10 by Market Capitalization

($ in millions)

Company Name	Market Cap	2008 Revenue	% Revenue from Battery Sales[(b)]	Employees	Domicile
Panasonic	$28,364	$81,658	< 13%	307,444	Japan
Mitsubishi	27,257	233,376	< 1%	60,664	Japan
Sumitomo	12,036	110,068	< 23%	133,853	Japan
Johnson Controls	11,788	35,765	15%	130,000	United States
Hitachi	11,760	130,875	< 11%	358,674	Japan
Toshiba	9,804	69,764	< 37%	197,000	Japan
Sanyo	8,544	18,788	25%	92,879	Japan
GS Yuasa	4,267	2,978	100%	12,467	Japan
NGK	3,076	2,973	< 30%	10,342	Japan
BYD	2,285	3,926	23%	130,000	China

Note: Data as of July 10, 2009.
(a) Defined as participants in non-lead acid battery manufacturing.
(b) Represents percentage of revenues from batteries, including conventional and advanced battery sales.

The President's Economic Recovery Advisory Board

MEMORANDUM FOR THE PRESIDENT

FROM: Economic Recovery Advisory Board
DATE: June 17, 2009
SUBJECT: Energy, the Environment and Technology

Energy and the climate are complex global issues with many different views on how to manage them. We are a diverse group of advisors, but we agree on some important matters and want to convey them to you.

We believe that a successful, lasting economic recovery should include energy and climate policies that accelerate innovation, reduce our CO_2 emissions and provide energy security. The three foundations for a sound energy policy are simple, widely accepted, and proven in different states across our country and different countries across the world:

- Let the market determine the most efficient way to achieve emissions targets
- Set clear, consistent long-term signals for enhanced energy performance
- Stimulate innovation in new technology

The single most important policy is to put a price on carbon. Businesses want the certainty that will unleash innovation and investment to create jobs now and ensure America is the worldwide leader of the next great global industry: sustainable energy. We are not on that path today.

In short, we endorse a cap on carbon emissions. It alone cannot meet all our objectives, so we must adopt complementary programs for an economically viable and smooth transition.

I. GREENHOUSE GAS EMISSIONS: WHY CAP THEM AND WHY NOW?

A. Why a Cap and Trade System?

We need Cap and Trade to reduce greenhouse gas emissions. There is broad consensus among scientists that global warming is a threat and greenhouse gases exacerbate the problem. Today, the world emits CO_2 into the atmosphere without any economic consequences, and the United States is one of its largest emitters. A globally negotiated Cap and Trade system would help the world reduce CO_2 emissions in a pragmatic and swift way.

We need Cap and Trade for the U.S. to be a market leader in the sustainable economy. A cap should create massive new markets for energy efficiency and renewable energy by setting a market-based price on carbon. For technology developers, it will signal a large, sustained market for lower carbon-emitting innovations. For utilities and project developers, a well-designed cap will accelerate deployment of lower emitting technologies. And for businesses and investors financing capital expenditures, a price on carbon will provide certainty for investment decisions made today that will impact tomorrow.

The business community is often incorrectly portrayed as universally opposing climate policy. We believe businesses want certainty, and many favor clear rules for managing carbon. 25 major corporations, including General Electric and Caterpillar, joined the United States Climate Action Partnership (USCAP) to support Cap and Trade policy. USCAP proposes an economy-wide cap-and-trade system that would reduce emissions by 20% by 2020 and 80% by 2050. Their proposal rightly includes domestic and international offsets and calls for a strategic offset and allowance reserve pool to smooth spikes in allowance prices. Labor organizations, including the AFL-CIO, also agree that American Cap and Trade means domestic jobs.

Cap and Trade works. The Clean Air Act Amendments of 1990 established a cap and trade system for sulfur and nitrogen pollution from power plants. The market found solutions at one-tenth the projected price, and cut these pollutants by more than half. We believe Cap and Trade works better than alternatives, especially alternatives where several agencies share authority. The potential conflicts between agencies could slow progress. To succeed, any Cap and Trade system should provide clear boundaries for and direction to the EPA and other agencies, so all U.S. government bodies act in concert. Regardless of the administering agency, the approach needs to recognize fundamental differences between the traditional regulation of local pollutants and the global, disperse nature and impact of greenhouse gas emissions.

B. Why Now?

We have already described the importance of the environmental impact of climate policy. It has an important competitive impact as well. If the U.S. fails to adopt an economy-wide carbon abatement program, we will continue to cede leadership in new energy technology to other nations. The U.S. is now home to only two of the ten largest solar photovoltaic producers in the world, two of the top ten wind turbine producers and one of the top ten advanced battery manufacturers. (See Appendix A.) That is, only one-sixth of the world's top renewable energy manufacturers are based in the United States. Last year, less than half the 8,500 gigawatts of wind turbines used in the U.S. were made in the U.S.

Losing our advantage in technologies that were pioneered in the U.S. would cost us dearly. Sustainable technologies in solar, wind, electric vehicles, nuclear and other innovations will, in the view of many on our board, drive the future global economy. We can either invest in policies to build U.S. leadership in these new industries and jobs today, or we can continue with business as usual and buy windmills from Europe, batteries from Japan and solar panels from Asia.

Leading the new green economy could be transformational for our country. Compare it to the internet. Fifteen years ago there was no web browser. There was no internet at your fingertips, no ecommerce, no search engines. Now, the internet has transformed our lives: how we learn and inform, how we entertain and communicate, how we buy and sell goods. Today, the internet economy is estimated at $1 trillion with 1.5 billion internet users worldwide—and growing.

The new green economy has greater potential. Energy is a $6 trillion market with 4 billion users of electricity—and usage doubling in 25 years. It is perhaps the largest economic opportunity of the 21st century. With the right policies driving innovation and investment, America can retake

the lead in energy technology and create millions of new green jobs and industries, preserve millions of indirect jobs and repower our economy.

II. CRAFTING AN ECONOMICALLY SOUND CARBON POLICY

A. Global Problems Require a Global Solution

Federal legislation to establish Cap and Trade will require complementary and coordinated international action. Even the best Cap and Trade system will not prevent many industries from facing serious competitiveness concerns, particularly from developing nations, in the absence of international regulatory and policy collaboration.

It is clear that the rest of the world must also move to lower carbon-emitting energy if we want to reduce global emissions by meaningful levels. It is also clear that global leadership is forming to define and craft a global policy solution. Indeed, we think it is imperative that the U.S. take the lead in shaping global policy and that it do so in Copenhagen. India and China are increasing emissions as their populations urbanize and seek the same energy intensive goods and services we do; if they do not reduce emissions, any decreases we generate could be outweighed by increasing emissions in Asia. In addition, if other countries do not adopt a comparable system, we could become less competitive as their goods and services could have lower costs.

We cannot convince China and India to lower emissions unless we are willing to do so ourselves. The United States, as an industrial powerhouse, uses almost as much energy each year as India and China combined, but has only 12% of their combined population. We emit more CO_2 from transportation than all of Europe, China and India combined. We must commit to a path to drive our CO_2 emissions down if we want secure footing in Copenhagen to help lead the world to a clean energy economy.

B. Offsetting the Costs of Carbon Pricing

Dramatic changes will come with a cost. While the cost of Cap and Trade will be much less than the cost of doing nothing, American households will be impacted by some level of carbon costs. Because a cap forces us to internalize the costs of our emissions, a carbon abatement policy will raise the prices of many goods and services that are central to our lifestyle. As Paul Krugman succinctly states, "A cap and trade system will raise the price of anything that directly or indirectly leads to the burning of fossil fuels. Electricity, in particular, would become more expensive, since so much generation takes place in coal-powered plants." By increasing prices for carbon-intensive goods and services, carbon Cap and Trade should drive meaningful behavioral changes and should lead consumers to choose less carbon-intensive goods. At the same time, these price signals will increase the pace and trajectory of technological innovation for lowering carbon emitting energy and enhancing energy efficiency.

The level of these costs will vary over time, and will depend on the structure of the system, the amount of innovation and, crucially, on the efficiency of recycling revenues from carbon emissions back into the economy, or, alternatively, the handling of the initial allocation of allowances. Current estimates of 2020 costs range from less than $100 per capita to over $1,000

per capita depending on many factors, including assumptions around how permits are provided and how much of permit revenue gets rebated to consumers. There is uncertainty among the various complex models, and these models do not account for the benefits of reduced emissions. We think it is important to consider the distributional impact of energy policy and to provide direct relief to consumers so they do not bear the full burden of the adjustment.

To control these costs, regardless of the level, we believe firms should be able to purchase offsets—verified, credentialed, voluntary emissions reductions by domestic or international entities not covered by the cap. Offsets reduce the cost of a climate policy by encouraging firms to implement low-cost reductions and allowing them to sell extra allowances to firms with higher costs for emissions abatement. Policymakers can reduce cost uncertainty by letting firms bank allowances when reductions are relatively cheap, and use those allowances or borrow future ones when emissions reductions are relatively expensive.

These allowances will create a new financial asset and market, and we should diligently oversee this new asset to make sure it develops into a healthy, stable market without unnecessary price volatility. An important part of this effort will be an effective verification and credentialing process and system. We need strict monitoring, including disciplined regulatory reforms, transaction transparency and disclosure, and tools for intervention to ensure the viability of this new market.

C. Smoothing the Coal Transition

We are not suggesting a wholesale, immediate rejection of all carbon-based technologies. Climate change policies need to be aligned with national energy policies, which in turn need to focus on energy security, domestic energy sources, and their availability and cost. To protect industries vulnerable to international competition—and the workers who depend on them—the Administration should consider measures to ensure that the burden of mitigating climate change does not render strategic American industries uncompetitive. A properly designed Cap and Trade program will include transition assistance funds for deploying lower carbon emitting technologies in heavily coal-dependent and energy-intensive economies.

Because coal constitutes roughly half of U.S. electricity generation, and an even larger portion of several emerging economies, including China (80%) and India (70%)[1], coal will be with us for some considerable time, and we must build a lower carbon strategy for coal. We recommend the Administration maintain, and add to, its focus on Carbon Capture and Storage (CCS) technologies. The Economic Recovery Act includes over $2.4 billion for CCS technology research, development and deployment. We advise the DOE also to focus on CCS, to ensure its emergence as a serious energy strategy. We also recommend joint programs on CCS with China and India, as their adoption of the technology will be crucial to reducing global emissions.

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[1] *China's coal output increased from 1.3 billion tons in 2000 to 2.23 billion tons in 2005 making China the world's largest coal producer (next largest is the U.S. with 1.13 billion tons produced in 2005). India's coal consumption increased from 360 million tons in 2000 to 460 million tons in 2005 (5.5%/year over this period).*

III. COMPLEMENTARY POLICIES TO CAP AND TRADE

A cap on carbon is the single most important energy and climate policy this nation could adopt. But it will be far stronger if it is accompanied by complementary policies. We do not have the space to go into detail on all our views on these policies, but they include:

- making utilities an engine of economic recovery through a unified national smart grid and through strong efficiency and renewable energy programs;
- making our buildings, cars and trucks as energy efficient as any in the world; and
- accelerating energy innovation through public, university and private sector R&D.

IV. SUMMARY

Mr. President, we urge you to support a market-based Cap and Trade system that is both economically sustainable and environmentally sound. We believe it can help propel our economy, enhance our energy security goals and help make America the worldwide leader in the next great global industry.

Appendix A. Top Renewable Energy Manufacturers by Market Capitalization
Source: Lazard Freres, April 2009

Solar PV Suppliers: Top 10 by Market Capitalization

Company Name	Market Cap	Domicile
Kyocera	$12,224	Japan
First Solar	10,834	United States
Sharp	8,853	Japan
Sanyo	2,738	Japan
Q-Cells	2,215	Germany
SunPower	2,045	United States
Suntech	1,821	China
Yingli Green Energy	764	China
Motech	714	Taiwan
JA Solar	566	China

Wind Turbine Manufacturers: Top 10 by Market Capitalization

Company Name	Market Cap	Domicile
GE	$106,853	United States
Siemens	49,568	Germany
Mitsubishi	22,024	Japan
Vestas	8,131	Denmark
Acciona	6,385	Spain
Goldwind	5,875	China
Gamesa	3,088	Spain
Suzlon	1,253	India
Nordex	862	Germany
Clipper	127	United Kingdom

Advanced Battery Manufacturers: Top 10 by Market Capitalization

Company Name	Market Cap	Domicile
Panasonic	$22,372	Japan
Mitsubishi	22,024	Japan
Sumitomo	10,650	Japan
Hitachi	8,936	Japan
Toshiba	8,306	Japan
Johnson Controls	7,131	United States
NGK	4,970	Japan
BYD	3,777	China
Sanyo	2,738	Japan
GS Yuasa	1,796	Japan

Senator BOXER. Thank you very much, Mr. Doerr.

I just want to say something here. Because Senator Merkley is in between committees, I think it would be only fair now if he would like to make an opening statement.

Senator INHOFE. That is fine.

Senator BOXER. It is OK with Senator Inhofe.

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

Senator MERKLEY. Thank you very much, Madam Chair, and I will be very brief, that is to say that in Oregon, green energy jobs are growing at seven times the rate of other jobs in the economy. It is our brightest hope for putting our economy on track.

It is my belief that our economy and our energy strategies are joined at the hip, and I am very interested in the details that you are presenting today. Because this committee has to figure out how do we take and produce a triple win, that is to end our dependence on foreign oil, which is costing us nearly $2 billion a day, and how many more jobs could we create if those funds are spent here in the United States, and I think of our increase in our national security. So, it is the impact on national security, the impact on our economy and creating jobs, and our impact upon the environment of this planet.

All three are closely tied together. We need to make sure that we put the United States at the forefront of energy policies that will create stable, low cost energy over the long term, a strategy that will create jobs, and a strategy that will address global warming.

So, I am deeply interested in your testimony, and thank you for coming today.

Senator BOXER. Thank you so much, Senator.

Now we will hear from John Krenicki, Vice Chairman, General Electric; President and CEO, General Electric Energy Infrastructure. Welcome.

STATEMENT OF JOHN KRENICKI, VICE CHAIRMAN, GE; PRESIDENT AND CEO, GE ENERGY INFRASTRUCTURE

Mr. KRENICKI. Thank you, Madam Chairman, Ranking Member Inhofe and members of the committee.

I am John Krenicki, GE Vice Chairman, President and CEO of GE Energy. I appreciate the opportunity to discuss global competitiveness in cleaner energy.

GE believes that leadership in cleaner, smarter energy technology is vital to economic growth, job creation and energy security. This could become the dominant job creator of the 21st century and companies, and countries that move quickly to seize that opportunity will reap the rewards going forward.

Energy is a scale driven business. For the United States to lead in the area of clean energy technology, I believe we need to do five things.

No. 1, we need a very big domestic marketplace that spurs investment and job creation and to be relevant on a global scale. Second, a scalable, competitive supply chain has to be put in place that delivers the lowest possible unit cost over a long period of time. Third, absolutely the best technologies because the best prod-

ucts win, time and time again. Fourth, strong intellectual property protections need to be put in place so that investors can generate a fair return on their investments. And fifth and finally, we need free and open markets. Given the global scale involved here, we need to be able to spread those costs over many geographies.

Over the past 4 years, for example, the U.S. has become a world leader in the deployment of wind energy. The U.S. wind industry hits its high water mark in 2008 when over 8.5 gigawatts of wind power were installed, enough to power roughly 7 million homes. That capped a 3-year run during which the U.S. added over 16 gigawatts of wind power and now supports more than 85,000 jobs.

Unfortunately, due to the economic crisis, the U.S. now is projected to install only half of what was installed in 2008. And we now find ourselves worried about the health of the renewables industry going forward.

The good news is that Congress is considering a national renewable electricity standard which has the potential to reinvigorate the industry and keep jobs in the United States. The bad news is that both the House and Senate versions of the RES are too weak to keep the U.S. wind industry from collapsing over the next 3 years.

The current targets for 2012 are equal to or below the status quo. It would not add a single wind turbine to the install base over the next 3 years. Our projections show that such RES would actually move the United States from No. 1 in 2008 to No. 3 behind the EU and China in new wind installations.

One way to address this challenge is through stronger near-term requirements. GE believes that it would take approximately a 12 percent RES standard by 2012 to keep U.S. wind deployment up and continue to grow U.S. jobs.

It is important, too, to understand that other countries are also on the move. China has doubled its wind power capacity in each of the last 4 years and is on track to pass the United States this year as the country with the largest number of wind installations. Europe also has strong targets, and over 70 countries have national renewable energy policies.

If the wind industry moves to China and Europe, small and medium-sized companies that supply key components for the U.S. industry will close factories and slash employment. In many quarters, orders have already begun to dry up, and this is a trend that no one in the United States wants to see continue.

As the person responsible for GE's energy portfolio, I have seen firsthand that the jobs will go where the big markets will develop. And strong markets can develop from good policy. The U.S. is, indeed, at a crossroads. And you and your colleagues can make the difference between retaining a strong U.S. clean energy industry or losing it to foreign shores.

I encourage you to address the need for strong national energy policy quickly so that the United States markets can continue to drive economic growth for the 21st century and the U.S. clean energy industries will have the scale, and the products, to enable the larger climate goals ahead.

Thank you very much.

[The prepared statement of Mr. Krenicki follows:]

Testimony of
John Krenicki
Vice Chairman, GE
President and CEO, GE Energy Infrastructure
Before the Environment and Public Works Committee
United States Senate

Hearing on
Ensuring and Enhancing U.S. Competitiveness while Moving toward a Clean Energy Economy

July 16, 2009

Introduction

Thank you, Madam Chairman, Ranking Member Inhofe, and members of the Committee. I am John Krenicki, GE Vice Chairman and President and CEO of GE Energy. I appreciate the opportunity to discuss global competitiveness in cleaner energy. We believe that leadership in cleaner, smarter energy technology is vital to economic growth and energy security for the nation. As the world stands today, the leadership roles in cleaner, smarter energy are being hotly contested. I'd like to offer you a few thoughts on what I believe are required for the U.S. to lead.

My perspective comes from my role as CEO of GE Energy, the energy technology business Thomas Edison started more than 100 years ago in Schenectady, NY. Today we are truly a global company with more than 1/4 of the world's electricity generated utilizing GE technology. Our technology portfolio includes electricity generation from solar, wind, nuclear, cleaner coal, high efficiency gas turbines, and biomass and smart grid products, with operations in over 140 countries, 65,000 employees and almost $39 billion revenue in 2008. We are an export driven company with approximately 70% of our sales derived outside of the United States. GE has played a central role in the world's energy economy for 120 years. It is a role we have been honored to play, and is a source of pride for the many manufacturing and technology employees we have in the United States.

In recent years we have seen a worldwide, rapid transition toward cleaner and more efficient technologies in the electricity industry. This change has created millions of jobs and opened up tremendous possibilities for innovation and economic growth. That transition has been partly fueled by the recognition that climate change demands a movement away from greenhouse-gas intensive technologies and toward cleaner sources of power, such as wind, solar, natural gas, nuclear, or cleaner coal with carbon capture and storage. It has also been fueled by the knowledge that cleaner energy could become the dominant job-creating industry of the 21st century, and the companies – and countries – that move quickly to seize that opportunity will reap the rewards.

WHAT IT TAKES TO LEAD

The energy business is a scale driven business. Time horizons are measured in decades; capital investments in billions, and suppliers and competitors engage globally to deliver the lowest unit cost. Competitiveness and leadership in this industry require a long-term, sustained, highly committed effort. It requires massive investment, discipline, and vision that spans beyond the next quarter, the next fiscal year, or the next election cycle.

Will the U.S. lead the world in cleaner, smarter energy technology? Let's examine some of the factors.

For a nation to lead in energy technology, and take part in the economic growth that goes along with that leadership, I believe it needs five things:

- A big domestic marketplace – a pull for technology that will spur investment and job creation.
- A scalable, competitive supply chain that can deliver the lowest unit costs to the end customers over time.
- Best-in-class technologies. In this business, the best technology wins
- Strong intellectual property protection. In order to make technology investments, investors expect a fair return.
- Free and open markets. The ability to trade commercial products with advanced technology freely is vital to grow markets.

Let me offer an example from the history of energy technology. Today, almost 90% of the nuclear energy produced in the world comes from light-water reactors, such as pressurized water reactors and boiling water reactors. The U.S. led the world in the commercialization of these technologies and as a result, during the nuclear build out in the 60s, 70s, and 80s, tens of thousands of people were employed in the U.S. nuclear industry. Key policy decisions embodied in the Atomic Energy Act of 1946, President Eisenhower's "Atoms for Peace" proposal in 1953, and the Price-Anderson Act of 1957, helped shape the domestic market, and enabled private and public investment in critical technologies and manufacturing capability. Through a concerted, sustained effort, both public and private, the U.S. led the world in this new energy technology. Today, nuclear energy generates nearly 20% of the electricity in the U.S., and about 370 GW of power worldwide.

The history is interesting to note, and very applicable to this discussion as we contemplate U.S. competitiveness in the cleaner energy technologies of today: Since the U.S. hiatus from the nuclear industry in the 80s, many critical components and expertise for the manufacture of nuclear reactors are now sourced from outside the U.S. The U.S. stepped back from new nuclear and the technology followed the market to other countries.

Let's discuss a more contemporary example, in which the U.S. has forged its way to the lead, but now faces a collapse.

THE RACE TO LEAD TODAY'S RENEWABLE INDUSTRY

Over the past four years, the U.S. has been at the forefront of renewable energy, and that's particularly true of wind energy. Growth in U.S. wind projects has led to an increase in domestically manufactured wind turbines and components from less than 25% a few years ago, to now approaching 50% with current manufacturing announcements. According to the American Wind Energy Association (AWEA), in 2008 the industry spurred $17 billion in investment and created more than 35,000 jobs. Also in 2008, over 55 new facilities came online, were announced, or expanded, increasing our nation's total wind industry supply capacity by fifty percent.

The U.S. Wind industry hit its high watermark to date in 2008, when over 8.5 gigawatts (GW) of wind power were installed, enough to power approximately 7 million homes. That capped a three-year run, where the U.S. wind industry added over 16GW of power and now supports more than 85,000 jobs. Wind energy is clean energy, and in the U.S. wind power avoids the emissions of 28 million tons of carbon dioxide from traditional power plants annually – equal to taking six million cars off the road.

GE has worked very hard to play a central role in the clean energy revolution, and our renewables business has grown dramatically to keep up with growing U.S. and global demand. Since entering the industry in 2002, GE has invested over $850 million in renewable energy technology and production.

Wind energy lends itself to a highly localized manufacturing base and supplier network and our U.S. business growth has therefore translated into new American jobs. In the U.S., GE employs more than 2,000 people in our Wind and Solar businesses. These include wind turbine manufacturing jobs in Pensacola, Florida; Greenville, South Carolina; Salem, Virginia; Erie, Pennsylvania; and Tehachapi, California. They include solar manufacturing and professional jobs in Newark, Delaware; Montague, Michigan; and Golden, Colorado. And they include professional jobs at our headquarters in Schenectady, New York, where since 2007 we have added over 300 jobs in Engineering, Project Management, and Services to support our Wind and Solar businesses. In addition, more than 4,000 sub-supplier jobs have been created in the U.S. to support these endeavors.

At that high watermark in 2008, the U.S. briefly led the world in wind energy production and cumulative wind power generating capacity.

Today, the story is much different. In the last nine months, the world has changed a great deal, as we all know. With a slow-down in electricity demand, policy uncertainty, and lower natural gas prices, the U.S. is projected to install about 5GW of wind in 2009, or about half of what was installed in 2008. The stimulus might stir a couple of more gigawatts of installs, although we haven't seen stimulus dollars actually get to many developers yet – less than 1% of energy stimulus dollars have been spent year to date. But let's say the stimulus fulfills expectations, our projections show that the U.S. will still move from #1 to #3 in new wind installations, behind the EU and China.

Stimulus is a tactic not a strategy. For the wind industry, its impact will fade over the next few years. During that period, 2010-2013, we project that the U.S. wind industry will only average about 4GW of installations a year. That's half of what the industry delivered in 2008.

That means that of the 85,000 jobs created through 2008, half we would expect to go away. Small and medium size companies, who are suppliers of key components for the U.S. wind industry, may have to close factories and slash employment. At GE alone, we've already canceled $5 billion worth of material orders from our sub-suppliers in the last eight months.

The U.S. finds itself at a crossroads. Will the U.S. capitalize on the brief leadership in renewables achieved in 2008, or will it, like the 80's and 90's in the nuclear industry, take a hiatus and watch the technology leadership, manufacturing investments and jobs materialize in countries with more certain commercial prospects?

For several decades, forward thinking government policy has helped to support the spread of clean energy and the economic opportunity it brings. The federal Investment and Production Tax Credits that Congress rightly extended in 2008 have helped companies and investors large and small bring highly innovative technologies to market that otherwise may not have had a chance. More than thirty states across the U.S. have adopted Renewable Portfolio Standards (RPS) or renewables targets that support installations of renewable energy and the creation of tens of thousands of jobs.

These policies, standing alone, are an incomplete solution. Short-lived tax credits have led to a "boom-bust" pattern in the wind industry; when the production tax credit expired at the end of 1999, 2001 and 2003, wind power installations declined by 73-93%. State-based RPS policies, which help create individual pockets of renewable energy growth, also create a patchwork of rules and incentives that large companies – those with the most capacity to create jobs – have difficulty negotiating.

Some would point to the cap and trade system as a future driver of clean energy investment, and while GE supports carbon-based decision making, massive new investments in manufacturing will not be made in the U.S. today based on the hope of a strong carbon price signal 10 years from now.

While the U.S. struggles to determine the future of clean energy, other countries around the world are setting aggressive near-term and long-term standards and incentives to create large domestic markets for renewable energy. The policies now in place to support renewable energy in the U.S. are insufficient to counter weak investor confidence, and fall far short of incentives now being put in place by other nations. As history has shown, technology will follow the promise of future commercial sales. The current trajectory would suggest the future technology and expertise of the renewables industry will be concentrated outside the U.S.

Current Federal RES Proposals Are Too Weak

The good news is Congress is considering national renewable electricity standards, which would require an increasing percentage of electricity be provided by clean energy or energy efficiency. The bad news is that both the RES passed by the House of Representatives and the RES approved by the Senate Energy and Natural Resources Committee last month are far too weak to keep the U.S. wind industry from collapsing in the next three years. Allow me to explain why.

The current RES proposals for 2012 – anywhere from 3 to 6 percent of total U.S. electricity generation – are essentially equal to or below the status quo, where renewable energy accounts for about 5% of the baseline requirement as defined in those proposals. Therefore, those proposals would not incentivize the addition of a single wind turbine in the United States in the next three years. Those proposals also allow energy efficiency to be applied toward an RES, an option GE strongly supports, but in the near term that option lowers requirements for renewable energy even further.

In February my colleague Edward Lowe from GE's renewables business testified before the House that the stronger RES targets then under consideration would support the creation of "100,000 new jobs between the end of 2008 and the end of 2012, with even greater long-term potential." But the weakening of RES targets by House and Senate committees in the last five months has reversed the potential for near-term jobs creation and made the RES's long-term potential irrelevant.

The fact that longer-term targets, for 2020 and beyond, would increase wind and other renewables is immaterial, because the current weak near-term targets would drive the U.S. wind technology and manufacturing expertise overseas to the countries that have thriving commercial activity over the next 3-5 years. In other words, without a significantly higher RES target for 2012, the federal government will be offering long-term support to an industry with no long-term future.

One way to address this challenge is through near-term renewable requirements that will help drive a domestic wind industry consistent with the last three years. For example, it would take a 12% renewable electricity standard by 2012, with reasonable percentages to be satisfied by energy efficiency measures, to enable U.S. wind deployments to continue on the current growth trajectory. Such a standard would also help drive dollars to small companies and developers waiting for stimulus checks to begin rolling out, and help sustain a domestic industry that cannot wait for longer term carbon legislation to come into effect.

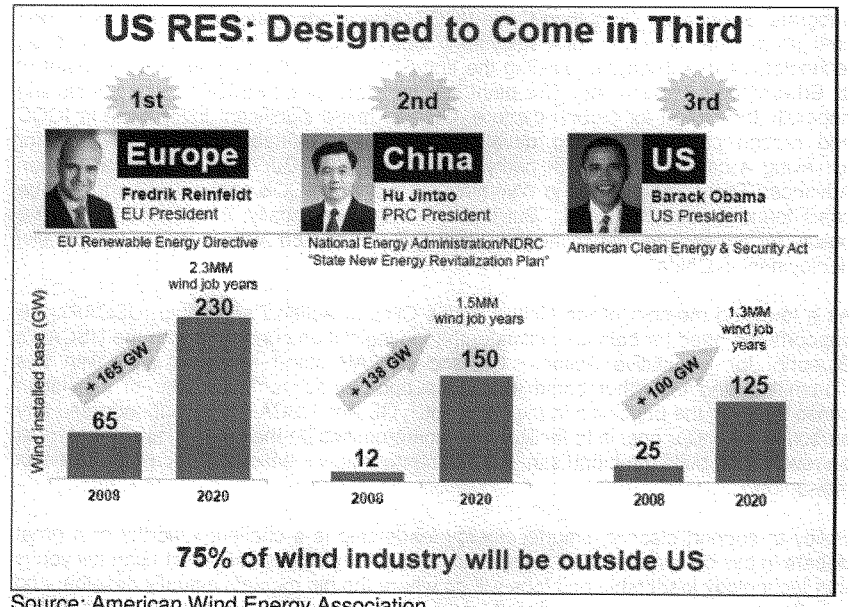
International Competition for Cleaner Energy Leadership

While there are many reasons why a stronger near-term requirement is essential, perhaps the most important is international competition.

Both Europe and China have publicly committed to strong, long-term renewable energy policies, with aggressive near-term goals. The EU's Renewable Energy Directive commits member nations to 20% renewable energy by 2020, with targets beyond "business-as-usual" that begin in 2012. Countries like Germany, which have significantly less wind power potential than the U.S., have policies that help Germany and other EU countries to lead the world in the manufacture and export of wind and solar technologies. That is one reason why European companies account for the vast majority of the wind industry leaders.

China presents an even greater challenge. China has doubled its wind power capacity in each of the last four years, and is on track to pass the U.S. this year as the country with the largest number of wind installations in 2009. China expects to have 30 gigawatts of wind installed by the end of 2010 – 10 years ahead of schedule – and has established a goal of having 100 gigawatts of wind installed by 2020. They are also in the process of raising that goal to 150 gigawatts. Compare that to a total of about 25 gigawatts installed in the U.S. at the end of 2008 and you begin to see the scope of the challenge. Over 70 countries worldwide now have national targets for renewable energy, but the United States is not one of them. Interesting note: GE competes against 70 domestic Chinese wind manufacturers in China.

As I have testified, a large and relevant domestic market is key. If the wind industry moves to Europe and China, U.S. jobs that currently support the industry will evaporate. If Congress passes the weak RES targets now being contemplated, the U.S. could see up to half of our 85,000 domestic wind jobs disappear. As a country, we are contemplating climate and energy legislation with the potential to lose 42,000 clean energy jobs, in places like Illinois, Iowa, North Dakota, South Dakota, Oklahoma, and Texas, which have become hubs for renewable energy suppliers. Enacting no legislation will have the same result. Rather than doubling the renewables industry in the next three years, we will take half of it out. By 2012, up to 75% of the global wind industry will be outside the U.S. The promise of making this country a center of excellence for cleaner, smarter energy jobs and exports – still a very real possibility today – would not be fulfilled and communities that had just begun to feel the promise of these technologies would witness its flight to overseas countries.



Source: American Wind Energy Association

A Turning Point and a Clear Choice

As I stated before, the U.S. is at a crossroads. Policy will play a pivotal role, in determining whether there is a U.S. industry for cleaner, smarter energy technologies. The debate is not limited to wind alone. There are other cleaner energy technologies on the verge of emergence, or in the case of nuclear, resurgence. Consider this: over the next three years, of the 483 gigawatts of electricity generation expected to be installed worldwide, 62% of it will be based on coal, nuclear, wind, and solar. The U.S. can stand by and watch other countries take the leadership role in these technologies, and accrue the economic benefits that go with it, or act swiftly to ensure that there is a large domestic industry for the best technologies.

The deployment of cleaner coal technology is another example of an immediate opportunity with job and environmental benefits that we can either seize or relinquish to others. Coal is a national and globally abundant, low cost resource that is and will continue to be a predominant generation choice in developing nations such as China and India. In order to achieve climate change goals, the future of coal needs to incorporate carbon capture and storage. The potential for cleaner coal globally has not gone unnoticed by European countries that are aggressively pursuing funding for their domestic technologies and collaboration with China.

Integrate Gasification Combined-Cycle (IGCC) is a superior technology for low carbon coal power that is ready for deployment today. The U.S. holds the lead in IGCC technology. Duke Energy is building the first 630 megawatt commercial IGCC plant at its Edwardsport, Indiana site. This plant is a template for future IGCC plants, including hopefully the option for carbon capture. GE has made significant investment in IGCC and carbon capture including development of a retrofittable Carbon Island™ for achieving a carbon footprint at parity with natural gas. Our High Plains Gasification Advanced Technology Center in Wyoming will expand IGCC's coal envelope to include coals found around the world. But if IGCC is to win globally, it will need supportive policy for immediate deployment in the U.S. combined with support for parallel deployment in China.

As a founding member of the United States Climate Action Partnership (USCAP), GE supports the need for balanced climate change legislation consistent with the USCAP's Blueprint for Legislative Action. GE and USCAP stand ready to work with this Committee and the other committees to support enactment this year of legislation consistent with the principles in the Blueprint. GE and USCAP have not endorsed any particular bill. Our goal is to facilitate the compromises on the difficult issues that must be resolved to build the bipartisan, political center that we believe is necessary to enact legislation.

Policy to support cleaner, smarter energy leadership is a challenge worthy of a great debate in this country. I am not a legislator, but as a businessman, what I can tell you is that technology leadership and jobs will go where the big markets actually develop, and market development follows directly from policy. I can also tell you that policy uncertainty not only inhibits growth, it causes disinvestment. Not acting on this issue sends a signal to industry – one that may have economic ramifications for a generation in the large-scale energy business. I encourage you to address the need for energy policy quickly, and help support the development of markets in the technologies that will drive economic growth for the 21st century.

Environment and Public Works Committee Hearing
July 16, 2009
Follow-Up Questions for Written Submission

Questions for Krenicki

Questions from:

Senator David Vitter

1. It is my understanding that GE has started a joint venture called Greenhouse Gas Services, which invests in – and hopes to manage the trade in – greenhouse gas credits. How much has GE invested thus far in Greenhouse Gas Services, and what will be the value of those investments if the government fails to implement restrictions on greenhouse gases? In addition, has any investment in Greenhouse Gas Services come from monies derived from the American Recovery and Reinvestment Act or the Troubled Asset Relief Program?

   Answer: GE has not made significant investments in this business. GE has not received any monies under TARP, and no ARRA money has been invested in the joint venture.

2. How much money has GE thus far received in government "bailouts" or government backed loans? Please describe the banking institutions through which GE qualified for the Temporary Liquidity Guarantee Program. Has any of this money gone to lobbying for cap-and-trade?

   Answer: As noted above, GE has received no money under TARP, and GE has not used any government money for advocacy on any issue. We have also not received any government-backed loans. GE has participated in the Temporary Liquidity Guarantee Program (TLGP) of the Federal Deposit Insurance Corporation based on GE's ownership of two insured depository institutions. As a part of this participation, GE has paid $1.2 billion in premiums. On July 22, GE announced it would be exiting TLGP, a positive step in returning the broader capital markets to normal functioning.

3. Do you believe GE is in anyway breaching its fiduciary duty to shareholders by lobbying for cap-and-trade legislation that will increase the cost of energy on its shareholders, and at the same time increasing salaries of news anchors that push the Administration's global warming agenda, while cutting dividends?

   Answer: No. GE's position on climate change and its salary and dividend decisions are unrelated. GE exerts no editorial influence on its business unit's newsgathering enterprise.

4. In 2008, while GE stock was losing more than half its value, the company spent upwards of $18 million on federal lobbying. The majority of the $18 million was spent pushing for cap-and trade. GE is positioned to make a fortune on a cap-and-trade scheme. Does GE see cap-and-trade as a viable way of rebuilding its financial derivatives business?

   Answer: GE is a large company and has a number of issues on which we do advocacy. Our reported expenses for 2008 cover all issues on which we did advocacy, and a majority was not spent on climate change. GE is not in the financial derivatives business.

5. How much money has GE spent thus far on lobbying for cap-and-trade?

   Answer: GE follows applicable law and does not report expenses segmented by issue. However, we can report that the majority of GE's expenses are wholly unrelated to climate change.

Senator BOXER. Thank you very much, Mr. Krenicki.

Our next speaker is Julian Wong, Senior Policy Analyst at the Center for American Progress Action Fund. Welcome, sir.

STATEMENT OF JULIAN L. WONG, SENIOR POLICY ANALYST, CENTER FOR AMERICAN PROGRESS ACTION FUND

Mr. WONG. Chairman Boxer, Ranking Member Inhofe and members of the committee, thank you for this opportunity to testify.

I am Julian Wong, Senior Policy Analyst for the Center for American Progress Action Fund. I will describe China's plans to build a low carbon economy, a strategy for economic growth, something I am pleased to do after spending most of last year in China as a Fulbright Scholar actively researching China's clean energy initiatives.

In the U.S. debate over clean energy policies, China has been used as a scapegoat for domestic inaction. Yes, China remains heavily reliant on coal, and yes, it has surpassed the United States as the largest annual emitter of greenhouse gas emissions. But U.S. total cumulative emissions in the atmosphere are three times that of China, and the U.S. per capita annual emissions are still four to five times that of China.

China was slow to acknowledge the threats posed by climate change. But once it did, it acted swiftly and decisively to reduce both emissions growth and to seize the economic opportunity to create a new period of prosperity out of reduction, deployment and sale of clean energy technologies.

China's Vice Premier, Li Keqiang, repeatedly said that the development of new energy sources represents an opportunity to stimulate investment during this economic slowdown, to achieve stable export opportunities, all while building international economic competitiveness.

So what has China done so far? Let me describe three aspects of China's green leap forward.

First, energy efficiency is now a pillar of China's growth policy. China plans to reduce its energy intensity by 20 percent from 2006 to 2010. There are now efficiency benchmarks for many industries including thermal power, steel and cement. This will reduce over 1 billion tons of carbon dioxide per year, starting at 2010, compared to business as usual, equivalent to taking over 200 million cars off the road.

China's fuel economy standards are higher than the U.S. standard in 2016. As a result, China is now a leading innovator in various technological sectors including advanced efficient coal combustion and plug-in hybrid vehicles.

Second, China has national targets for clean electricity production leading to the emergence of innovative technologies. It plans to produce 10 percent of its electricity from low carbon sources by 2010 and 15 percent by 2020. China's total wind energy capacity doubled in each of the past 4 years. This year, it will surpass the U.S. as the largest installer of new wind capacity.

China is the world's largest supplier of solar panels, accounting for 40 percent of the world's market share. Of the top 10 solar companies by output, 3 are Chinese while just 1 is American.

Third, China has new industrial zones dedicated to the manufacture of low carbon technologies. For instance, the city of Baoding, a hub for development, is an emerging leader. When I visited Baoding last December, I was amazed to see factory after factory of wind and solar component manufacturers. There are now over 150 wind and solar and other low carbon companies accounting for 12 percent of Baoding's GDP in 2007, and this percentage will be up to 40 percent by 2015. Baoding is not just an isolated example. Together with Tianjin and Jiangsu, these economic hubs are the future of China's low carbon economy.

The United States won the race to the Moon. But we are losing the race for a sustainable Earth. As The Post said this morning said, we are not only behind China, but also Korea, and in some respects even India, which recently set the world's most ambitious solar energy target of 20 gigawatts by 2020.

Opponents of clean energy policies often cite costs. This confuses cost with investment. When temperatures rise, when increased droughts and floods wreak havoc to our food systems and when our rivers run dry, these are the true costs of inaction. When we spend money fostering innovation in clean technologies, developing the talents of a work force, these are investments that will have returns many times over and truly enhance our economic competitiveness.

The House Energy Bill provides a historic opportunity to turn the corner and regain global economic leadership. It sets clear electricity and efficiency standards that will spur new investments while saving consumers money. It proposes an independent clean energy deployment administration, or Green Bank, an idea that the Center for American Progress helped shape, to finance emerging clean energy technologies.

The bill also provides funds to help U.S. manufacturers retool plants, retrain workers to produce the components of a clean energy economy. Jobs installing and operating new technologies will stay within the United States and cannot be outsourced. The bill puts a price on carbon pollution so that the energy investments are more attractive.

To conclude, President Obama has said the Nation that leads the world in creating a new clean energy economy will be the Nation that leads the 21st century global economy. Americans look to the Senate to seize the clean energy economic opportunity and reestablish our leadership.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. Wong follows:]

Center for American Progress Action Fund

Written testimony for the
Senate Committee on Environment and Public Works hearing
on
Ensuring and Enhancing U.S. Competitiveness while
Moving toward a Clean-Energy Economy

July 16, 2009

Julian L. Wong
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Madam Chairman and Members of the Senate Committee on Environment and Public Works, good morning and thank you for this opportunity to discuss how the U.S. economy can stay internationally competitive while moving toward a clean-energy economy. My name is Julian L. Wong and I am a Senior Policy Analyst at the Center for American Progress Action Fund. I have been specifically asked to describe what China is doing to invest in building a low-carbon economy as a driver for future economic growth, something I am pleased to share with the committee after spending most of last year in China as a Fulbright Scholar affiliated with Tsinghua University where I actively researched China's policy and private sector initiatives in renewable energy and interacted daily with thought leaders who are shaping China's clean-energy agenda.

It may seem paradoxical that a country said to be building an average of two medium-sized coal power plants a week is also laying the foundation for a clean-energy economy. But that is exactly what they are doing. Thomas Friedman tells a story in his latest book *Hot, Flat and Crowded*, about how when he was on a visit to China, speaking to Chinese students about the need for China to act on their energy and environmental problems, the students would inevitably respond that China should have a right to develop just like the West has done for the past 150 years. Friedman's response would be something like: "Sure, take your time, grow as dirty as you want because the United States will just need five years to build all the clean-energy technologies that China will need when it starts choking on its pollution. Then, the United States will sell all the clean technologies that China needs."

The irony is that, as Friedman noted in a column earlier this month,[1] the Chinese seem to have completely grasped the point he was making to those Chinese students. It is China, and much less so the United States, that is now laying the foundation for a new clean-energy economy. It has emerged as a world leader in solar and wind component manufacturing and ultra high voltage grid transmission technology, as well as the development of electric vehicles and their associated charging infrastructure.

China recognizes the full threats of climate change and the limits of its own fossil fuel supply. It announced a National Climate Change Program in 2007, subsequently created an office for climate change within the National Development and Reform Commission—its top economic planning agency—and last year released a very comprehensive white paper on climate change outlining the threats and necessary responses that China will face.

China may have moved slower to acknowledge the threats of climate change than many other countries, but once it did, it acted swiftly and decisively, not only to address the need for action to slow down emissions from a business-as-usual scenario, but also to seize the energy opportunity to create a new pillar of prosperity. As Li Keqiang, first vice premier of China and Premier Wen Jiabao's deputy, has said on various occasions, the development of new energy sources represents an opportunity to stimulate consumption, increase investments, achieve stable export opportunities, and adjust China's energy structure, all while building international economic competitiveness.[2]

China has, to that end, set up ambitious targets for itself in energy efficiency and renewable energy development across various sectors. And the government has now indicated that it is poised to unveil a new long-term stimulus package specifically for new energy development that will total as much as $440 billion over the next decade and include additional large investments in the wind and solar sectors.[3] A comprehensive list of China's efforts to build a clean-energy economy is listed in a recent article that my colleague Andrew Light and I published last month, included in this written testimony as **Appendix I**. I wish to discuss today three noteworthy aspects of China's green leap forward toward a new energy economy that emphasize or supplement what is covered in that more extensive list.

I. Clean-energy infrastructure

China has set an aggressive target of achieving 15 percent of its electricity production from clean-energy sources by 2020. This initiative has already spurred entire new industries, particularly in wind and solar. The wind industry has been growing at over 100 percent per year for four years running. There were virtually no Chinese companies that made wind turbines five years ago, but now there are now more than 40. China now has the fourth largest installed capacity in the world—the United

States is number one—but many are projecting that China will eclipse the United States as the largest installer of wind power on an annual basis this year.

China's solar sector is equally impressive. China makes 40 percent of the world's solar photovoltaic panels, almost all of which it exports. But it recently enacted a national incentive program for roof top solar applications and has begun awarding tariffs for utility scale ground mounted solar power plants, actions that are kickstarting what is shaping up to be a vibrant domestic solar market. China is also the world's leader in solar thermal water heating, holding a 60 percent market share. Goldman Sachs invested recently in a Shangdong province-based company, Himin Solar, an industry leader that will soon start exporting their solar water heaters to the United States.

In terms of infrastructure, China is investing $88 billion through 2020 to build high voltage transmission lines, in large part to tap into these clean renewable sources located away from the cities. Its economic stimulus package also provides significant investments in rail infrastructure; although not necessarily "green" per se, such logistics infrastructure supports enhancing supply chains and building a low-carbon manufacturing economy. By the end of 2008, China had installed 76 GW of renewable energy capacity, which is nearly twice the United States' 40 GW.[4] And China is just getting started.

II. Energy efficiency

China has embarked on what must be acknowledged as one of the most aggressive energy conservation policies in the world. By 2010, China expects to have reduced its energy consumption by 20 percent per unit of GDP compared to 2005 levels. According to analysis by Lawrence Berkeley National Laboratory, such efforts, if sustained, will start to yield reductions from a business-as-usual trajectory of over one billion tons of carbon dioxide emissions per year by 2010.

China has also identified its top 1,000 energy consuming enterprises, which account for a whopping one-third of all of China's emissions, and it has set binding energy efficiency targets for each of them. The program is on track to realize a savings of 100 million tons of coal equivalent by 2010.

Even though coal remains a dominant source of electricity in China, and the country continues to build new power plants, there is a policy to shut down smaller and inefficient coal plants as larger and more efficient ones take their place. China shut down 34 gigawatts worth of small, inefficient plants between 2006 and 2008, and plans to close another 31 GW (or more than 150 200-MW coal plants, or about one such plant a week) over the next three years.[5] This relentless policy of "opening-the-large-and-closing-the-small" has increased Chinese coal plants' average efficiency from 370 grams of coal per kilowatt hour of electricity generated in 2005 to

349 grams in 2008. And new plants such as the four units of 1 GW ultrasupercritical coal plants in Yuhuan can generate a kilowatt hour of electricity with just 283 grams of coal. By contrast, existing coal plants in the OECD average around 320 grams per kilowatt hour. The International Energy Agency has been compelled because of these rapid gains in efficiency to downward revise is projections of annual greenhouse gas emissions growth for China from 3.2 percent to 3 percent.[6]

And in the auto sector, China's fuel economy standards provide an average of over 36 miles per gallon, which is already higher than the new standards that President Barack Obama announced in May that will help U.S. fleets reach 35.5 miles per gallon by 2016. Plans to raise China's standards to as high as 42 miles per gallon by 2015 are reportedly under serious consideration.[7] The drive toward efficiency is spurring research and development of new drive-train technologies, including technologies for hybrid, plug-in hybrid, and pure electric vehicles.

III. Low-carbon development zones

I have witnessed firsthand how the drive toward a low-carbon economy is transforming China's cities. Baoding, a city 140 kilometers southwest of Beijing, is an excellent case in point. I had the opportunity to visit this once sleepy agricultural-based town, which has transformed itself into a vibrant high-tech manufacturing hub for clean-energy products and technologies. It is home to one of the world's largest solar companies, Yingli Green Energy, and many other manufacturers of components for the wind and solar sectors, numbering 150 businesses in total. Twelve percent of Baoding's gross domestic product was derived from clean tech manufacturing in 2007, and the city has a long-term target of raising this percentage to 40 percent by 2050.[8]

Baoding is not the only city pursuing a low-carbon growth strategy. I also visited the up and coming industrial hub of Tianjin, the site of a 30 square-kilometer eco-township that is integrating the latest designs in low-carbon sustainable living measured by tracking 22 key performance indicators and will be home to 350,000 residents within 10 to 15 years. The project is being implemented in collaboration with the Singapore government and has already broken ground. Tianjin is also a major wind manufacturing base that has attracted international names such as Vestas from Denmark and Gamesa from Spain to set up manufacturing plants. I also got to visit in Tianjin new dynamic Chinese enterprises such as Lishen, a lithium-ion battery maker, and Qingyuan, a manufacturer of electric vehicles.

Baoding and Tianjin are living examples of the future—the future of a new energy economy.

Implications for the United States

The United States may have won the race to the moon, but we're losing the race for a sustainable Earth. And we're not only behind China, and therefore losing access to valuable export markets, but also losing to countries such as Germany, Spain, and even India, which has recently set the world's most ambitious solar energy target of 20 GW by 2020.

Opponents to climate action often cite the costs of legislation. These people are confusing cost with investment. Costs are incurred when the planet heats up, when the increased frequency of drought and floods wreak havoc to our food systems, when our rivers run dry. Those are the true costs—with no paybacks—that come with inaction. When we put money into research and innovation on clean technologies, and into our people in the form of education and workforce development, that is an investment that will provide returns many times over and truly enhance our competiveness.

The good news is that the United States has all the right ingredients to turn the corner and regain global leadership. We have always been a leader in technological innovation; we have the world's most robust network of research and educational institutions, and a hardworking and productive work force. And now, we have an amazing opportunity before us to adopt a policy framework that will channel new investments into precisely these job creating clean-energy sectors. We should not be timid about climate legislation. Michael Porter of Harvard Business School, the guru on competition theory, has said:

> Properly designed environmental standards can trigger innovation that may partially or more than fully offset the costs of complying with them. Such "innovation offsets" can not only lower the net cost of meeting environmental regulations, but can lead to absolute advantages over firms in foreign countries not subject to such regulations. Innovation offsets will be common because reducing pollution is often coincident with improving the productivity with which resources are used... By stimulating innovation, strict environmental regulations can actually enhance competitiveness.[9]

With innovation and competitiveness comes job creation. A report by the University of Massachusetts and the Center for American Progress says an investment of $150 billion in clean energy—an amount that will be achievable through the combination of the American Recovery and Reinvestment Act of 2009 and the American Clean Energy and Security Act (ACESA) that just passed the House—will create 1.7 million new net jobs in the clean-energy sector.[10]

ACESA is not just a "cap-and-trade" bill. ACESA not only attaches a price on carbon and sets renewable energy and energy efficiency standards that create signals to spur

new energy investments; it also contains supporting mechanisms such as the Green Bank to finance emerging clean-energy companies, and provides financial incentives for small and medium sized manufacturers of clean-energy technologies and their components up their supply chains to ensure that new jobs stay within the United States and are not outsourced. ACESA is an integrated energy bill that provides us the unprecedented opportunity to lay the foundation for a prosperous clean-energy economy, but only if the House legislation has been met with a strong positive response from the Senate.

President Obama has said many times that, "The nation that leads the world in creating a new clean-energy economy will be the nation that leads the 21st century global economy." The United States needs a bold vision and to seize the energy opportunity and be the nation that leads.

Thank you for listening and I look forward to your questions.

Endnotes

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Appendix I

China Begins Its Transition to a Clean-Energy Economy

China's Climate Progress by the Numbers

By Julian L. Wong and Andrew Light

Article and hyperlinks to sources available at:
http://www.americanprogress.org/issues/2009/06/china_energy_numbers.html

A common refrain from climate action naysayers is that, "China is building two coal-fired power plants a week!" They insist that the United States should wait until this major emitter takes on binding commitments to climate change mitigation before it decides to adopt global warming pollution reduction policies in the American Climate and Energy Security Act (H.R. 2454). They further claim that if such a bill became law, the United States would be transferring its jobs to countries such as China and India that are doing nothing to curb emissions. But that thinking is exactly wrong.

Critics fairly point to the fact that 80 percent of China's power is derived from dirty coal, and that China recently surpassed the United States as the word's largest emitter of carbon dioxide. Yet China's per capita emissions remain a fifth that of the United States, and its historical cumulative per capita emissions from 1960 to 2005 are less than one-tenth that of the United States.

Still, the Chinese have recognized that it's climate inaction—not climate legislation—that will lead to its own economic undoing. As the U.S. Congress debates the merits of enacting renewable electricity and energy efficiency standards, China has already forged ahead with building its own low-carbon economy, laying the foundation for clean-energy jobs and innovation.

China ranked second in the world in 2007 in terms of the absolute dollar amount invested in renewable energy, according to the Climate Group. It spent $12 billion, which put it just behind Germany's $14 billion. These investments have placed China among the world leaders in solar, wind, electric vehicle, rail, and grid technologies. And now approximately 9 percent of China's $586 billion economic stimulus package will go toward sustainable development (excluding rail and grid) projects.

China is expected to unveil in the coming weeks another extensive and unprecedented stimulus package—reported to be in the range of $440 billion to $660 billion—dedicated solely to new energy development over the next decade, including generous investments in wind, solar, and hydropower. If those expectations are fulfilled, China could emerge as the unquestioned global leader in clean-energy production, significantly increasing its chances to wean its energy appetite off coal, and at the same time ushering in an era of sustainable economic growth by exporting these clean-energy technologies to the world.

The bottom line: China is not there yet, but it is beginning to transition to a clean-energy economy

through a wide range of actions. The United States should encourage China's efforts and encourage China to expand upon them. We have sketched this claim before, but let's run though the numbers in more detail.

Energy efficiency

Energy efficiency is China's primary energy priority. China just last year revised its Energy Conservation Law to declare that it "implements an energy strategy of promoting conservation and development concurrently *while giving top priority to conservation*" (emphasis added). This emphasis runs through many of China's policies.

- China aims to reduce energy intensity—the amount of energy consumed per unit of gross domestic product—by 20 percent of 2005 levels by 2020. Each province and provincial-level city has been assigned an energy intensity reduction target ranging between 12 percent and 30 percent, and the respective governors or mayors are held accountable to such targets. Their success is part of the basis for their evaluation for promotion. China has made steady progress toward reaching this goal, achieving a 10-percent reduction of energy intensity by the end of 2008. If the goal is fully realized, it will translate to an annual reduction from a business-as-usual scenario of over 1 billion tons of carbon dioxide per year starting in 2010. By comparison, the European Union's targets under the Kyoto Protocol translate to an annual absolute reduction of 300 million tons of carbon dioxide by the end of its compliance period in 2012.

- The Top 1,000 Energy-Consuming Enterprises program, which China started in 2006, sets energy efficiency benchmarks for the top 1,000 energy-consuming enterprises across nine sectors of heavy industry. These 1,000 industries alone constituted 33 percent of China's overall energy consumption and 47 percent of industrial energy consumption in 2004, and 43 percent of China's carbon dioxide emissions in 2006. Data suggests that the program is on target to achieve its goal of saving 100 million tons of coal equivalent, which translates to reducing carbon dioxide emissions by between 300 million and 450 million tons. This is also the equivalent of removing 68 million to 100 million cars from the road.

- China launched a rebate program in April 2008 to subsidize the purchase of energy efficient light bulbs by 30 percent on wholesale purchases and 50 percent on retail sales. Some local governments provide an additional subsidy of up to 40 percent. China subsidized 62 million bulbs by the end of January 2009, which can help save 3.2 billion kilowatt hours of electricity annually and reduce carbon dioxide discharges by 3.2 million tons. China announced plans earlier this year to double the size of the program to subsidize 100 million bulbs in 2009.

- Smaller and less efficient power plants in China are closing down as larger, more efficient power plants are built. China shut down 34 gigawatts worth of small, inefficient plants between 2006 and 2008, and plans to close another 31 GW over the next three years. This active policy of "opening-the-large-and-closing-the-small" increased average efficiencies

from 370 grams of coal per kilowatt hour of electricity generated in 2005 to 349 grams in 2008. And new plants such as the 1 GW ultrasupercritical coal plant in Yuhuan can generate a kilowatt hour of electricity with just 283 grams of coal.

- China enacted a new building code in 2006 that requires new buildings to halve their energy consumption levels compared to the current average. Enforcement remains a difficult challenge, and the code does not address the vast stock of existing structures, only 4 percent of which meets the new standards. A more successful program has been the requirement that government offices set thermostats at no lower than 26 degrees Celsius in the summer and no higher than 20 degrees Celsius in the winter, while encouraging the general public to do the same. And China has recently launched the Three Star green building evaluation standard, a voluntary set of standards aimed at encouraging green building development with performance standards above and beyond what the building code requires.

- China is the world's largest producer of electronic and home appliances, and it developed mandatory energy efficiency standards and labels for a range of such products in 2005. These standards are coupled with the adoption of green procurement polices for government offices and state-owned enterprises and will enable China to avoid 100 million tons of carbon dioxide emissions per year.

- A pilot energy demand-side program—whereby the quantity and pattern of consumption are smartly managed to match supply constraints—in Jiangsu province has eliminated the need to build 300 megawatts of electricity capacity in the area, thus eliminating 1.84 million tons of carbon dioxide equivalent. A World Bank study concludes that if properly scaled, demand-side management can eliminate the need to build more than 100 GW of electricity capacity in China by 2020.

Renewable energy

China is keenly aware of the threats that climate change poses and the need to diversify its energy base away from coal and oil. The Renewable Energy Law of 2006 and subsequent Medium and Long-Term Renewable Energy Plan set a framework for ambitious targets to develop renewable energy sources in China.

- China has set a goal of generating 10 percent of its electricity from renewable energy sources by 2010, and 15 percent by 2020.

- China just tripled is 2020 target for installed wind capacity from 20 GW to 100 GW and has recently surpassed India as the fourth-largest installer of wind power.

- China's 2020 target of building 1.8 GW of installed solar power capacity is expected to be increased at least fivefold to 10 GW. China was the world's largest manufacturer of solar photovoltaic panels until recently, providing roughly 40 percent of the global market

share in 2008. An overwhelming majority of those solar panels have been exported, but China's domestic solar market is on the cusp of experiencing a boom thanks to new solar incentives announced this year that cut the cost of purchase and installation by as much as half.

- One in 10 Chinese households use solar thermal water heaters. China had deployed 40 million solar water heaters in 2007—two-thirds of the global market share. The country plans for 30 percent of its households to have installed solar water heaters by 2020.

- China has a target for 300 GW of installed hydropower by 2020, which is twice what it has now.

- China implemented a feed-in tariff for biomass power generation at the rate of 3.2 cents per kwh. This means that China essentially provides a preferential electricity tariff to biomass power producers of 3.2 cents per kwh over the tariff for conventional fossil fuels. It plans to install 30 GW of biomass power capacity by 2020.

- China aims to use 10 million tons of bioethanol and 2 million tons of biodiesel by 2020, replacing 10 million tons of petroleum-based fuel annually.

- The national renewable energy targets do not include nuclear energy. China currently has just over 9 GW of installed nuclear power, but is poised to ramp that up to account for 5 percent of electricity production by 2020, translating to an installed capacity of 60 to 75 GW.

- All electricity end-users (other than the agriculture sector and residents of Tibet) have had to pay a renewable energy surcharge of 0.001 yuan per kwh since 2006. This surcharge doubled to 0.002 yuan per kwh for commercial and industrial users in August 2008. Proceeds from the surcharge have been distributed in three batches to renewable energy projects (mostly wind and biomass)—$34.6 million in 2006, $106 million in the first through third quarter of 2007, and $295.2 million in the fourth quarter of 2007 through the second quarter of 2008.

Energy grid

China, like the United States, must modernize its national grid infrastructure in order to accelerate its uptake of renewable energy. This discussion is actively in the works now.

- China is an emerging world leader in ultra-high-voltage, or UHV transmission technology, with more than 100 domestic manufacturers and suppliers participating in the manufacturing and supply of UHV equipment. A transmission line from Shanxi to Hubei boasts the highest capacity in the world, and is able to transmit 1,000 kilovolts over 640 kilometers. The State Grid Corporation will invest $44 billion through 2012, and $88 billion through 2020 in building UHV transmission lines.

- China will unveil in the coming months plans to build an extensive smart grid by 2020.

Auto industry

In contrast to the decline of the United State's automotive industry, China is creating a strong and robust automotive manufacturing capacity, especially with respect to highly efficient cars, hybrid-electric vehicles, and pure-electric vehicles.

- China has fuel economy standards that translate to 36.7 miles per gallon and is said to be considering a proposal to raise that to 42.2 mpg by 2015. The U.S. standard was only 27.5 MPG for 20 years, although President Barack Obama announced a new standard in May of 35.5 mpg by 2016.

- China last September doubled taxes on cars with engines above four liters from 20 percent to 40 percent, and increased them from 15 percent to 20 percent for those with engines between three and four liters. At the same time, China reduced taxes for cars with engines under one liter from 3 percent to 1 percent.

- China has been criticized until recently for fixing energy prices at artificially low rates. China is now embarking on progressive energy price reform to indirectly link transportation fuel prices to global crude prices. It raised gasoline and diesel prices once in 2007 and once in 2008. Yet it has increased prices twice in the first five months of this year alone.

- China wants to raise its annual production capacity of hybrid, all-electric cars and buses to 500,000 by the end of 2011. This would account for only 5 percent of total car sales, but is up from 2,100 in 2008. Thirteen cities will roll out pilot subsidy schemes for "new energy vehicles," ranging from $7,350 for small hybrid passenger cars to $87,700 for large, fuel-cell-powered commercial buses. The subsidies will target public-sector purchases such as public transportation, sanitation, and postal services. The State Grid plans to deploy pilot networks of charging stations in Beijing, Tianjin, and Shanghai, while Nissan-Renault plans to help establish a pilot charging infrastructure network in Wuhan.

- China's emerging leadership in electric vehicles is based on its innovation in energy storage technology. The world's first mass-produced, plug-in hybrid is the F3DM, launched by China's BYD Auto last December. Just six years ago this company was only in the business of making batteries for mobile phones. The F3DM sells in China for approximately $22,000.

- China has also become the world's leader in electric bicycles, which are fitted with a small 250-watt motor and rechargeable nickel-cadmium battery. They have a range of 60 kilometers between charges and can reach speeds of 30 kilometers/hour, which make

them ideal for intracity mobility, providing a zero-emission (during operation) alternative to a car or motorcycle. China accounts for 80 percent of global electric bicycles sales.

Public transportation

Cars will probably remain outside of economic reach for Chinese households, despite the growing automotive market. Mass transit—particularly intracity subways and long-distance high speed rail—will remain the mobility solutions of choice.

- China is embarking on the largest railway expansion in history and plans to spend more than $1 trillion expanding its railway network from 78,000 km today to 120,000 km in 2020. Of this, 13,000 km will be comprised of high-speed rail. The 1,300 kilometer Beijing-Shanghai line is under construction and it will reduce travel time between those destinations from 14 hours to 5 hours when it opens in 2013. This will attract an estimated 220,000 daily passengers and should dramatically reduce air travel between the metropolises.

- China reportedly has 26,000 km of electrified railways, making it second in the world in this arena. Encouragingly, this figure accounts for 32 percent of China's total railways, but is responsible for 50 percent of overall passenger and cargo volume.

- China is poised to have the world's largest network for intracity urban rail transit. About 2,100 km of railway lines will be laid and operational by 2015 in 19 cities. Ten cities currently have 29 urban rail routes, totaling 778 km, and 14 cities are building 46 urban rail lines, which total 1,212 km.

Other initiatives

- An unprecedented wave of rural-to-urban migration is creating opportunities to experiment with new development patterns. There are over 40 different eco-city projects currently proposed or under development throughout China.

- Low-carbon manufacturing zones, such as those in Baoding, Tianjin, and Jiangsu, are emerging as engines of growth for clean energy.

- China has a target to increase forest area coverage to 20 percent by 2010 and has committed $9 billion annually toward this effort.

- A total of 1,200 counties across the country are utilizing fertilizers according to the results of local soil tests to reduce emissions of nitrogen oxide—a less common but more potent global warming pollutant.

Conclusion

It's true that China's absolute emissions are rising as its economy continues to expand by 6 percent to 8 percent annually even amidst a global recession, and that compliance with government mandates are difficult to assess given the lack of transparency in reporting or to enforce due to limited institutional capacity. But it would clearly be incorrect to accuse China of doing nothing on climate change.

When the framework for assessing a country's climate change mitigation efforts is narrowly confined to carbon emission caps, it glosses over a multitude of complementary actions that provide meaningful emissions reductions compared to a business-as-usual scenario. This is why we at the Center for American Progress have proposed "carbon cap equivalents" as a better model for assessing a country's carbon profile rather than only looking at stipulated caps.

The carbon cap equivalents strategy calls for us to rigorously model what China's carbon dioxide emissions reductions will add up to through a future date—such as the 2020 benchmark midterm year used in the U.N. climate change negotiations process—relative to a base line year, such as 1990. Looking at the full range of China's measures in this way shows that these iterated measures will amount to significant reductions relative to a business-as-usual scenario had China continued its emissions growth unabated. Together they will amount to a level of emissions reductions equivalent to if China had adopted an explicit targeted emissions cap.

We must also use the same technique to reveal the actual carbon emissions reductions achievable in the midterm by the American Clean Energy and Security Act currently making its way through Congress. A full analysis of the carbon cap equivalent of ACES compared to a model of the full range of measures being undertaken by China will likely show that the two countries are not as far apart in terms of their aspirations for carbon reductions as is commonly thought.

What makes the above list of actions by China all the more impressive is that the country's leaders decided to act unilaterally even though its per capita GDP and per capita emissions, both historical and present, remain a fraction of the United States'. China hasn't done so out of charity, but out of recognition that doing so is both critical to its national security and a huge opportunity for future economic prosperity.

Sure, China can do more. But we can create a much more constructive platform for forging a consensus in Copenhagen or forming the basis for a bilateral agreement with China on climate change by acknowledging and understanding the effects of the full range of China's climate actions outside of its lack of hard caps on carbon emissions. A more extensive analysis should quiet the naysayers on Capitol Hill that use the false excuse of Chinese inaction to block the passage of the historic climate and energy bill in the U.S. Congress.

Center for American Progress Action Fund

August 20, 2009

The Honorable Barbara Boxer
Chairman
Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

The Honorable James M. Inhofe
Ranking Member
Senate Committee on Environment and Public Works
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Boxer and Ranking Member Inhofe:

This written testimony is in response to your letter dated August 6, 2009, in which I was asked to answer the following question:

Senator Boxer:
Based on your own analysis or any other analyses with which you are familiar, including EPA analysis, what effect will a bill that caps carbon dioxide emissions from power plants have on demand for new nuclear power plants?

The Center for American Progress Action Fund has not conducted specific analysis on whether legislation that caps carbon dioxide emissions from power plants would spur nuclear power growth. However, I will offer some preliminary observations in this written testimony about the possible effects that the American Clean Energy and Security Act, H.R. 2454, passed by the U.S. House of Representatives passed in June could have on nuclear power.

Nuclear is a power source that results in zero carbon dioxide emissions from electricity generation. Any legislation that establishes a price on carbon dioxide would improve the attractiveness of nuclear power compared to fossil fuels. ACESA proposes architecture for a cap-and-trade system that would create a price for carbon (see Title III of H.R. 2454). The cap-and-trade system would increase the cost of producing carbon-intensive sources of energy such as coal and oil—and to a lesser extent natural gas—thus enhancing the competitiveness of carbon-free alternatives such as renewable energy and nuclear. ACESA's cap-and-trade provisions provide a market-based mechanism that does not favor any particular low- or no-carbon technology. Nuclear power therefore stands to benefit to the extent that it can compete economically with other low-carbon technological options.

Section 186 of ACESA establishes an independent Clean Energy Deployment Authority or "Green Bank," which would offer direct loans, letters of credit, loan guarantees, and other forms of credit enhancements to support clean-energy projects, including nuclear power projects. The Nuclear Energy Institute—the membership-based public policy and lobby arm of the nuclear industry—has publicly endorsed ACESA. It noted that the

provisions relating to CEDA "will accelerate deployment of clean-energy technologies. [CEDA] can help stimulate construction of the advanced-design nuclear power plants that our nation needs."[i] Other utilities that use nuclear power—such as Duke Energy and Exelon—have praised the House of Representatives' passage of ACESA.[ii,iii]

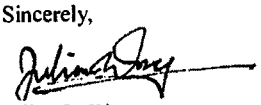
Nuclear power generation is projected to increase by 150 percent from 782 billion kwh in 2005 to 2,081 billion kwh in 2050, according to an analysis by the Environmental Protection Agency.[iv] In fact, the analysis constrains the growth of nuclear at 150 percent because not doing so—according to the author of the report—would lead to even more dramatic and disproportionate increases in nuclear power generation.

The Energy Information Administration's ACESA modeling similarly shows that ACESA is a boon to the nuclear industry.[v] Without a carbon cap, the EIA projects that there will be 11 gigawatts of new nuclear capacity by 2030. However, with a cap in place, the nuclear industry is expected to install 96 GW of capacity by 2030—nearly nine times as much growth. The EIA notes similarly that nuclear power will provide 74 percent more energy (in billion kilowatthours) by 2030 with ACESA than it would without it. When the international offset provisions are removed from consideration, the EIA projects that up to 135 GW of new nuclear capacity will be installed between now and 2030. These projections may even be conservative, as the EIA did not assess the additional impact of CEDA.

The Electric Power Research Institute's 2009 PRISM/Merge Analysis also confirms the importance of nuclear power in meeting long-term emissions reduction targets similar to those required by the ACESA.[vi] This analysis found the most economically efficient method of meeting comparable emission reductions for two scenarios, "full technology" and "limited technology"—which included no additional nuclear or coal with carbon capture and storage technology. It found that the deployment of a full set of technologies—including 64 GW of new nuclear capacity by 2030—would lower the net economic cost by over $1 trillion. Indeed, wholesale electricity in 2050 would be 43 percent less with "full" deployment of nuclear and other technologies than it would be with a "limited" deployment of such technologies.

At least three existing studies have found that legislation that caps carbon dioxide emissions from power plants—such as ACESA or a bill similar to it—will lead to the significant growth of nuclear power in the United States. The nuclear industry itself supports ACESA. Those who say ACESA does little to boost nuclear power should consider the findings of these studies and the views of the nuclear industry.

Sincerely,



Julian L. Wong
Senior Policy Analyst
Center for American Progress Action Fund

Endnotes

[i] Nuclear Energy Institute, "NEI Welcomes Inclusion of Clean-Energy Provisions in Climate Bill OK'd by House," Press Release, June 26, 2009, available at http://www.nei.org/newsandevents/senatevotenuclearplantdeployment/nei-welcomes-inclusion-of-clean-energy-provisions-in-climate-bill-okd-by-house

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[iv] Office of Atmospheric Programs, U.S. EPA, "EPA Analysis of the American Clean Energy and Security Act of 2009, H.R. 2454 in the 111th Congress," June 23, 2009, available at http://www.epa.gov/climatechange/economics/economicanalyses.html

[v] Office of Energy Statistics from the U.S. Government, EIA, "Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009," August 2009, available at http://www.eia.doe.gov/oiaf/servicerpt/hr2454/index.html?featureclicked=2&

[vi] EPRI, "PRISM/MERGE Analysis 2009 Update," available at http://my.epri.com/portal/server.pt?Abstract_id=000000000001019563

Senator BOXER. Thank you so much.

Our last speaker is Harry Alford, President of the National Black Chamber of Commerce. Welcome, sir.

STATEMENT OF HARRY C. ALFORD, PRESIDENT AND CEO, NATIONAL BLACK CHAMBER OF COMMERCE

Mr. ALFORD. Thank you, Madam Chair.

The National Black Chamber of Commerce was incorporated in May 1993 for the purpose of developing economic policy for African-American communities.

We have been looking at energy policy since 1996. And in 1999 we took a delegation to Brazil, where the country of Brazil gave us a very formal presentation on their energy policy. Envious, intimidated and quite impressed, we came back to the United States to help the United States develop an energy policy. So far, we have failed. We have no energy policy.

I come to you, not as an economist, but with a deep understanding of small and minority-owned businesses and as someone who has experience with consumer behavior.

Climate change is a vital issue that must be addressed. It will take time and cost real money to mitigate humanity's influence on climate. But any legislation must take into account the costs that will be shouldered by small and minority-owned businesses.

Unfortunately, the current legislation from the House of Representatives will negatively impact the most vulnerable. It does not do what it is supposed to do. I learned a long time ago to beware of any document that has more authors than readers.

The costs associated with the House bill are not readily understood. Let me quote from our study with Charles River Associates.

Businesses and consumers will face higher energy and transportation costs that could lead to increased costs of other goods and services throughout the economy.

Household disposable income and household consumption would fall. Purchasing power would decline by $730 in 2015 and $940 in 2050, adjusted against 2010 base income levels.

Wages and returns on investments would fall, lowering productivity growth and reducing employment opportunities. Wages would be $170 a year less by 2015, $390 a year less by 2030, and $960 less by 2050.

Green jobs, whatever they are, gained would be swamped by jobs lost in old industries and businesses, leading to a net loss of 2.5 million jobs.

These impacts would adversely affect some groups more than others. They will also put our businesses at a competitive disadvantage, vis-à-vis the Chinas and the Indias of the world who will open factories and businesses that we cannot afford to build here.

And what about the emissions permits that we would give away? Are we really contemplating handing the reins of our economy over to Wall Street emission traders who will deal in politically generated emissions permits and foreign offsets?

The bottom line is this: any climate legislation that fails to meaningfully reduce the human impact on the climate or does so in an economically unsustainable manner cannot be effective. While consumers may not have much choice but to pay the higher

costs that will be passed on to them if the current legislation becomes law, the actions they would take to deal with those costs would affect us all.

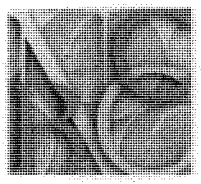
I urge the Senate to take a different path, one that marries our need to address climate change with our economic realities. I am not an expert, but I have to believe that there are better options than the one currently on the table.

We not only need to get the politics right when it comes to climate change, we need to get the economics right. If we do not, we will not truly get to where we want to be on the climate front, the economic front or any other front.

We, the United States, the No. 1 power among nations, are threatened because we cannot get ourselves together to formulate a viable energy policy. And there are examples out there from other countries.

Madam Chair, I am through.

[The prepared statement of Mr. Alford follows:]



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Senate Testimony

Presented to:

U.S. Senate Committee on Environment and Public Works

Honorable Barbara Boxer, Chairwoman

Presented by:

Harry C. Alford
President and CEO

National Black Chamber of Commerce

July 16, 2009
Washington, DC

Madam Chairwoman, ladies and gentlemen of the Committee. On behalf of the National Black Chamber of Commerce (NBCC), thank you for the opportunity to address you today.

I come to you, not as an economist, but with a deep understanding of small and minority-owned businesses and as someone who has experience with consumer behavior.

Climate change is a vital issue that must be addressed. It will take time and cost real money to mitigate humanity's influence on our climate. The thing that concerns me and many of the 95,000 business members of the National Black Chamber is that any legislation Congress enacts must consider the impact that costs will have on small and minority-owned businesses, their ability to create jobs and the impact on the communities that they serve.

Regretfully, the current legislation out of the U.S. House of Representatives will negatively impact the most vulnerable of our society. I'm sure that those who proposed it had the best intentions, but the bill doesn't do what it's supposed to do, and it does so at a very high cost -- especially high for working families and small business owners.

I learned a long time ago to beware of any document that has more authors than readers. The fact that so few people have actually read the House bill may explain why the full costs that American businesses and everyday people would shoulder are not readily apparent. Let me quote from a recent study that we did with CRA International:

- Businesses and consumers will face higher energy and transportation costs that could lead to increased costs of other goods and services throughout the economy;
- Household disposable income and household consumption would fall. Purchasing power would decline by $730 in 2015 and $940 in 2050, adjusted against 2010 base income levels;
- Wages and returns on investment would fall, lowering productivity growth and reducing employment opportunities. Wages would decline $170 a year by 2015, $390 a year by 2030 and $960 a year by 2050;
- Green jobs gained would be swamped by jobs lost in old industries and businesses, leading to a net loss of 2.3 million to 2.7 million jobs.

These impacts, the study found, would differ across regions, across industries and across income levels depending on changes in local energy costs and on allocation formulas for permits. And that worries me and my members because the black community suffers mightily when the economy goes south.

Finally, there's the issue of how this House bill would limit our ability to compete internationally. Our study found that there is no environmental impact to justify this loss of income and siphoning away our nation's wealth as long as developing nations such as China and India aren't part of the program. They'll be happy to open the factories and the businesses we can't afford to build here.

Our report also highlighted that U.S. emissions would exceed the caps put on them by 30% due to international offsets, resulting in a transfer of wealth varying from $40 billion to $60 billion per year from 2012 to 2030. In other words, we're going to send roughly $700 billion to $1 trillion abroad to make up for 30% higher pollution here. Combine these costs with the kind of badly-needed potential revenue we would be leaving on the table by giving away 85% of the emissions permits.

I opposed the massive bail out of Wall Street last fall because it sent the wrong signal by rewarding the wrong people, the ones who got us into our current mess. Now we're contemplating handing the reins of our economy over to emissions traders on Wall Street who will deal in politically-generated emissions permits and foreign offsets. The inherent complexity of a government-regulated emissions system, especially with an unenforceable international component, sets the stage for a perpetual struggle for political handouts. And that is a recipe for corruption, not for emissions reductions.

The bottom line is this: any climate legislation that fails to meaningfully reduce the human impact on the climate or does so in an economically unsustainable manner, can't be effective. Under the House bill, American consumers and businesses would take on a heavy burden. This burden would fall at exactly the wrong time.

While consumers may not have much choice but to pay the higher energy costs that would be passed onto them if the current legislation becomes law, the actions they would take to deal with

those costs would affect us all. They would buy less and delay their purchasing decisions – exactly the opposite of what we need to lift ourselves out of our historic economic dilemma. Further, many low-income families and those on fixed incomes will have to make even tougher choices. Imagine the elderly woman who has to choose between heating her home and purchasing the food that she needs.

Another thing will happen, too. When those consumers lose their jobs as a result of cap-and-trade legislation – including those who may ultimately be encouraging you to vote for it – they will come looking for someone to blame. And that someone could be their elected officials.

I urge the Senate to take a different path. – one that marries our need to address climate change with our economic realities.

I'm not a climate change expert, but I have to believe that there are better options than the one currently on the table. I saw an article the other day in the *San Francisco Chronicle* that cited Elaine Kamarck, former advisor to Vice President Al Gore. She just released a paper on the historical politics surrounding climate change legislation in the U.S. She said, "If we can design a policy that is transparent and easy for people to understand, puts an effective price on carbon, and reimburses average Americans for all or nearly all of their increased costs, we have a chance of reversing climate change in a timely manner."

She also said that "no major policy change has ever occurred without first getting the politics right." I think she's spot on, but I'd add that it's equally important to get the economics right.

If we don't, we won't truly get to where we want to be on the climate front, the economic front, or any other front.

I thank you for your time and look forward to answering any questions you may have.

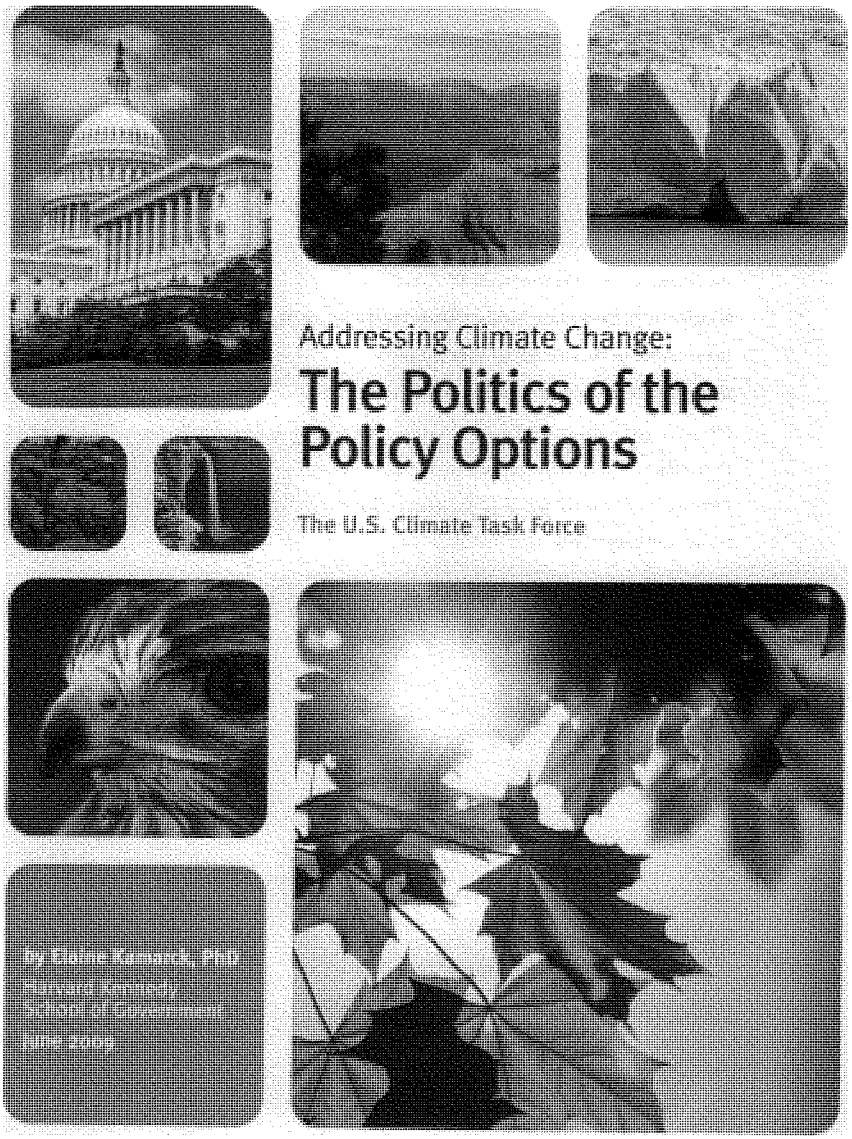

Addressing Climate Change:
The Politics of the Policy Options
The U.S. Climate Task Force

Table of Contents

Elaine Kamarck, PhD
Harvard Kennedy School of Government

For the U.S. Climate Task Force
(The views expressed in this paper are the Author's only.)

Addressing Climate Change: The Politics of the Policy Options

Introduction

It often takes a long time for a policy issue to get to the point where all the complex factors required for change through the American political process come together. Take health care. President Harry Truman advocated universal health care for all Americans in the late 1940s, universal health care was provided for senior citizens and the poor in 1965, and now we are well into the 21st century and still arguing about whether and how to guarantee health care coverage for all Americans.

It has been 30 years since scientists introduced the problem of global warming into the American political dialogue. More than a generation later, the news from the polar ice caps grows worse with each passing year. Environmental disruptions, extreme weather events, species extinction and new and more powerful germs are frequent topics in the news; and as a result, public awareness and concerns have increased. Although scientists cannot predict exactly when a "tipping point" will occur and the changes in our atmosphere from greenhouse gases will become irreversible, a scientific consensus has formed that we must begin to act now if we are to avoid profoundly damaging changes in weather patterns and sea levels that would disrupt countless ecosystems, threaten many low-lying parts of the world, and profoundly affect weather patterns. In short, solving the climate change crisis cannot take another 30 years.

But there are daunting political problems to be dealt with in solving the climate challenge — and in the past year, the economic crisis facing the United States and the world has made some of those problems even more intractable. This paper looks at the politics of the climate change crisis, in the hope that a better understanding of these dynamics will enable policymakers to avoid some of the political pitfalls and act both quickly and responsibly.

Some Recent History

While the climate change problem has been with us for several decades, the possible solutions have recently come to the forefront of the political debate. Climate change was initially raised in Congress in the late 1970s, when then

A LexisNexis search of major U.S. newspapers in the last three years of the 1970s yields just over 100 articles on climate change.

Congressman Al Gore held the first hearings on global warming and its effects on the climate. Then, with the exception of a number of administrative initiatives, the issue languished for much of the next two decades. A LexisNexis search of major U.S. newspapers in the last three years of the 1970s yielded just over 100 articles on climate change. (The same search covering the last three years produced more than 1,000 hits.) The first front-page New York Times story on climate change appeared in 1981. While there was sparse polling on climate change in the 1970s and 1980s, a 1981 poll found that less than half of the public had heard of the greenhouse effect and of those, only 37 percent thought it was "somewhat serious."[1] The discovery of the ozone hole in the atmosphere by British scientists in 1985 and subsequent international action in Montreal helped to establish for many people the concept that human activity is, in fact, an influence on climactic conditions, an important step forward. A few years later, the climate expert James Hansen's testimony before Congress during an extremely hot spell in Washington was widely covered and thrust the issue into newspapers around the country.

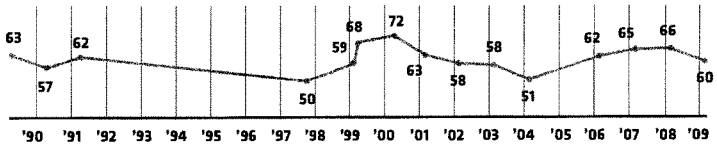
Even so, climate change continued to encounter problems penetrating the American political agenda. Unlike prior environmental concerns and the popular movements they inspired, cause and effect in climate change are not immediately observable. In earlier instances of environmental

1 Opinion Research Corporation poll, May 1981, USORC.81MAY.R22. 5% Not at all serious, 16% Not too serious, 28% Somewhat serious, 37% Very serious, 24% Don't know: Opinion Research Corporation poll, April 1980, USORC.80APR1.R3M. Data furnished by Roper Center for Public Opinion Research, Storrs, CT.

Chart 1 The "Greenhouse Effect" or Global Warming

I'm going to read you a list of environmental problems. As I read each one, please tell me if you personally worry about this problem a great deal, a fair amount, only a little, or not at all.

% Great deal / Fair amount



Gallup Poll

activism, around air and water pollution, cause and effect were clear: Anyone could immediately observe industrial or automobile discharges, identify their sources, and observe their effects: The air was visibly dirty and filled with particulate matter, dead fish floated in polluted lakes, rivers caught fire, and trees turned brown and died. Climate change is largely an invisible problem; and while it can manifest itself in dramatic, extreme weather, the absence of immediately observable cause and effect makes public appreciation of its nature and significance more difficult.

Nonetheless, by the time the Nobel Committee awarded its Peace Prize to Al Gore and the United Nations Intergovernmental Panel on Climate Change (IPCC) in 2007, these problems were beginning to decline. There is now a broad, scientific consensus on the need to take prompt steps to stabilize the atmospheric concentrations of greenhouse gases at levels of roughly 440 to 550 parts per million.[2] In addition, members of the media have been educated and have begun to connect extreme weather events to climate change. This is, in significant part, a result of Al Gore's campaign to educate the public about these challenges, especially through his documentary *An Inconvenient Truth*, which showed how events in distant parts of the world are connected to extreme weather developments continents away. When a waitress in New York City was interviewed on television on an unseasonably warm day in January worrying about climate change instead of delighting in the warm temperatures, the message had reached the public.

Thus, after languishing in scientific journals and environmental think tanks for years, the climate change issue has finally entered the general public's consciousness. The number of people who believe that global warming is having serious effects now has increased 14 points since 2001 in CBS/NYT polling.[3] And the number of people who have heard or read about global warming increased 14 points between 2003 and 2006 alone.[4] Today, six in 10 Americans indicate that they are highly worried about global warming.[5] But the Democratic Pollster Stan Greenberg conducted focus groups on climate change and found, among swing voters, a lack of urgency on the issue.[6]

2 See page 12, *Confronting Climate Change: A Strategy for U.S. Foreign Policy*, Council on Foreign Relations Task Force report #61. Pataki, George E. and Vilsack, Thomas J., Chairs, Levi, Michael A., Project Director, CFR 2008. And "EPA Analysis of the Climate Stewardship and Innovation Act of 2007," S. 280 in 110th Congress, EPA, 2007. Stern, Nicholas, "The Economics of Climate Change, The Stern Review," Cabinet Office, HM Treasury; http://www.hm-treasury.gov.uk/independent_review_economics_climate_change/stern_review_reporte.cfm. All of these reports contain reviews and summaries of the scientific evidence.

3 "Recent Polling on Public Perceptions of Climate Change," Environmental and Energy Study Institute press release, May 4, 2007.

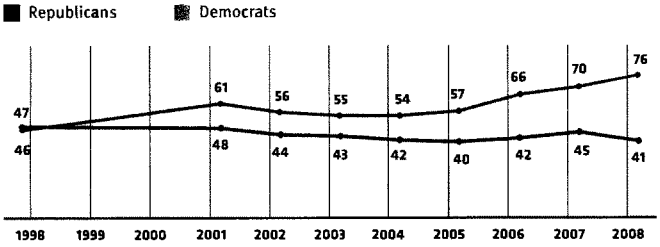
4 Ibid.

5 Gallup Poll, March 11, 2009.

6 "Voters in our groups do not see global warming as an immediate threat to the United States, their communities or their families — especially relative to the threats posed by high and unstable energy prices and the impact prices are having on their personal finances and the national economy. Even those who view global warming as a threat largely see it as long-term, remote or hard to understand." Greenberg, Quirlan Rosner Research Memo for the Third Way, June 16, 2009, p. 7 at http://www.thirdway.org/data/product/file/218/Clean_Energy_Focus_Group_Report_061509.pdf

Chart 2 The "Greenhouse Effect" or Global Warming

Percentage Saying the Effects of Global Warming Have Already Begun (by party ID*)



* Results for political independents not shown

Gallup Poll

While public interest in the issue has certainly increased, it also has picked up a partisan coloration. As **Chart #1** and **Chart #2** from Gallup show, in 1998 the numbers of Democrats and Republicans who believed that the effects of global warming had already begun were about even; 10 years later, Democrats are decidedly more firm in this belief than Republicans. The same partisan differences are apparent when people are asked whether the news media exaggerate the seriousness of global warming. An 11-point gap in the answers to this question in 1998 grew to a 41-point gap in 2008, with Republicans now much more likely than Democrats to believe that global warming has been exaggerated.[7]

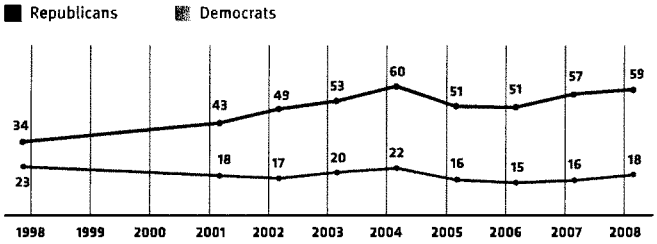
The emergence of a strong partisan divide on climate change presented complex political and policy problems *before* the 2008-2009 economic crisis, and now those problems are magnified. First, as a matter of serious and urgent policy, the issue is fairly new. While experts have discussed it for some 30 years, it only entered the political lexicon five to seven years ago; and over those years, support and opposition to serious policy measures have taken on decidedly partisan casts. Second, there have been relatively few major policy debates over the issue in recent years. During the Clinton/Gore administration, ratification of the Kyoto Protocol was such a non-starter that it was never formally submitted to the Senate. Action on the treaty was preempted by passage, in July 1997, of what came to be known as the Byrd-Hagel resolution, stating that the United States would not sign any treaty that did not call for targets for developing countries and that would result in serious economic impacts on the United States. While the decision to avoid a Senate defeat was a sensible political decision for the time, in retrospect it deprived the public of an early, serious open discussion of the issue and the ways to address it. As economic and environmental policy analysts have debated the policy options, those options have generally fallen into two broad categories. The first category consists of "carrots" such as tax credits to purchase fuel-efficient automobiles or appliances and create incentives for consumers to reduce their energy use without experiencing any pain. The second category consists of various "sticks" that would increase the

Climate change is largely an invisible problem; and while it can manifest itself in dramatic, extreme weather, the absence of immediately observable cause and effect makes public appreciation of its nature and significance more difficult.

7 "Climate-Change Views: Republican-Democratic Gaps Expand," by Riley E. Dunlap, Gallup, May 29, 2008.

Chart 3 The "Greenhouse Effect" or Global Warming

Percentage Saying the Seriousness of Global Warming is Generally Exaggerated in the news (by party ID*)



* Results for political independents not shown

Gallup Poll

price of CO_2 and other greenhouse gases in order to make production and use of alternative energy sources more profitable and widespread. The most popular options in this category are cap and trade systems and a carbon-based tax. In a cap and trade system, the government sets a "cap" on the total amount of emissions that can be sent into the atmosphere and then either gives out or auctions permits to produce those emissions, which also can be traded among greenhouse gas emitters. A carbon tax is simply that — a tax imposed on energy based on the carbon or greenhouse gases it emits.

In addition to Al Gore, a large number of economists who have written on this topic favor a carbon tax.

The debate has settled on these two options because both of them are "market based" and because "command and control" regulatory action is broadly considered too "bureaucratic" and inefficient. Thus, tracing the evolving politics around both of these options will help us to understand how best to approach the climate change debate as it unfolds.

The Original Option — A Carbon "Tax-Shift"

Al Gore's original solution to the climate change problem was to advocate a tax on carbon. In his landmark book *Earth in the Balance*, he proposed what has come to be known as a "tax shift" — taxing carbon and using the revenues to reduce some other tax by an equivalent amount. "I am convinced that a CO_2 tax that is completely offset by decreases in other taxes is rapidly becoming politically feasible."[8] Over the years, Gore has reiterated his support for a carbon tax combined with a reduction in other taxes. At a New York University Law School speech in 2006, he advocated replacing payroll taxes with carbon taxes arguing that "penalizing pollution instead of penalizing employment will work to reduce that pollution."[9] In his 2007 speech accepting the Nobel Peace Prize in Oslo, Gore said, "And most important of all, we need to put a price on carbon — with a CO_2 tax that is then rebated back to the people, progressively, according to the laws of each nation in ways that shift the burden of taxation from employment to pollution. This is by far the most effective and simplest way to accelerate solutions to this crisis."[10]

8 Al Gore, *Earth in the Balance*, Houghton, Mifflin, 2000, p. 349.

9 "Al Gore suggests carbon taxes replace payroll taxes," by Gerald Prante; http://www.taxfoundation.org/blog/show/1849.html.

In addition to Al Gore, a large number of economists who have written on this topic favor a carbon tax. Peter Orszag, author of a 2008 Congressional Budget Office study (and President Obama's Director of the Office of Management and Budget), argues, "A tax on emissions would be the most efficient incentive-based option for reducing emissions and could be relatively easy to implement."[11] Yet, despite a high degree of consensus on the topic, most political actors and environmentalists have come to favor cap and trade as the issue has matured politically. During the presidential campaign, President Obama, along with many other Democratic leaders in this area, expressed a preference for dealing with climate change through some sort of cap and trade system. Today, even Gore himself expresses less enthusiasm for the tax option than he once did. In a 2008 interview in *Newsweek* with Fareed Zakaria, he was asked about his efforts to raise the gasoline tax in 1993. When Zakaria asked him, "Should we try it again despite the economic downturn?" Gore responded, "I don't think that's likely to happen but that's my preferred alternative."[12]

As cap and trade gained favor among many environmentalists, the carbon tax shift approach lost favor, largely because cap and trade was considered the more politically palatable option. This is not the only reason environmentalists like the cap and trade option, however. Unlike a carbon tax, the "cap" offers potentially greater certainty about the amount of annual emissions produced each year. But while both systems can limit emissions, the cap and trade system has the additional advantage of *not* being a tax. The conventional wisdom about broad support for cap and trade persisted until summer 2008, when a major, bipartisan cap and trade bill failed in the United States Senate.

In spite of some rhetorical nods in this direction toward the end of George W. Bush's Administration, as long as he remained president, there could not be a serious debate on climate change policy. With the Democratic takeover of both houses of Congress in 2006 and the Democratic victory for the White House in 2008, it is clear that finally serious steps may well be taken. However, regarding what will be done, how it will be done, and what exactly the public will tolerate all remain uncharted political territory. The lack of political clarity is not for want of debate and discussion among environmentalists and their supporters in Congress. Rather, it stems from the fact that the public has never been exposed to a serious debate over the difficult, central issue for climate change policy: putting a price on carbon that deliberately and inescapably raises the price of energy based on its carbon content. To explore these issues, we need to take a step back and look at what we can learn from past efforts in this area.

Reexamining the Conventional Political Wisdom: The BTU Tax and SO_2 Emissions Trading

Two critical initiatives in the 1990s, one a failure and one a success, have shaped many people's political assumptions about the alleged political advantages of cap and trade systems over carbon-based taxes — the failure of the BTU tax in 1993, and the success of the SO_2 emissions trading system for acid rain. Let's examine each one for the lessons they can teach us about the politics of this issue.

The BTU (British Thermal Unit) tax on the energy produced by certain fossil-based fuels was a major part of President Clinton's first deficit reduction budget proposal

With the Democratic takeover of both houses of Congress in 2006 ... it is clear that finally serious steps may well be taken.

in 1993. Energy generated from natural gas, coal, hydroelectric, and nuclear power would be taxed at a rate of 26.8 cents per BTU, energy generated from oil would be taxed at a rate of 61 cents per BTU, and energy generated from biomass and renewable sources would be exempt from the tax. The proposal faced immediate and solid opposition from the Republican Party and Democratic Senators from oil-producing states, especially Senators John Breaux of Louisiana and David Boren of Oklahoma. It also was the focus of a powerful lobbying campaign by the energy industry and the National Association of Manufacturers, which claimed that the tax would make American products less competitive around the world. In Oklahoma, anti-BTU forces ran newspaper ads claiming that BTU stood for "Big Time

10 Al Gore, Nobel Lecture, December 10, 2007, Oslo, Norway. Downloaded 6/9/09 from http://nobelprize.org.

11 "Policy Options for Reducing CO2 Emissions," a Congressional Budget Office Study, February 2008, page, viii.

12 Fareed Zakaria interview with Al Gore, "Don't Count on Magic" The world's most prominent environmentalist on carbon taxes, clean coal and the dangers of illusion," *Newsweek*, December 8, 2008.

As cap and trade gained favor among many environmentalists, the carbon tax shift approach lost favor, largely because cap and trade was considered the more politically palatable option.

Unemployment."[13] Had it been uniformly applied across energy sectors, however, it may not have faced such intense opposition — an important lesson for the current debate.

Less than six months into the debate, by June of 1993, it was clear that the tax would fail. Senator Breaux declared it "dead, huried and beginning to decay,"[14] and by July President Clinton gave up on the tax.[15] The short and brutal life of the BTU tax taught the Clinton Administration a hard lesson. Jeffrey Frankel, an economist who worked on climate change issues in the Clinton Administration, writes, "After the fiasco of the proposed BTU tax and gas tax in the first year of the Clinton Administration, one could not even mention the word 'tax' out loud in a discussion of GCC (global climate change) options in the late 1990s."[16]

The failure of the BTU tax convinced many policymakers concerned about climate change that anything called a tax would be politically unsustainable. As recently as August 2008, Bill Clinton himself, addressing the National Clean Energy Summit, said that he supports a cap and trade system, because "I tried [a carbon tax] once. It didn't work for me."[17] However, some key differences between 1993 and today are noteworthy. First is the current scientific consensus about climate change. A LexisNexis search for the first six months of 1993 reveals two important findings: First, the BTU tax was not seen primarily as a response to global warming, but rather as one of a series of deficit reduction tactics; and second, global warming still faced significant public skepticism and uncertainty. A review of some of the headlines from mainstream news sources in those years illustrates that the media, reporting in part on what came to be seen as junk science, were not convinced that global warming was real. They included headlines such as: "Warming to Illusory Dangers," "Global Warming Proof Still Feels Lukewarm," "Global Warming a Myth," "Artic Weather Study Fogs Warming Theory," "Ancient Tree Rings Show No Evidence of Global Warming, Study Says," "Dire Reports of Global Warming May Not Be Based on Reliable Data," and "Study: No Evidence of Global Warming."[18]

With news reports casting doubt on the whole issue and an energetic lobbying campaign against it, it is not surprising that the public rejected higher energy taxes. Surveys sponsored by the bill's opponents were widely circulated and discussed. One nationwide survey conducted by CambridgeReports/Research International and released by the American Energy Alliance reported that 57 percent of Americans opposed the tax, with only 36 percent supporting it, and that those who "strongly oppose" a broad-based energy tax outnumbered those who "strongly support" the tax by a 4-to-1 margin. Another poll conducted by the National Association of Manufacturers, a major opponent of the BTU tax, found that, "75 percent of those surveyed agree that the tax would fall more heavily on lower- and middle-income people; 71 percent believed that the revenues raised by the BTU tax would be used primarily to fund new government-spending programs rather than helping reduce the deficit; and 61 percent thought that a BTU tax would increase costs to businesses and industries, slowing our economic growth and costing jobs."[19]

Last but not least, the proposed BTU tax was burdened by its own complexity. The *Journal of Commerce's* editorial page summed it up as follows: "...The BTU tax posed almost insurmountable administrative problems. As first proposed, it would have required a new bureaucracy to determine the energy content of goods and services and decide where to apply the tax. But in pushing his plan through the House, the president made it even more complex, riddling the tax with exemptions and side deals."[20]

13 "Fanning A Prairie Fire: Capital Lobbies Stirred Oklahomans' Tax Revolt," by Michael Weisskopf, *The Washington Post*, May 21, 1993.

14 Quoted in The Hotline, June 28, 1993.

15 UPI, July 20, 1993.

16 "Formulas for Quantitative Emission Targets," by Jeffrey Frankel, in *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World*," edited by Joseph E. Aldy and Robert N. Stavins, Cambridge University Press, 2007.

17 http://www.carbontax.org/progress/a-brief-history-of-energy-tax-efforts/

18 *The Washington Times*, April 4, 1993; *The Wisconsin State Journal*, June 7, 1993; *Houston Chronicle*, April 17, 1993; *Chicago Sun-Times*, January 28, 1993; *Associated Press*, May 20, 1993; *Atlanta Journal-Constitution*, April 22, 1993; *USA Today*, January 28, 1993.

19 PR Newswire, July 1, 1993, "Public Opinion Poll Shows Majority of Americans Oppose Broad-Based BTU Energy Tax."

20 "Demise of the BTU Tax," *Journal of Commerce*, June 10, 1993, page 6A.

Administrative overhead was thought to be as high as 20 percent of the total revenues collected, according to a former Carter Administration economist.[21]

The lessons from the short, brutal life of the BTU tax probably have been over-learned. The tax was part of a large and controversial deficit-reduction package that led the Republican National Committee to run ads in the districts of 15 Democrats who had voted for it — ads that helped the Republicans acbieve their historic takeover of Congress in 1994. Secondly, there was no urgency to the issue of global warming in 1993, as a review of the media from that era indicates. Third, the whole idea of a BTU tax was foreign to the American public at the time and arguably posed a potential threat to some American jobs. It is no wonder then that the BTU tax proposal fell.

In contrast to the BTU tax, another environmental innovation of the 1990s, the Sulfur Dioxide Trading Scheme enacted as part of President George H.W. Bush's Clean Air Act, has been judged a great success. In fact, it has been so successful that many environmentalists who initially resisted it on grounds that polluters shouldn't be allowed to pay to pollute now want to apply the same model for a variety of other environmental problems, including greenhouse gases. While the lessons of the BTU tax scared a generation of policymakers away from a tax approach to environmental problems, the success of the sulfur dioxide trading scheme has convinced many of them that the cap and trade model can work in a variety of circumstances. This conclusion also requires reexamination.

The 1990 Clean Air Act, more than a decade in the making, had clear-cut goals. By the time tbis legislation was debated and enacted, most voters were familiar with the damage that acid rain was doing to lakes, streams, and forests. "Dead lakes," dead fish, and trees that stopped growing were present in many parts of the country, especially the Northeast, suffering the effects of the sulfur dioxide gases produced by old Midwestern power plants. Thus, the object of the legislation was clear and understandable.

In addition, the administration of George H.W. Busb earned praise for experimenting with this new approach to environmental policy. In contrast to command and control environmental regulations that often resulted in obsolete or inappropriate technology being mandated to solve a problem, the 1990 legislation was hailed as a conceptual and political breakthrough by creating the first cap and trade program for environmental purposes. According to one contemporaneous account, "[r]ather than simply balancing environmental goals against economic goals, Bush took a different tack. The use of marketplace incentives in controlling pollution has been gaining acceptance now for several years. But Bush has given the notion a strong embrace. It allowed him, at least in a broad conceptual plan such as the one he introduced this week, to choose targets acceptable to environmentalists while giving business the flexibility to cut the cost."[22] "It took a lot more creativity," Dudeck says, than just splitting the difference between warring interests. That flexibility "was real critical," notes Mike Core, an official with Buckeye Power, an Ohio utility with coal-burning plants."[23]

Since then, the Clean Air Act of 1990 has been remarkably successful. The emission reductions targeted in the law were achieved and then exceeded. Acid rain is a topic that is almost never in the news anymore — at least regarding the United States. It also established a model that many environmentalists have favored ever since, even though they were initially suspicious of a plan that would "let polluters pay to pollute."

The failure of the BTU tax convinced many policy makers concerned about climate change that anything called a tax would be politically unsustainable.

Robert N. Stavins, one of the architects of the initial SO_2 trading system, cautions that there are lessons to be learned from its success. These lessons are "...about the importance of flexibility and simplicity, the role of monitoring and enforcement, and the capabilities of the private sector to make markets of this sort work."[24] The sulfur dioxide emissions trading scheme was small and highly targeted, beginning with 263 units at 110 power plants run by 61 electric utilities. The technology for dealing with sulfur dioxide emissions was known at the time the legislation became law.

21 "Drop the BTU Tax: Complexity Frustrates Citizens and Feeds Resentment of Government," *Pittsburgh Post-Gazette*, Editorial, Page B3, June 6, 1993.

22 "Free Market Tack to Cleaner Air," by Marshall Ingwerson, *Christian Science Monitor*, June 14, 1989.

23 Ibid.

24 "Lessons Learned from SO2 Allowance Trading," by Robert N. Stavins, in *Choices, the Magazine of Food, Farm and Resource Issues*, 1st Quarter, 2005.

"In 1990, environmental advocates insisted on continuous emissions monitoring, which helps build market confidence. The costs of such monitoring, however, are significant." (Robert N. Stavins)

As Stavins points out, "...both scrubbing and fuel-switching were feasible options."[25] Third, Stavins points out that "...simple formulas for allocating permits based upon historical data have proven difficult to contest or manipulate." Although the SO_2 permits were given out without charge, Stavins argues that the costs of trading SO_2 would have been 25 percent lower if permits had been auctioned instead of freely allocated. Finally, Stavins argues for the "importance of monitoring and enforcement provisions. In 1990, environmental advocates insisted on continuous emissions monitoring, which helps build market confidence. The costs of such monitoring, however, are significant."[26]

Laurie Williams and Allan Zabel, two environmental enforcement attorneys from San Francisco, call the acid rain program the "poster child" for the cap and trade program.[27] It appeared to prove the possibilities in this new public policy approach when it succeeded in reducing SO_2 emissions. It succeeded, however, because power plants could switch from high-sulfur eastern coal to low-sulfur western coal. Achieving these reductions, therefore, required very little infrastructure — some new rail lines (deregulation of the railroads meant that cleaner coal could get where it needed to be) minor burner modifications, and some more efficient scrubbers. In contrast, Williams and Zabel point out, fighting climate change requires an energy revolution that will have to include massive new infrastructure and extensive innovation.

Lieberman-Warner Tests the Cap and Trade Consensus

It is not surprising that a consensus evolved around the political desirability of cap and trade. After all, the BTU tax was a bust; the SO_2 program was a success. Writing for the Center for Progressive Reform, Rena Steinzor sums up the enthusiasm for cap and trade as follows: "The overall success of acid rain trading has provoked extravagant claims about the desirability of cap and trade systems as a more efficient alternative to traditional regulation."[28] Moreover, in the 1990s Americans were in the midst of a love affair with the private sector and deep distrust of government. Market-based mechanisms were popular in both political parties, and taxes and regulation carried such negative political baggage that they were to be avoided at all costs.

Since 2003, several cap and trade bills have been introduced in Congress that have ultimately been unsuccessful. The most recent example of Lieberman-Warner exemplifies the arguments used to defeat cap and trade. In the fall of 2007, Senators Joe Lieberman (I-CT) and John Warner (R-VA) teamed up to introduce a bipartisan cap and trade bill — "The Climate Security Act of 2007." The fact that this major congressional debate on global warming legislation occurred during the largest run-up in gasoline prices in decades did not help it succeed. But its rapid demise called into question years of assurances from advocates that cap and trade was the most politically palatable way of addressing climate change. In fact, much of the debate in the Congress focused on whether or not the bill would further increase gas prices, complete with the selective use of statistics by both sides. The concern over gas prices was so strong that Senate Republican Leader Mitch McConnell "... had an amendment ready that would suspend the bill if it caused gasoline prices to rise by any amount. If that amendment ever went to a vote, it would force the bill's supporters to come out in favor of higher gas prices and the Republican TV attack ads would produce themselves."[29]

Many of the proponents of cap and trade supported it primarily for what it was not — a tax. But as the debate over Lieberman-Warner illustrated, increases in energy prices that result from congressional legislation will be called a tax by the opposition — and the basic theory of cap and trade entails higher prices for gasoline and other carbon-inten-

25 Ibid.

26 Stavins, OpCit, page 4.

27 Laurie Williams and Allan Zabel, "Climate Change Solutions: Cap-and-Trade versus Carbon Tax" PowerPoint presentation at www.carbonfees.org.

28 "Emissions Trading," by Rena Steinzor, in *Perspectives*, by the Center for Progressive Reform, 2005.

29 "Why the Climate Bill Failed," by Eric Pooley, Time Magazine, at http://www.time.com/time/nation/article/0,8599,1812836,00.html.

sive energy. Speaking against the Lieberman-Warner bill, Senator Grassley from Iowa had this to say, "I have already quoted the CBO Director saying that this bill will have the same economic effect as tax increases ... where I come from, as the saying goes, if it walks like a duck, talks like a duck, it is a duck. Well, this looks like a tax and it talks like a tax."[30] The conservative columnist George Will wrote, "A carbon tax would be too clear and candid for political comfort. It would be what cap-and-trade deviously is, a tax, but one with a known cost."[31] And the *San Francisco Chronicle* reports "but many conservatives see it as a tax-and-spend scheme dressed up as a market-based approach.[32]

In addition to being called a tax, the 2007 cap and trade bill was, in the words of a blogger for the liberal publication, *The American Prospect*, "comically complicated."[33] It "would have established enough boards and regulations that the Chamber [of Commerce] was able to distribute a devastating chart, modeled on those used against Hillary Clinton's health care plan in 1993, that portrayed the proposal as an impossibly tangled hedge of new bureaucracies. The 492-page bill had become, in the words of Senator Lamar Alexander of Tennessee, "...a well-intentioned contraption and it creates boards and czars and commissioners and money, and it is too complicated and too expensive. It has the potential for too many surprises." Even the environmentalists thought it was a bit much. The next version will "have to be simpler," says Eileen Claussen, president of the nonpartisan Pew Center on Global Climate Change.[34]

The bill's complexity meant that its opponents, including the Bush White House, were able to argue that it would raise gasoline prices, increase other energy prices, and cost jobs at a time when Americans were suffering record high gas prices, high energy prices, and rising unemployment. James Connaughton, chairman of the White House's Council on Environmental Quality, warned in April 2008 that "the country would face the prospect of a 50-cent increase in gas prices at the pump; a $1,200 increase in home heating bills; and even a national recession, possibly leading to a global recession."[35] Senator Alexander (R-TN) argued that the bill would create a massive "slush fund" showering federal money on all sorts of projects that had little to do with alternative sources of energy. And on April 9, 2008, the Congressional Budget Office "scored" the bill at a whopping $1.2 trillion over a nine-year period. It hardly mattered that the $1.2 trillion would come into the government as the result of the auction of permits and go out of the government in the form of aid to a variety of "green" projects that would presumably help the U.S. wean itself from carbon dioxide-emitting forms of energy. The cost estimate was sufficient to convince many skeptics of government that the bill was just too big.

Legislation often gets more and more complex as it attempts to address more problems and answer more objections. For example, in the course of the debate, the Senator from Wyoming pleaded the case of small refiners, the Senator from Minnesota pleaded for exemptions for steel process emissions, and the Senator from Iowa pleaded for an extension of wind energy credits. The liberal icon Robert Greenstein pleaded the case of the poor. Like Hillary Clinton's health care bill 14 years earlier, complexity did not help the politics of the climate change bill.

In fact, much of the debate in the Congress focused on whether or not the bill would further increase gas prices, complete with the selective use of statistics by both sides.

The complexity of the bill meant that at the heart of the 2008 climate change debate, there was massive uncertainty about how much it would actually cost. Opponents did their best to make those costs look massive, relying, for instance, on studies that assumed no innovation in energy efficiency in coming years. Supporters assumed too much innovation or had trouble accurately capturing the gains of energy efficiency. Supporters of the bill also could not nail down the cost issue. As the economist Richard Cooper points out, in open societies straight talk often wins. "One way or another, the energy-consuming public is going to

30 http://thomas.loc.gov/cgi-bin/query/C?r110:./temp/_r110qQnrT.

31 "Carbon's Power Brokers," by George Will, *The Washington Post*, June 1, 2008, page B7.

32 "Senate taking up key climate-change bill," by Zachary Coile, *San Francisco Chronicle*, June 2, 2008.

33 Posted by Ezra Klein on June 16, 2008 8:27 PM, *The American Prospect website*.

34 Quoted in "The Greenhouse Gas Debacle," by Ron Brownstein, *National Journal*, June 14, 2008.

35 "White House Environment Advisor Paints Gloomy Picture of Life Under Emissions Caps," by Lachlan Markay, April 25, 2008.

have to pay higher prices [to reduce greenhouse gas emissions] ... Advocates of significant action in the near future to reduce emissions have been reluctant to acknowledge this ineluctable fact... This strategy of concealing or seriously downplaying an important consequence of proposed actions will not work in open societies where skepticism of government claims has grown significantly."[36]

The Politics of Climate Change — What Have We Learned So Far?

The Democratic takeover of Congress in 2006 and the presidency in 2008 means that in coming months, the United States will likely confront the issue of climate change more seriously than it ever has before. As I write today, in June 2009, the Waxman-Markey bill, (The American Clean Energy and Security Act of 2009) is moving through Congress, and many Americans are hearing a debate over climate change for the first time. Thus it makes sense to ask what we have learned from past efforts to deal with climate change and other difficult problems, and how these lessons might help actually pass serious climate change legislation in the near future. These lessons fall into the following categories:

1) Costs to consumers matter, especially during a recession.

2) Complexity matters, because it can create distrust in an already cynical public.

3) Fairness matters, especially in the capacity to enforce public policy.

4) International compatibility matters, since Americans will not want to feel that they alone are making sacrifices.

5) Effectiveness matters, because as we have seen, a system with too many loopholes will not effectively curb emissions.

The complexity of the bill meant that at the heart of the 2008 climate change debate, there was massive uncertainty about how much it would actually cost.

Cost

Thus far, the debate on climate change has suffered from an understandable yet misguided tendency on the part of advocates to obscure the issue of cost, even though the point of climate change legislation is to *raise the price of carbon*. Since carbon-based energy is much cheaper than cleaner forms of energy, the government has to raise it somehow in order to do the two things necessary to reduce CO_2 levels: stimulate investment and innovation in alternative energy, and change the behaviors of millions of businesses and households.

The Lieberman-Warner bill was debated during a huge upsurge in gasoline prices, in the summer of 2008. One of the many problems it encountered was that no one could say exactly *how* much energy prices, especially gasoline prices, would increase as a result of the legislation. A year later, gasoline prices have dropped significantly; but overall economic conditions in 2009 are far worse. In the first six months of the year, unemployment has risen sharply, and investment portfolios and housing prices have collapsed. Ironically, in the midst of this historic economic meltdown, one bright spot for consumers has been relatively low gasoline prices.

Increased costs to the consumer are by far the biggest obstacle to passing climate change legislation in both the near and longer-term future. The cost issue, moreover, is exacerbated by the choice of a cap and trade system. Energy prices under cap and trade systems are inherently volatile — the prices of the permits fluctuate sharply, depending on things as unpredictable as the weather and the economy's growth rate. Besides the obvious economic problems, such price volatility also creates serious political problems. First, no one can answer with any certainty the all-important question, how much will this cost me? This is a tough political sell in good times; and an even harder sell in a recession.

The second cost problem involves the issue of rebates. Nearly all plans recognize that the only way to make an increase in the price of carbon politically feasible is to recycle some of the government revenues to consumers. But the amount of revenues returned and the mechanism for returning those revenues varies, depending on whether it's a cap and trade system or a carbon tax. The Waxman-Markey bill includes provisions to return 15 percent of the

36 "The Case for a Carbon Tax," by Richard N. Cooper, in *Architectures for Agreement*, Cambridge University Press, 2007, page 106.

money from the sale of emissions allowances to the poorest 20 percent of the population, using the federal tax code and existing state-level social service systems.

Rebating money to low-income people is important, but it does not solve the political problem likely to arise among the other 80 percent of Americans. As we have seen, the 1993 proposal for a BTU tax for the purpose of deficit reduction fell like a lead balloon. For political purposes, legislation raising the price of carbon during a recession would have to rebate much more than 15 percent of its revenues. One option would be to rebate most of the proceeds from a cap and trade system directly to all Americans, in the form of checks cut directly from the Treasury each month. This proposal, known as cap and rebate, would take some of the pain out of increasing energy prices in the midst of a recession. (Some members of Congress are discussing just such an approach). The other option would be to return to Al Gore's original idea and impose a tax on carbon and a simultaneous decrease in some other tax. In a detailed analysis, former Clinton official Robert Shapiro and two colleagues, Dr. Nam Pham and Dr. Arun Malik, have shown how a steadily increasing carbon tax could be offset by reducing the payroll tax for all Americans.[37] (This option has the advantage of built-in progressivity, since the effect of the payroll tax is regressive.) In the end, it is far easier to design a rebate for a carbon tax than for a cap and trade system, because there is no volatility in prices and revenues under the carbon tax, compared to such substantial volatility in a cap and trade system — in other words, the government knows what it has to rebate.

The final reason why clear and simple rebates are so important is that Americans do not respond well to sudden, unexpected and not well-understood increases in their expenses. The saga of the Medicare Catastrophic Coverage Act of 1988 bears retelling. It was unveiled in President Reagan's State of the Union address in 1986 and passed by a Democratic Congress in 1988. Less than a year and a half later, it was repealed, making it "one of the shortest-lived pieces of social policy in U.S. history."[38] Congress seriously misjudged seniors' tolerance for higher premiums — expecting that they would value the prescription drug benefits. But angry middle-class senior citizens rebelled when they discovered that they were being asked to pay higher Medicare premiums in order to cover benefits that many of them already had. Putting aside the merits of the issues, the Medicare Catastrophic Coverage shows just how difficult Congress finds it to stick to its guns when faced with an outright revolt by the voters.

The Democratic takeover of Congress in 2006 and the presidency in 2008 means that in coming months, the United States will likely confront the issue of climate change more seriously than it ever has before.

Any increase in energy prices will be a hard sell under any circumstances, and especially so during a recession. But if politicians can be precise about the cost and rebate nearly all of the revenues back to consumers, they may be able to pass a bill that does not end the same way as the Medicare Catastrophic Coverage Act.

Complexity

The broad public skepticism of government also makes the imposition of large-scale, complex legislation extraordinarily difficult. Issues that have been on the table for decades — such as universal health care — have suffered at the hands of Americans' trust deficit, not to mention issues like climate change that are relatively new to public discussion. As **Table #1** illustrates, in recent decades very low levels of trust in government have been the norm. These low levels of trust persist across demographic groups and in the face of changes in the political party in power. Distrust is highest at the federal level and lower at the state and local levels, but it is pervasive. Trust in other institutions also is low. Not surprisingly, trust in banks and financial institutions has dropped from 30 percent to 19 percent in the past two years — levels not seen since the savings and loan scandals of the 1980s.[39] Complexity, uncertainty, and partisan divisions are difficult obstacles to overcome under the best of circumstances — add pervasive distrust of government to the mix, and those obstacles may become insurmountable.

37 Robert Shapiro, Nam Pham and Arun Malik, "Addressing Climate Change Without Impairing the U.S. Economy: The Economics and Environmental Science of Combining a Carbon-Based Tax and Tax Relief," June 2008 at http://www.climatetaskforce.org/images/62008shapiro.pdf.

38 Eric M. Patashnik, *Reforms at Risk: What Happens After Major Policy Changes Are Enacted, (Princeton, NJ, Princeton University Press, 2008)* p. 166.

39 Nate Silver, "Americans losing their faith in faith and everything else," March 12, 2009, at FiveThirtyEight: Politics Done Right.

Table 1 **Trust in Government**

How much of the time do you think you can trust government in Washington to do what is right — just about always, most of the time, only some of the time or never?

1958	73	23	4
1968	61	36	3
1970	53	44	3
1972	53	40	7
1974	36	60	4
1980	25	73	2
1984	44	54	2
1990	29	71	1
1996	33	67	0
2000	44	56	0
2002	56	44	0
2005	29	69	1
2007	24	76	0
2008	32	67	1

Source: Gallup Poll asked continuously since 1958

This was vividly illustrated in 1993 and 1994, when Hillary Clinton's massive and complex health care legislation failed — a victim, in part, of its own complexity. It was illustrated again in the summer of 2008 when the Lieberman-Warner bill failed, also a victim of its own complexity. The political pitfall with complexity is that it allows opponents to read into the legislation the worst possible outcomes, while making it difficult for proponents to defend the bill in easily understandable terms.

The Waxman-Markey bill already suffers from enormous complexity. At more than 1,000 pages, it is a ripe target for those who seek to stop all climate change legislation. In the end, the inherent organizational complexity and concomitant opportunities for evasion, manipulation, and corruption in all large-scale cap and trade systems are difficult to defend.

Perhaps an even bigger problem with the Waxman-Markey bill is not what Americans don't understand about it, but what they may actually come to understand — namely, that Waxman-Markey creates a volatile market that will be subject to the kinds of complex financial manipulations and hedging strategies that were so instrumental in bringing on the current economic crisis. Both the SO_2 trading scheme and the European Union's Emissions Trading Scheme have seen large swings in prices, averaging between 17 percent and 22 percent per month.[40] Any market subject to such price volatility invites the creation of derivatives, options, calls, and other instruments designed to protect against or take advantage of price volatility, and then speculation in those various instruments. While the bill makes several attempts to regulate these new markets, its effectiveness is doubtful, and its timing is inauspicious. After all, the current economic collapse is the result of market manipulations that a long-standing regulatory system failed to police. NASA scientist James Hansen writes "Trading of rights to pollute…introduces speculation and makes millionaires on Wall Street."[41]

40 See United States Environmental Protection Agency, "Clean Air Markets — Data and Publications" at http://www.epa.gov/airmarkets/auctions/index.html. See also European Energy Exchange, EU Emission Allowances" at www.eex.de/get.php?f=emission_spot_historic_2007.

41 Speech at Columbia University's 350 Climate Conference, May 2009.

Fairness

In addition to taking steps to rebate costs and deal with complexity, proponents of climate change legislation have to make sure that the public perceives it to be fair and that everyone is treated more or less the same. This is a tall order for carbon tax schemes or for cap and trade schemes, since both are vulnerable to special-interest deals as they move through the legislative process. In the case of taxes, the challenge is simple and straightforward — the legislation has to minimize the number of loopholes and exemptions to the tax. In the case of cap and trade systems, the challenge is similar but not as transparent.

An ideal cap and trade system would auction off all permits under a cap drawn tightly enough to reduce overall greenhouse gas levels. Yet this ideal, endorsed by President Barack Obama during his campaign, never happens in the real world. In the initial creation of the European Union's Emissions Trading Scheme, politicians gave away so many allowances for political purposes that the system has had little impact on emissions. In Germany, for instance, politicians made sure to protect their all-important auto industry. Subsequent calls for reform in the European system have urged that a greater proportion of allowances be auctioned off. Lieberman-Warner reserved only a small portion of its permits for auction and as Waxman-Markey moves through the legislative process, it has reserved just 15 percent of its initial permits for auction.

Nonetheless, one of the strengths of cap and trade is, as Rob Stavins points out, that even with political allocation of permits, as long as the cap is in place, it should be environmentally effective. What is seen as a "massive corporate giveaway" of allowances doesn't need to affect the environmental effectiveness of the bill, as long as the cap is in place and trading takes place within the cap.

Yet, the lackluster performance of the European system suggests that the political impulse to buy support by giving away permits does, in fact, over time, affect the cap. In the allocation of permits, the German government was eager to protect its coal industry and awarded free credits to coal-fired plants. Similar inside dealing happened in other European countries, even though, in principle, the EU was supposed to review each government's allocation to reduce favoritism. In short, according to Lionel Fretz of the Carbon Capital Markets, "Companies overrepresented their allocation needs and lost a lot of trust by making the European Community and national governments look stupid."[42]

NASA scientist James Hansen writes "Trading of rights to pollute...introduces speculation and makes millionaires on Wall Street."

The EU experience shows that many powerful industries may support cap and trade systems, because they are confident that they can lobby successfully for free allowances. Writing in *Scientific American*, D. Cullenward and D.G. Victor note that "...interested industries typically press for trading markets rather than taxes. They do so because they know that politicians tend to give away the emission credits for free to existing emitters, which constitutes huge windfalls. ...In the past, a few trading systems have auctioned some of their permits, but 'big carbon' — including coal mining firms and owners of coal-fired plants – is organizing to resist such attempts."[43] The initial EU plan limited auctions to no more than one-tenth of the permits. While that will increase for 2013, it is naïve to think that politicians will give up their control over something that is so valuable to important interests. In Australia recently, 70 large energy companies also joined forces to lobby the Energy Minister for greater compensation in terms of permits.

In Europe today, carbon permits are very cheap, reflecting a cap so high as to be ineffective; and accordingly, CO_2 emissions have not decreased significantly.[44] In fact, throughout much of Europe, countries are building coal-fired power plants in spite of widespread support for the Kyoto Protocol and an operating cap and trade market. This has proven to be an embarrassment in Germany, where the trading scheme has been successful in creating alternative energy sources but *not* successful in reducing CO_2 emissions. A recent *Business Week* article examined the situation and asked, "So why has nothing changed? According to experts, one reason has to do with technical problems. In the course of an ongoing trading period, they claim, adjusting the volume of CO_2 certificates is no easy

42 "Firm Footprints to a Global Market," by M. Scott, *The Financial Times*, May 4, 2008.

43 "Making Carbon Markets Work, D. Cullenward and D.G. Victor, *Scientific American*, September 24, 2007.

44 "EU Greenhouse Gas Emissions Increase for Second Year in a Row," press release, June 22, 2006, European Environment Agency.

task. Still, a Social Democratic Party of Germany (SPD) insider provides yet another explanation: "Politicians just have to resign themselves to certain things." As the insider sees it, if the state went back to the companies and took away the certificates they had been allotted, the result would be an uproar. "What do you think the companies would say to us?" he asks. "As a politician, there are certain storms that you simply can't weather."[45]

Another example of how the political process undermines emissions trading is the fact that Europeans are building those new coal plants. A skeptic has to ask, "Why are Europeans building new coal plants, if coal is the single-largest source of CO_2 emissions, if a market for CO_2 exists that should make the price go up every year, and if there are no commercially available carbon sequestration technologies?" The answer is that these plants are cheap despite Europe's current cap and trade schemes, and because in the long run the energy industry doesn't believe that politicians will allow the price of permits to rise. *The New York Times* article on this topic concludes, "The European Union, through its emissions trading scheme, has tried to make power plants consider the costs of carbon, forcing them to buy 'permits' for emissions. But with the price of oil so high, coal is far cheaper, even with the cost of permits to pollute factored in, Enel (Italy's major electricity producer) has calculated."[46]

A second fairness issue arises from the proposals in many cap and trade plans to allow polluters to buy offsets. This proposal has scientific merit; after all, preservation of a forest in Brazil or of wetlands in some other part of the world can be as useful to the reduction of CO_2 as actual emissions reductions. On the other hand, the experience of the United Nations' CDM (Clean Development Mechanism) has left many environmentalists skeptical about offset plans that permit cheap offsets that, in the end, do nothing to reduce the production of CO_2 at its source.

For instance, in a recent letter to President-elect Obama, James Hansen pointed out that Japan has been increasing its use of coal and justifying it by buying credits from China through the CDM and yet, China's emissions have also increased.[47] Unless incredibly well designed and well policed, which could mean access to many parts of many countries, offset plans are likely to make polluters feel good without creating meaningful reductions in CO_2.

The fairness issue is likely to cause public concern in either a cap and trade or a tax system, but the differences can be significant. In focus groups with swing voters, the Democratic pollster Stan Greenberg found that the trading aspect of cap and trade rouses suspicions among those voters. "The problem with 'Trade': The more voters hear about the mechanism, the less supportive they become because it sounds like big polluters will just buy their way out of doing the right thing. And 'trade' conjures up all the Wall Street practices that voters believe have drained their 401(k)s."[48]

In focus groups with swing voters, the Democratic pollster Stan Greenberg found that the trading aspect of cap and trade rouses suspicions among those voters.

It is much easier to monitor and understand, and therefore hold Congress accountable for, tax breaks to industries. By contrast, the issue of fairness in allocating allowances is shrouded in complexity, and in Europe it has taken the public years to begin to understand its consequences.

International Compatibility

The political problems facing cap and trade are not only domestic, but also international. The United States has been historically the biggest emitter of greenhouse gases.

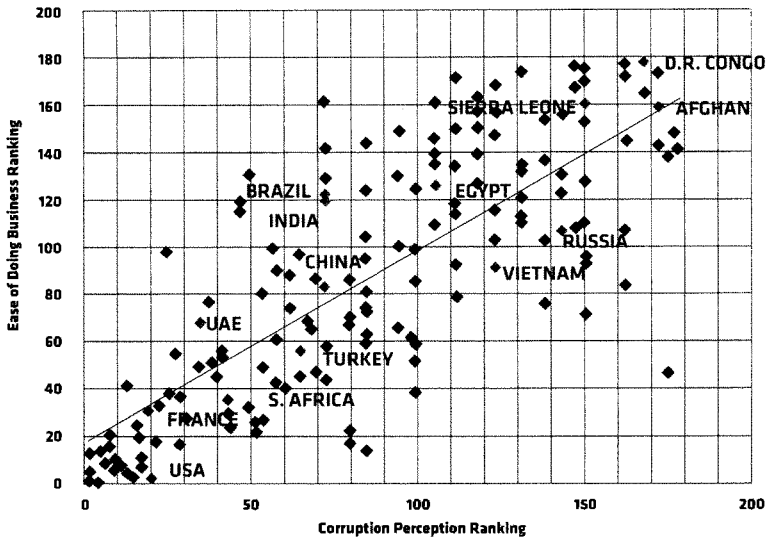
45 Anselm Walderman, "Green Energy Not Cutting Europe's Carbon; wind farms and solar panels are a European success story. But the dirty little secret is that using renewable energy isn't reducing carbon emissions," *Business Week, Europe*, February 10, 2009. Downloaded at: http://www.businessweek.com/globalbiz/content/feb2009/gb20090210_228781.htm.

46 "Europe Turns to Coal Again, Raising Alarms on Climate Change," by Elisabeth Rosenthal, *The New York Times*, April 23, 2008, Page 1, Section A.

47 James Randerson, "Climate Change Policies Failing, NASA scientist warns Obama," *Guardian*, January 1, 2009.

48 Greenberg Quinlan Rosner, op. cit. P. 8.

Chart 4 Corruption and Regulation Across Countries: 2007



Transparency International and the World Bank Doing Business Project. (Note: Rankings include 178 countries with the highest ranking as 1.)

However, with the rapid development of India and China, their greenhouse gas emissions are rapidly surpassing the United States; and the American public will not stand for a solution that does not address and include developing countries. But cap and trade systems pose especially difficult problems for developing countries. They presuppose a highly developed regulatory system that can police markets as well as monitor and verify emissions. These conditions simply do not exist in much of the developing world. In many developing countries, regulatory institutions are no more than a few years old. The challenge of establishing new modern institutions in developing countries is frequently underestimated. It takes many years to build up such professional capacity, and many years to root out corruption.

The corruption problem is endemic throughout the developing world. But the relationship between corruption and regulation is often misunderstood. In much of the world, corruption is directly related to excessively burdensome and complex regulatory processes. Stated simply, systems that are not transparent create environments where corruption can thrive most easily. **Chart #4** illustrates this point. The vertical axis consists of rankings by the World Bank that summarize the ease of doing business in a country. The horizontal axis is the Transparency International ranking of the perceived degree of corruption in any given country. The relationship is clearly linear. As the difficulty of doing business increases, so does corruption. Low levels of corruption correlate with ease of doing business.

An extensive literature supports the findings of the above graph by showing that high levels of corruption are associated with greater "formalism" in the legal processes of a country and higher levels of frequent regulatory interventions.[49] There is also evidence from developing countries

that regulation can hinder economic performance. An increase in pro-worker regulation in India, for example, was associated with a decrease in output, productivity, and employment in registered manufacturing, while the number of unregistered or "informal" firms increased. Developing nations that have implemented higher levels of regulation also have experienced increases in urban poverty.[50] Developing countries also uniformly lack the human capital needed to regulate complex systems effectively.[51] One study found that environmental officials in China usually have lower status than other government officials. They tend to avoid controversy, to favor politically connected enterprises, and to pursue regulatory action against mainly less powerful or less well-connected entities.[52]

However, with the rapid development of India and China, their greenhouse gas emissions are rapidly surpassing the United States; and the American public will not stand for a solution that does not address and include developing countries.

In India, regulatory failures are particularly dramatic in the electricity sector, an area that would come under strict regulation in an international cap and trade system. Farmers receive electricity virtually for free, making them insensitive to cap and trade restrictions, and other customers routinely steal electricity, costing suppliers an estimated $4 billion per year. According to one report, utility employees who conspire to steal electricity can earn many times their annual salary in bribes.[53] Furthermore, state governments tend to appoint political cronies to regulatory positions; and as a result, the regulatory commissions have been found to spend as much as 17 percent of their expenditures on external consultants.[54] State governments further influence the regulatory process by asking state-controlled utilities not to file for tariff revisions at politically inconvenient moments. They also direct state-owned generating companies to sell power to distribution companies at deep discounts, even at the expense of incurring losses, so that no tariff revision at the distribution end is necessary.[55] Given that basic electric utility regulation in India is barely functional today, it is hard to imagine adding the level of regulatory oversight necessary to make a cap and trade system function.

Nor is it reasonable to imagine China implementing an effective cap and trade system any time soon — even though the U.S. government is working hard to build institutions and infrastructure to do just that.[56] In recent years, China's inability to regulate has been legendary. From contamination in the Songhua River caused by an explosion in a petrochemical plant, contamination in a batch of the drug Heparin that killed 19 people in the United States, and contamination in pet food, toothpaste and the paint on children's toys, China has gained an international reputation for lax or nonexistent regulation. In the environmental area, China has the world's worst air pollution problem, and hundreds of millions of people drink contaminated water on a daily basis. Almost one-fourth of China's land is affected by acid rain.[57] The poor quality of China's air became international news when many athletes seriously considered skipping the 2008 Beijing Olympics, and the Chinese government had to shut down factories and restrict the use of vehicles for days in order to get air quality down to acceptable levels for the athletes.

49 See, for instance, "The Regulation of Labor," by J.C. Botero, R. La Porta, F. Lopez-de-Silanes, A. Shleifer, in *Quarterly Journal of Economics*, 119(4): 1339-82 and "What have we learned about the causes of corruption from ten years of national empirical research?" by D. Treisman, *Annual Review of Political Science*, Vol. 10: 211-244.

50 "Can Labor Regulation Hinder Economic Performance? Evidence from India" by Timothy Besley and Robin Burgess, *Quarterly Journal of Economics*, 119 (1).

51 "Wanted! Good Regulators for Good Regulation: An evaluation of human and financial resource constraints for utility regulation," A Report for the World Bank, 2005.

52 *Environmental Regulation in China*, by Ma and Ortolano, Rowman and Littlefield, 2000.

53 "A Better Investment Climate for Everyone," World Bank Development Report, the World Bank, 2005.

54 "Electricity Governance Initiative — India" 2005 and "A Good Beginning but Challenges Galore: A Survey-based Study of Resources, Transparency and Public Participation in Electricity Regulatory Commissions in India," Pune: Prayas Energy Group.

55 "Regulatory Experiments in the Indian Power Sector: Missing the Wood for the Trees," in A. Singh (eds) *Administrative Reforms: Towards Sustainable Practices*, Sage Publications 2005.

56 See http://www.epa.gov/airmarkt/international/index.html#china.

57 "Cleaning the Air in Developing Countries," by K. Bolt, S. Dasgupta, and D. Wheeler, *Forum for Applied Research and Public Policy*, 2001, Vol. 16, #3, Fall. And, "Looking at the Songhua River Incident from an Environmental Regulatory Governance Perspective: A Long-standing Issue," in *China Perspectives*, Vol. 7, #1 (March 2006) 21-35.

China's poor environment is not due to a lack of laws and agencies. Since 1979, China has had in place a large network of environmental protection agencies at all levels of government. They have promulgated dozens of environmental laws and created eight major pollution programs. Nonetheless, China's environmental quality has deteriorated, not improved. One reason is that China's EPBs (Environmental Protection Bureaus) are subordinate to local governments. Not only do they have to compete with other government agencies for funding and influence, but their enforcement often conflicts with a primary goal of local government officials, who are rewarded based on the rate of economic growth in their jurisdictions. Thus, economic growth tends to trump regulatory enforcement. Finally, the EPBs suffer from a lack of human and technological capital. In some cases, monitoring stations are actually contracted out to the industry they are monitoring, causing significant and obvious conflicts of interest.[58]

A study by KPMG, the global tax and auditing services firm, summed up the regulatory situation in China, and the conclusions apply to many of the world's other developing nations. "On paper, China's environmental laws and regulations are excellent — as good as anywhere in the world... However, when it comes to overseeing the operations of older and smaller plants, the rules are often implemented poorly or not at all."[59] A cap and trade system presupposes the ability to distribute initial permits in an honest and non-political way (a problem for modern democracies as well as for developing countries). It pre-supposes the capacity to monitor the behavior of large and powerful enterprises. And it pre-supposes the capacity to enforce compliance.

Thus, even if India and China are willing to join the international community in a greenhouse gas reduction plan, a cap and trade system would pose enormous implementation and administrative problems. A carbon tax would be far simpler to administer and monitor and thus would be more effective. But China and India are not, in fact, yet interested in participating in any global arrangement that might slow their modernization. As the United Nations General Assembly met to debate climate change, the Chinese Ambassador Yu Qingtai told a reporter, "The United States and the developed states as a whole are the countries that created the problem, caused the problem of climate change in the first place. In my view, that's what a culprit means."[60] And this past summer, R.K. Pachauri, head of the Intergovernmental Panel on Climate Change, stated that "India can not be held for any emission control. They (developed countries) should get off the back of India and China. We are an expanding economy. How can we levy a cap when millions are living with deprivation? To impose any cap (on India) at a time when others (industrialized countries) are saying that they will reach the 1990 level of emission by 2025 is hazardous."[61]

The challenge of establishing new modern institutions in developing countries is frequently underestimated. It takes many years to build up such professional capacity, and many years to root out corruption.

The ability of developing nations to effectively participate in any kind of global climate change scheme is complicated by the fact that a political precondition for American voters will be knowledge that they are not alone. As was evident during the short debate on the BTU tax, maintaining American competitiveness was a key concern. The clarity and lack of volatility in a carbon tax means that the United States can make its own assessments of how well other countries or regions are doing in reducing carbon and place a carbon tax on imports to the United States or exports from those countries. Not only would this assure Americans that they aren't the only ones making sacrifices, but it would send a powerful signal to countries that sign on in name but not in fact that we are serious about global CO_2 reduction.

Effectiveness

Any society-wide plan to fight climate change has to be effective. Effectiveness can be compromised in many ways. The system will not work if too many permits are given out, if the tax is too low, or if over time Congress lowers the tax or increases the number of permits as the result of

58 Li, op cit.

59 "Pollution Incidents Highlight Severe Environmental Risk," by Ian Young, *Chemical Week*, Aug. 30, 2006, Vol. 168, Issue 29.

60 "China says new climate pact must treat rich nations as 'culprits'" by Edith M. Lederer, *AP*, Feb. 16, 2008.

61 "Get off India's Back, Pachauri Tells Developed Nations," *Economic Times*, July 8, 2008.

political pressure. There also are signs of effectiveness for the short term, such as the building of coal plants. Since there is, as yet, no effective technology for coal sequestration and since coal is the major planetary culprit in climate change, any proposal that includes the possibility of new coal-fired plants has to be suspect.

James Hansen, who along with Al Gore has done more to make the world aware of the climate crisis than anyone else, had this to say about coal in an article in the English newspaper *The Guardian* last year: "Coal is not only the largest fossil fuel reservoir of carbon dioxide, it is the dirtiest fuel. Coal is polluting the world's oceans and streams with mercury, arsenic and other dangerous chemicals. The dirtiest trick that governments play on their citizens is the pretence that they are working on 'clean coal' or that they will build power plants that are 'capture-ready' in case technology is ever developed to capture all pollutants."[62]

While many mainstream environmental groups are still behind the cap and trade movement, many of the further left groups are skeptical. Rather than break ranks, in recent days groups such as moveon.org have been organizing to "improve" the Waxman-Markey bill. Underlying these and other concerns is the feeling that a cap and trade system might end up creating new wealth for the financial sector without doing anything to reduce CO_2 emissions after all.

The Way Forward

If we can design a policy that is transparent and easy for people to understand, puts an effective price on carbon, and reimburses average Americans for all or nearly all of their increased energy costs, we have a chance to reverse climate change in a timely manner. A system that does not raise prices and that does not deal with coal is a system that will waste time, and we have no time to waste.

The ability of developing nations to effectively participate in any kind of global climate change scheme is complicated by the fact that a political precondition for American voters will be knowledge that they are not alone.

The biggest problem with a carbon-based tax approach to climate change is the word "tax." But as we saw in the first congressional debate on climate change, any increases in energy prices that result from governmental action will be called a tax and understood as such. Once past the word "tax," however, carbon taxes have numerous important advantages compared to cap and trade systems. First, they are predictable and easy to understand. A carbon-based tax could be phased in over a period of five to 10 years. Businesses and consumers would know exactly how much their energy and gas would cost over years, and they could plan accordingly. Politicians would not have to debate for days the cost of the legislation — everyone would know it. Certainty is a valuable commodity in politics, and uncertainty is often a killer. The big disadvantage of a carbon tax is the absence of a cap — but the program could set "hard targets" for emissions reductions, CO_2 emissions could then be evaluated every three to five years, and the tax could be adjusted in order to keep the decline in emissions on target.

The second major advantage of a tax is that its costs to households can be directly offset. Citizens can be told exactly how much more they will have to spend on energy, and they can be told exactly how much less will be deducted from their paychecks in the form of payroll taxes or income taxes. As Robert Shapiro has shown, a carbon tax combined with a payroll tax deduction could be a very effective way of reducing greenhouse gas emissions.[63] For example, a tax-shift strategy could start at $14 per metric ton of CO_2 and increase to $50 per ton in 2030, while recycling 90 percent of the revenues in rebates on payroll taxes or payments to all households. Other countries have tried this successfully. Denmark has imposed a carbon tax with great success, and it has also offset the tax by cuts in other taxes.

Deep suspicion of government and government spending will be part of the American political psyche for the foreseeable future. Yet, we have grown accustomed to having the government levy substantial taxes on things that are not good for us — just compare the price of a pack of cigarettes today to its price a few decades ago. To pass a carbon-based tax, the cuts in other taxes would have to be

62 James Hansen, "Coal-Fired Power Plants are Death Factories: Close Them," *The Guardian*, February 15, 2009, at http://www.guardian.co.uk/commentisfree/2009/feb/15/james-hansen-power-plants-coal.

63 "Addressing Climate Change Without Impairing the U.S. Economy," by Robert Shapiro, Nam Pham and Arun Malik, U.S. Climate Task Force, June 2008.

simultaneous or, preferably, precede the imposition of the carbon tax, thereby creating a situation where a person's take-home pay increases more or less in step with the increases in his or her electricity and gas bills.

A third major advantage of a tax approach to climate change is that it increases the possibility of eventually establishing a global architecture. Governments around the world are not very good at regulation, but they tend to be able to collect taxes and, moreover, they have strong incentives to collect taxes. Richard Cooper has proposed "a uniform, incremental CO_2 tax," a major advantage of which would be that "compliance would be easy to assess."[64] The tax-shifting concept articulated by Shapiro *et al.* can work in a wide variety of different economies and different cultures, since it merely involves offsetting the high price of carbon with decreases in other taxes. It is simple to implement and does not require a mature regulatory system and competent regulators.

The major long-term problem with a carbon-based tax may be that it *would* work. People would grow to expect higher and higher energy costs; they would have the incentive to conserve, and businesses would have the incentive to invest in climate-friendly innovation. Thus, over time the good news would be that carbon consumption would decrease. However, the bad news is that revenues would decrease, and the government would have to figure out other ways to pay for its other services. But in the meantime, we could he on the path to serious reductions in greenhouse gases.

Time is running out for us to settle on a policy architecture. A cap and trade system can be designed to reduce its inherent volatility — by placing a floor and a ceiling on prices. It can be designed to reduce its inherent vulnerability to manipulations in the market — by limiting those who can trade in the permits. In addition, cap and trade systems that involve rebating the vast majority of revenues directly back to consumers — perhaps in the form of monthly rebates — can also help increase public acceptance of higher energy prices. In other words, a cap and trade system can be designed to work more like a carbon tax shift system.

No major policy change has ever occurred without first getting the politics right. This paper has been an attempt to show that the conventional wisdom about the politics of a cap and trade system need to be reexamined and the idea of a carbon tax resurrected. The goal of policymakers in the area of climate change should *not* be the imposition of one architecture or another. If we had a straight carbon tax, we would not need the multiple layers of bureaucracy that a cap and trade system would introduce. Given the urgency of the problem, those who desire immediate action on global warming need to have a "Plan B." If the bill now moving through Congress fails to pass, we cannot let that be the death of climate change legislation. The goal should be to design a system that will begin to revolutionize our energy use and that Americans, now in 2009, can accept.

If we can design a policy that is transparent and easy for people to understand, puts an effective price on carbon, and reimburses average Americans for all or nearly all of their increased energy costs, we have a chance to reverse climate change in a timely manner.

64 "The Case for A Carbon Tax," by Richard N. Cooper, in *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World*, edited by Joseph E. Aldy and Robert N. Stavins, Cambridge University Press, 2007.

About the Author

Elaine C. Kamarck is a Lecturer in Public Policy who came to the Kennedy School in 1997 after a career in politics and government. In the 1980s, she was one of the founders of the New Democrat movement that helped elect Bill Clinton president. She served in the White House from 1993 to 1997, where she created and managed the Clinton Administration's National Performance Review, also known as reinventing government.

At the Kennedy School she served as Director of Visions of Governance for the Twenty-First Century and as Faculty Advisor to the Innovations in American Government Awards Program. In 2000, she took a leave of absence to work as Senior Policy Advisor to the Gore campaign. She conducts research on 21st century government, the role of the Internet in political campaigns, homeland defense, intelligence reorganization, and governmental reform and innovation.

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Impact on the Economy of the American Clean Energy and Security Act of 2009 (H.R.2454)

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LIST OF ACRONYMS

ACESA - American Clean Energy and Security Act of 2009	FTE - Full-Time Equivalent
ACP - Alternative Compliance Payment	GDP - Gross Domestic Product
AEO - Annual Energy Outlook	GHG - Greenhouse Gas
BAU - Business As Usual	GW - Gigawatt
CAGR - Compound Annual Growth Rate	HHV - Higher Heating Value
CCS - Carbon Capture and Storage	kWh - Kilowatt-hour
CGE - Computable General Equilibrium	MMBtu - Million British Thermal Units
CRA - CRA International	MRN - Multi-Region National Model
EIA - Energy Information Administration	MS-MRT - Multi-Sector, Multi-Region Trade Model
EISA 2007 - Energy Independence and Security Act of 2007	NEEM - North American Electricity and Environment Model
EPA - Environmental Protection Agency	RES - Renewable Electricity Standard
EU-ETS - European Union Emissions Trading Scheme	VMT - Vehicle Miles Traveled
FOM - Fixed O&M	VOM - Variable O&M

DISCLAIMER

This report describes the conclusions of the individual authors and does not necessarily represent a position of CRA International or of its clients.

1. EXECUTIVE SUMMARY

CRA International (CRA) is a global consulting firm that has provided economic, financial, strategy and business management advice to public and private sector clients since 1965. CRA serves clients from offices on three continents.

As requested by the National Black Chamber of Commerce, CRA has used its proprietary, state-of-the-art MRN-NEEM and MS-MRT modeling systems to analyze the potential economic impacts of the proposed energy and climate legislation released by Reps. Waxman and Markey (hereafter referred to as American Clean Energy and Security Act of 2009, ACESA or H.R.2454)[1] currently being considered in the House Energy and Commerce Committee. This report is intended to help decision makers and the public understand some of the impacts the legislation could have on the U.S. economy and energy markets. These costs in turn need to be compared to the benefits of the specific proposal, and to the costs and benefits of alternatives, in order to make an informed policy choice.

To help with this comparison of approaches, the report also discusses alternative approaches that could increase or decrease the costs of meeting comparable environmental objectives. All projections in this analysis are based on the aforementioned CRA models, using publicly-available data for key input assumptions. The study examines key sections of the bill included in Title I – Clean Energy and Title III – Reducing Global Warming Pollution, particularly those provisions related to greenhouse gas (GHG) cap-and-trade, renewable energy, and offsets. The analysis focuses on how these could affect performance of the U.S. economy.

The most important conclusion is that, contrary to some claims that have been made recently, policies such as ACESA will have a cost.[2] Therefore the judgment about what action to take cannot be made simply on the grounds that a cap-and-trade program will create additional jobs and stimulate economic growth – it will not – but on whether the benefits are worth the cost. And it needs to be recognized that the benefits of any action by the United States alone are limited because of the relatively small share that the United States will contribute to global emissions over the next century.

This analysis reveals that businesses and consumers would face higher energy and transportation costs under ACESA, which would lead to increased costs of other goods and services throughout the economy. As the costs of goods and services rise, household

[1] Bill released May 15, 2009.

[2] Claims to the contrary include, for example, House Speaker Nancy Pelosi's statement, "There should be no cost to the consumer." *Wall Street Journal*, April 24, 2009, in "Democrats Weigh Break for Utilities in Climate-Change Bill," Greg Hitt and Stephen Power, available at http://online.wsj.com/article/SB124050061773748291.html.

disposable income and household consumption would fall. Wages and returns on investment would also fall, resulting in lower productivity growth and reduced employment opportunities. Impacts would differ across regions of the economy, depending on how local energy costs will change, whether local industries will be favored or harmed, and allocation formulas.

It is not possible to avoid these costs through any free distribution of carbon allowances.[3] Although the wise use of revenues from an auction or carbon tax can ameliorate impacts to some segments of the economy, the cost of bringing emissions down to levels required by the caps cannot be avoided. It is this cost of bringing down emissions that the present analysis estimates, in terms of reductions in GDP and household consumption. Allocations do shift who bears the burden across industries, regions, and income groups, as do decisions about how to spend or return to taxpayers the revenues from allowance auctions.

Just as it is impossible to eliminate the cost of reducing emissions to levels consistent with the cap through allocations or revenue recycling, it is impossible to bring about a net increase in labor earnings through measures that impose a net cost on the economy. The present study finds that the cap-and-trade program would lead to increases in spending on energy efficiency and renewable energy, and as a result that significant numbers of people would be employed in "green jobs" that would not exist in a no carbon policy world. However, any calculation of jobs created in these activities is incomplete if not supplemented with a calculation of the reduced employment in other industries and the decline in the average salary that would result from the associated higher energy costs and lower overall productivity in the economy. This study finds that even after accounting for green jobs, there is a substantial and long-term net reduction in total labor earnings and employment. This is the unintended but predictable consequence of investing to create a "green energy future."

The costs estimated in this study would be much higher if it were not for the assumed use (and *availability*) of international offsets authorized by the bill. Full use of these international offsets would allow U.S. total emissions over the period from 2012 to 2050 to exceed the cap by about 30%.[4] The difference would be made up by paying for offsets that are deemed to represent emission reductions occurring in other countries. However, in light of the difficulties in measuring, verifying, and ensuring the permanence of these offsets, international negotiations have stressed domestic sources of emission reductions over international offsets. The actual rules to be developed for international offsets might allow far fewer than the authorized amount. This would drive costs up substantially.

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[3] Estimates of impacts on consumers are based on the assumption that all auction revenues are returned to households on a per capita basis and that the value of allocated allowances is also returned in the form of utility rebates and increased investment income from companies receiving allocations.

[4] If domestic offsets are not fully utilized thereby allowing international offsets to increase to as much as 1.5 billion tons per year then the effective increase in the cap from international offsets would exceed 30%.

An important set of provisions in the bill, some of which neither this analysis nor any other has been able to model fully, are regulatory measures that go beyond the cap-and-trade program to require a certain percentage of electricity generation to come from renewable sources (included in this analysis) and mandate specific improvements in a number of standards for building energy efficiency, lighting and appliances. This analysis includes extensive improvements in energy efficiency, consistent with the amount of efficiency improvement implicit in these mandates. However, much of that efficiency improvement may come from a different mix of actions than the specific mandated actions in ACESA. ACESA's mandates approach will constrain the options of households and businesses as to how best to reduce their carbon footprints in light of the incentive provided by the cap-and-trade system. Therefore, the energy user (and electricity generator) may not be able to choose the most cost-effective technology or method to reduce their emissions. To the extent that the consumer and business person are the best judges of how to manage their own affairs and choose ways of dealing with higher energy prices, the regulatory measures in ACESA will increase costs to the U.S. economy beyond what we have estimated.

No model can capture all these costs, because to do so would require as much information as the individual household or business has about its own affairs. Thus any attempt to quantify the costs of command-and-control regulations of this type is likely to significantly underestimate their costs, though even these regulations can be designed in ways that do more or less harm. Indeed, if it were possible to model all the costs of regulatory measures, there would be enough information centrally available that government regulators might actually have sufficient information to tell households and businesses how to do better jobs of managing their affairs. But government agencies do not, in fact, have any better information than analysts trying to assess costs of new legislation, so that neither is likely to understand the impacts of the kinds of mandates included in ACESA. In contrast, a program that puts a uniform and predictable price on GHG emissions provides the incentive for households and businesses to use their own information and judgment to choose the most cost-effective ways to reduce emissions, and thereby to achieve the lowest possible cost for the economy as a whole.

1.1 Economic Impacts

Specific economic impacts resulting from ACESA include the following:[5]

- Carbon Allowance Costs – ACESA would reduce GHG emissions through decreased use of conventional energy. As the cap progressively tightens with time, the cost of reducing emissions becomes more expensive and as a result, the cost of CO_2 allowances increases. In 2015, the cost of a CO_2 allowance is estimated to be $22

[5] All costs in this report are expressed in terms of 2008 dollars, unless otherwise specified. In this report, when carbon or CO_2 allowance prices are discussed these prices are measured as dollars per metric ton of CO_2 equivalent (CO_2e). For GHG emissions the relevant measure is metric tons of CO_2e.

per metric ton of CO_2. By 2030, the allowance cost could increase to $46 per metric ton of CO_2 and by 2050, the allowance cost could reach $124 per metric ton of CO_2.

- Utility Rates and Utility Bills – Energy cost impacts consider the combined effect of changes in the prices of the fundamental energy commodities and the added cost of limiting carbon emissions. In the case of electricity and natural gas supplied through companies regulated by utility commissions, free allowance allocations will mitigate some of the total cost borne by retail customers. ACESA provides free allocations to such local distribution companies, but requires that the full cost of carbon still be reflected in the rates per unit of energy each customer uses. Relative to energy costs in the *Annual Energy Outlook (AEO) 2009* Baseline level, retail natural gas rates would rise by an estimated 10% ($1.20 per MMBtu) in 2015, by 16% ($2.30 per MMBtu) in 2030, and by 34% ($5.40 per MMBtu) in 2050. Retail electricity rates are estimated to increase by 7.3% (1.1 cents per kWh) relative to baseline levels in 2015, by 22% (2.8 cents per kWh) in 2030 and by 45% (6.1 cents per kWh) in 2050. To the extent that utilities return the value of their free allocations under ACESA to customers through reductions in fixed charges, actual total *bills* for electricity and natural gas will not rise as much as the *rates*. Total utility bills may even decline in the first years of the policy if there is also substantial investment in end-use efficiency and/or conservation in response to the higher energy rates. We estimate that given the allocations in ACESA, average U.S. electricity utility bills would decline by about 0.5% in 2015, and then rise by about 4% to 5% in the 2020 to 2025 time period. Post-2025, as the allocations are phased out bills would rise more dramatically. We estimate that given the allocations in ACESA, average U.S. natural gas utility bills would increase by about 2.5% in 2015, and then rise by about 5% to 6% in the 2020 to 2025 time period, then rise more dramatically as the allocations are phased out.

- Transportation Fuel Costs - After an estimated 12 cents per gallon increase in 2015, costs of using motor fuels are estimated to increase by 5% (23 cents per gallon) in 2030 and increase by 11% (59 cents per gallon) in 2050, relative to baseline levels. These cost impacts consider the combined effect of changes in the market prices of the fundamental energy commodities, the added cost of limiting carbon emissions, and projected shifts towards a lower-carbon mix of energy sources used to fuel the average vehicle.

- Employment – A net reduction in U.S. employment of 2.3 million to 2.7 million jobs in each year of the policy through 2030. These reductions are net of substantial gains in "green jobs." While all regions of the country would be adversely impacted, the West, Oklahoma/Texas and the Mississippi Valley regions would be disproportionately affected.

- Wages – Declines in workers' wages will become more severe with time. The earnings of an average worker who remains employed would be approximately $170 less by 2015, $390 less by 2030, and $960 less by 2050, relative to baseline levels.

- Household Purchasing Power - The average American household's annual purchasing power is estimated to decline relative to the no carbon policy case by $730 in 2015, by $830 in 2030, and by $940 in 2050. These changes are calculated against 2010 income levels (the median U.S. household income in 2007 is approximately $50,000). They would be larger if stated against projected future baseline income levels.

- Overall Economic Activity - In 2015, gross domestic product (GDP), a commonly-used measure of total economic activity, is estimated to be 1.0% ($170 billon) below the baseline level driven principally by declining consumption. In 2030, GDP is estimated to be roughly 1.3% ($350 billon) below the baseline level. In 2050, GDP is estimated to be roughly 1.5% ($730 billon) below the baseline level.

1.2 Related Issues

Implementation of ACESA would result in a number of other significant issues:

- Uncertainty - Rigid caps on GHG emissions achieve certainty in the precise amount of emissions reductions over several decades, at the cost of large uncertainties about long-run carbon prices and costs to the economy, as well as short-term volatility in carbon prices. Policymakers have to decide how tightly to set a cap while the best estimates of cost to constituents differ by about a factor of two. The uncertainty and volatility also are deterrents to investment, because under different and equally plausible scenarios for carbon prices, investors will want to make different investment choices (*e.g.*, about new electric generation capacity). Potential volatility in carbon prices will impose risk-bearing costs on companies with a compliance obligation, and for industries like utilities and refineries the costs of managing trading risk could erode a significant percentage of their profit margin. Businesses and consumers already have to live with substantial volatility in commodities markets, such as for fuels. Companies are generally able to cope with unavoidable volatility in natural commodities; but that is no reason to intentionally create volatility in a new, major input (i.e., allowances) given that policymakers can establish the same carbon price incentive without any volatility at all. No matter how manageable carbon price volatility is, it has a cost, and no benefits are derived from that cost. Therefore, it is desirable to minimize carbon price volatility wherever possible. Carbon policy is one of the rare situations where carbon price volatility can be eliminated altogether while still having a clear price signal.

- Green jobs versus effects on total employment - Despite the promise of green jobs, ACESA would, if enacted, inevitably depress total employment from baseline levels. The bill would divert resources now used to produce additional goods and services into the work of obtaining energy from sources that are more costly than fossil fuels. It would, therefore, lower the sum of goods and services produced by the economy and hence the output per unit of labor. Worker compensation will decline as

productivity falls. Although part of the decline in total compensation will show up as a decrease in earnings per worker, many factors inhibit decreases in average compensation. Another result of lowered productivity is likely, therefore, to appear in the form of lower employment levels.

- R&D - Technology advances sufficient to achieve the Reference or Low Cost cases will only come with a much more effective commitment to R&D. The stimulus package and ACESA almost exclusively address deployment of known technologies and large-scale demonstration of well-developed new technologies, and do not provide the level of support for the types of basic and applied research necessary to create the breakthroughs on which game-changing technologies can be built.

- Costs of a duplicate regulatory system – ACESA establishes both a GHG cap-and-trade and a series of command-and-control mandates. In some cases, the regulations may not appear to be binding; *i.e.*, the cap might, by itself, motivate all of the actions needed to meet the standard. In these instances, the standards would waste resources on needless monitoring, measuring, enforcement, and compliance, but they would not affect the pattern of GHG reductions. In other cases, the standards would change the allocation of abatement resources by mandating different choices. However, the cap sets the total GHG cutback. If the regulations mandate more change in one area, less will take place somewhere else. Standards, therefore, will force the economy to substitute more expensive GHG emission decreases for decreases of the same amount that could have been made elsewhere at lower cost.

- Wealth transfers abroad - ACESA contains provisions that will transfer wealth from the U.S. to other nations. These include allocations of allowances to overseas entities for international adaptation and purchases of offsets from foreign projects. We estimate that these provisions of ACESA would result in a transfer of U.S wealth to other countries varying from $40 billion to $60 billion per year in the years 2012 through 2030. Some possible circumstances can cause these amounts to be even larger.

Overall, ACESA is designed to raise the cost of using conventional energy by requiring emission allowances for the use of that energy, which effectively restricts the use of lower cost energy in the U.S. economy. Higher energy costs would likely reduce total consumption, employment, and economic output. The link between energy supply and its cost, and economic performance is the key to understanding the pattern of the study results and central to an assessment of the implications of ACESA. Table 1-1 provides a summary of economic impacts.

Table 1-1: Summary of projected economic impacts (change from projected baseline)

	2015	2020	2030	2040	2050
CO_2 Allowance Price (2008$/metric ton)	$22	$28	$46	$74	$124
Change in U.S. jobs (Millions)	-2.3	-2.7	-2.5	-2.5	-3.0
Change to Average Worker's Annual Wages: *Assumes Partial Wage Adjustment* ($2008)	-$170	-$270	-$390	-$600	-$960
Change in U.S. Purchasing Power ($2008 per Household)	-$730	-$800	-$830	-$850	-$940
Percentage Change in U.S. GDP	-1.0%	-1.2%	-1.3 %	-1.3 %	-1.5%
Percentage Change in Natural Gas Retail Rates*	10% ($1.20/MMBtu)	14% ($1.60/MMBtu)	16% ($2.30/MMBtu)	25% ($3.70/MMBtu)	34% ($5.40/MMBtu)
Percentage Change in Motor Fuel Cost	3% (12¢/Gallon)	4% (14¢/Gallon)	5% (23¢/Gallon)	7% (37¢/Gallon)	11% (59¢/Gallon)
Percentage Change in Electricity Retail Rates*	7.3% (1.1¢/ kWh)	16% (2.0¢/ kWh)	22% (2.8¢/ kWh)	34% (4.5¢/ kWh)	45% (6.1¢/ kWh)

* Percentage increases in utility bills will be smaller to the extent there are free allowance allocations to load-serving entities and natural gas local distribution companies and/or reduced energy consumption.

2. BACKGROUND

2.1 THE AMERICAN CLEAN ENERGY AND SECURITY ACT OF 2009

ACESA would, if enacted, impose sweeping changes on virtually all parts of the U.S. energy system. These changes would reverberate through much of the national economy. The two major provisions of the bill are a combined efficiency and renewable electricity standard and a greenhouse gas cap-and-trade system.

ACESA requires retail electric utilities to meet specified percentages of their annual load through renewable electricity generation and energy efficiency savings. The combined standard is initially set to 6% of load in 2012 and rises to a maximum of 20% by 2039. Up to one-quarter (or 5% of 2020 load) of the requirement can be met with savings from energy efficiency, and state governors can petition to increase the proportion of compliance met through energy efficiency to up to two-fifths of the combined percentage requirement. As an alternative to procuring renewable energy credits, retail electric utilities can purchase a $25 (adjusted for inflation) alternative compliance payment (ACP), the funds from which will flow back to state-led research and development of renewable electricity generation technologies and cost-effective energy efficiency programs.

Title III establishes a U.S. national cap on total GHG emissions. The cap would apply to electric utilities, oil companies, large industrial sources, and other covered entities. Entities covered by the act collectively contribute about 85% of U.S. greenhouse gas emissions, which are, in turn, approximately 17% of current global emissions. The program is designed to reduce covered emissions by 3% below 2005 levels in 2012, 17% below 2005 levels in 2020, 42% below 2005 levels in 2030, and 83% below 2005 levels in 2050.

Title III also provides for alternative compliance with the GHG emissions cap through offset credits and international emission allowances. However, it restricts the use of these measures. For international offset credits, an entity must submit five offset credits for every four tons of CO_2 that it emits, except for during the first five years of the cap. For international emission allowances, an entity may submit allowances issued by a foreign program that meets certain criteria. The total quantity of emissions that may be covered by rendering offsets to meet compliance obligations is limited to 2 billion metric tons of CO_2 in each year, split evenly between domestic and international offsets. Given the five offsets for four tons requirement for international offsets (after the first five years of the cap), this would mean that up to 2.25 billion offsets credits may be demanded under the cap each year.[6]

[6] In addition, if domestic offsets are not fully utilized, additional international offsets may be used (up to a total of 1.5 billion international offsets, but total offsets still cannot exceed 2 billion).

2.2 PROVISIONS MODELED

The text of ACESA is more than 900 pages in length. The Congress has yet to fully determine some key features, making it impossible to model their impact. Many provisions that are provided have too little an economic impact, or their effect is too speculative, to warrant modeling. In other cases, provisions are economically consequential, but modeling them would require time and resource constraints that exceed those available for this initial effort. Detailed energy efficiency standards and mandates are consequential and are likely to raise costs and economic impacts if they change the decisions that households and businesses would make in response to the incentives created by the cap-and-trade program. However, modeling the full costs of these provisions requires a more detailed representation of individual decisions than any comprehensive economic model can encompass.

Thus, it is important to understand which aspects of ACESA have been addressed, which will be addressed later, and which lie beyond the scope of the analysis. Table 2-1 summarizes the primary provisions included in this analysis

Table 2-1: ACESA provisions modeled

Provision	Details
Combined efficiency and renewable electricity standard	Required specified percentages of a baseline level of electricity sales to be met with qualified renewable resources; baseline level excludes certain existing hydroelectric generation, sales from small LDCs and generation from new nuclear and carbon, capture and storage units
Greenhouse gas cap & trade	Cap on covered emissions from 2012-2050, allows banking/borrowing, annually allows for up to 2 billion in offsets (split between domestic and international offsets)
Allowances for carbon capture and storage (CCS)	Funds from allowances are used to bring online 3 GW of new CCS in 2020
Allocations provisions and revenue recycling	Regional and U.S. welfare impacts reflect ACESA's provisions for free allocations to industries and for investments in CCS and adaptation. All auctioned revenues are recycled to U.S. consumers.

Our analysis of the cap-and-trade program includes offset provisions, banking and borrowing, and the strategic reserve, all measures meant to ease the burdens expected to result from allowance price fluctuations. We have not included any of the costs of volatility in our estimates of the economic costs of the cap-and-trade program, either with or without these measures. Therefore, we are unable at this time to estimate how much these measures could reduce volatility or the costs that any remaining volatility would add to those estimated in this study.

Our analysis also estimates the impact of allowance allocations on the regional distribution of impacts and on average utility bills. These allowance allocations include free allocations to the electric sector, energy-intensive industries, natural gas distributors, automotive sector and refining sector. In addition, there are allocations made to spur investment in CCS, prevent tropical deforestation and aid in domestic and international adaptation. Remaining allowances are auctioned with proceeds being used to assist low and moderate-income households, assist states in increasing renewable energy and energy efficiency, increase research and development, assist workers and maintain budget neutrality. Our analysis also accounts for the full recycling of auction revenues in these ways.

2.3 Study Objectives

This study evaluates the potential economic consequences of the key provisions of ACESA. Because these provisions interact and because different elements of the economy are interconnected, the task requires the use of comprehensive and detailed economic models. These models simulate the operations of major features of the economy, so that it is possible to trace the many pathways through which legislation can affect various economic sectors and activities. CRA used its proprietary, state-of-the-art MRN-NEEM and MS-MRT modeling systems to analyze the potential impacts from ACESA on domestic energy markets and the economy. The models are described more fully in Appendix D.

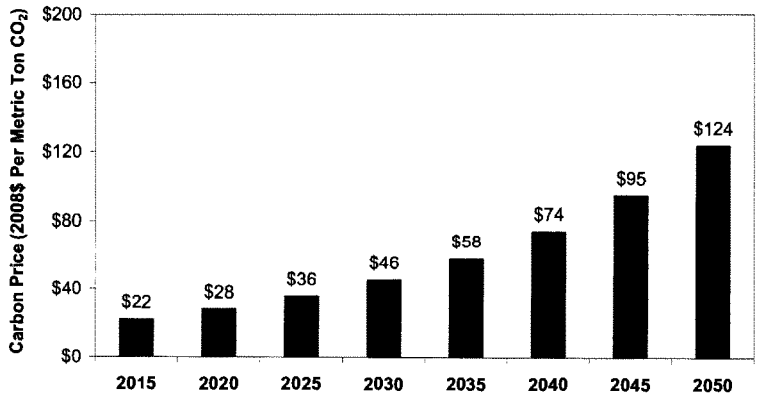
Like all other economic impact studies by EPA, EIA, and MIT, we assess only the costs of meeting the provisions of a policy, ACESA, in this case. These costs of the policy are to be compared to the benefits of whatever change in *global* atmospheric concentrations is projected to result from this single policy that affects U.S. emissions only. If a benefits calculation were to include emissions reductions from presently non-existent policies in other countries, then a different cost analysis would be required which would consider the additional costs on the U.S. economy of those additional assumed policies.

3. RESULTS

One of the primary objectives of ACESA is to implement a GHG cap-and-trade policy that would reduce greenhouse gas emissions by decreasing the use of conventional energy, which is carbon-emitting. This would be achieved by creating a limited supply of "allowances" required for the use of carbon-emitting energy, thereby increasing energy costs to the U.S. economy. As the cap progressively tightens with time (*i.e.*, allowances become scarcer), the marginal source of reducing emissions becomes more expensive as lower-cost sources of emissions reductions are exhausted. As a result, the price of an allowance increases with time as the cap becomes more stringent.

Figure 3.1 presents estimates of the CO_2 allowance price during the forecast period.[7] In 2015, the price of a carbon allowance is estimated to be $22 per metric ton of CO_2. By 2020, the allowance price would increase to $28 per metric ton of CO_2. By 2030, the allowance price would increase further to $46 per metric ton of CO_2. By 2050, the allowance price would reach $124 per metric ton of CO_2. The price pattern reflects the banking of permits that occurs in this policy. That is, permit prices increase by the annual discount rate of 5%.

Figure 3.1: Projected CO_2 allowance prices due to ACESA



Source: CRA Model Results, 2009

[7] All allowance prices are stated in terms of 2008 dollars per metric ton of CO_2e.

The economic impacts resulting from the increasing CO_2 allowance prices would be expected to cascade throughout the economy and would likely increase energy costs and decrease production and consumption across a wide array of goods and services. The size of the projected impacts varies by region but the direction does not. The projected impacts increase throughout the period analyzed (2010 through 2050) as the measures become more stringent, with the largest changes projected over the 2030 to 2050 time period.

3.1 Economic Impacts

3.1.1. Costs to consumers

Consumers ultimately bear the added costs projected to result from the cap-and-trade policy. The cap-and-trade provision is projected to result in fuel switching away from less costly conventional fuels (*e.g.*, coal), towards more costly lower carbon alternatives (including natural gas) due to tightening GHG emission caps. Further, costs for all carbon-based energy sources (*e.g.*, coal, oil, and natural gas) are projected to increase as allowances would need to be purchased for the emissions associated with the use of these fuels. In the case of electricity and natural gas supplied through companies regulated by utility commissions, free allowance allocations will mitigate some of the total cost borne by retail customers. ACESA provides free allowance allocations to such load-serving entities, but requires that the full cost of carbon still be reflected in the rates per unit of energy each customer uses. The ACESA allowance allocations are also accounted for in the impacts presented in this section.

Figure 3.2 reports how the cost per unit of energy consumed by businesses and households is projected to increase relative to energy costs in the AEO 2009 baseline level:[8]

- For transportation fuels, after an estimated 12 cents per gallon increase in 2015, costs of using motor fuels are estimated to increase by 5% (23 cents per gallon) in 2030 and increase by 11% (59 cents per gallon) in 2050 relative to baseline levels. These cost impacts consider the combined effect of changes in the market prices of the fundamental energy commodities, the added cost of limiting carbon emissions, and projected shifts towards a lower-carbon mix of energy sources used to fuel the average vehicle.

- Retail natural gas *rates* (*i.e.*, the price consumers pay per unit of gas energy used) would rise by an estimated 10% increase ($1.20 per MMBtu) by the year 2015, by 16% ($2.30 per MMBtu) by the year 2030, and by 34% ($5.40 per MMBtu) by the year 2050.

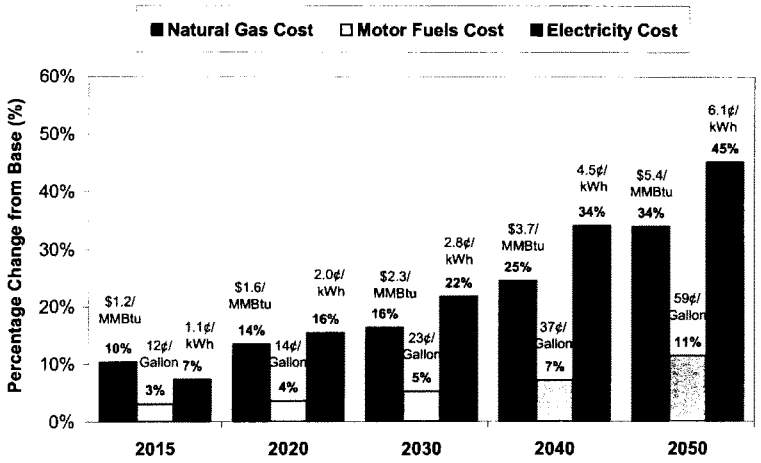
[8] Results herein are reported as changes from the EIA Annual Energy Outlook 2009 Early Release Reference Case.

- Retail electricity *rates* are estimated to increase by 7% (1.1 cents per kWh) relative to baseline levels in 2015, by 22% (2.8 cents per kWh) in 2030 and by 45% (6.1 cents per kWh) in 2050.

These increases in retail energy rates to customers of electricity and natural gas utilities are projected to occur even when accounting for ACESA's provision for free allocations of 30% of the allowances to electricity load-serving utilities, and 9% to gas utilities through 2025. This is because ACESA does not allow the value of those allocations to be returned to customers in proportion to the amount of energy that they use. The purpose of this provision is to ensure that consumers' incentives to conserve and to invest in energy efficiency are not undermined by attempts to mitigate their energy costs through free allocations. Instead, the allocation value will have to be returned to utility customers either through utility spending programs on energy efficiency or demand-side management, or through fixed rebates or credits on their bills. To the extent that utilities return the value of their free allocations under ACESA to customers through reductions in fixed charges, actual total *bills* for electricity and natural gas will not rise as much as the *rates* will. Total utility bills may even decline in the first years of the policy if there is also substantial investment in end-use efficiency and/or conservation in response to the higher energy rates.

We estimate that given the allocations in ACESA, average U.S. electricity utility bills would decline by about 0.5% in 2015, and then rise by about 4% to 5% in the 2020 to 2025 time period. Post-2025, as the allocations are phased out, bills would rise more dramatically. We estimate that given the allocations in ACESA, average U.S. natural gas utility bills would increase by about 2.5% in 2015, and then rise by about 5% to 6% in the 2020 to 2025 time period, with more dramatic increases after that as the allocations are phased out.

Figure 3.2: Projected U.S. household increases in costs inclusive of carbon costs for natural gas, motor fuels and electricity due to ACESA, relative to baseline costs



Source: CRA Model Results, 2009

3.1.2. Investment, employment and productivity growth

Claims that GHG cap-and-trade can boost total employment have become commonplace. This contention has become a central point in the national debate about climate policy. That it has is understandable; the U.S. economy is undergoing both a cyclical downturn and a structural adjustment. Unemployment is high, and so is political pressure to respond to both the short-term cyclical and to the long-term structural aspects of the challenge. Not surprisingly, this pressure has led to claims and hopes that GHG cap-and-trade might somehow solve both problems.

These claims are incorrect, and the hopes that spring from them are destined to lead to disappointment. ACESA can have no impact on the unemployment arising from the current cyclical downturn because its provisions will not take effect soon enough. In the longer run, its net effects on employment will be negative, for the reasons explained in this section.

Investment diversion and impacts to productivity growth

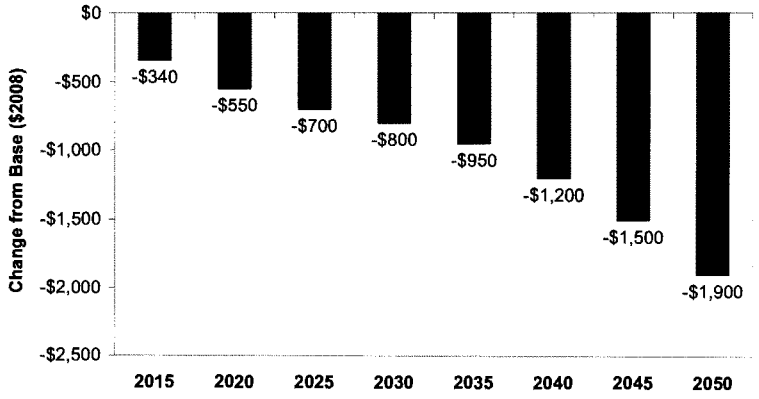
If enacted, ACESA would divert resources now used to produce goods and services into the task of obtaining energy from sources that are more costly than fossil fuels. If consumers and businesses are forced to spend more on energy due to its higher costs, they would have less to spend on other goods and services causing decreases in demand for the quantities of

goods and services produced by the economy. In addition, as the resources are diverted to more expensive energy sources, the productivity of labor will fall. Business activity is likely to contract relative to the levels that would have prevailed without policy-induced energy cost hikes. The demand for labor would weaken because employers would need to spend less on labor in order to supply the reduced amount of goods and services demanded by consumers. As a result, payments to labor are projected to decline relative to that which would have prevailed without the higher energy costs. This will be reflected in a combination of less employment, and lower wages for those workers not losing their job.

Reductions in employment and wages due to reduced productivity growth

If actual wages were to decline to their lower equilibrium level instantaneously when the equilibrium wage rate falls as a result of the lower productivity caused by the policy, then full employment would remain in effect, but workers would immediately experience reduced incomes. Figure 3.3 presents the decline in the average annual salary paid to workers that would occur under an assumption that actual wages are fully responsive to the new, lower equilibrium wage rate.

Figure 3.3: Projected impact on average annual wages due to ACESA, assuming wage rates decrease instantly to lower equilibrium



Source: CRA Model Results, 2009

Empirical experience suggests, however, that wages do not immediately respond to new equilibrium levels, particularly if that entails a decline in wages. If real wages do not immediately fall to the new, lower market-clearing level, then there will be an excess supply of labor in the economy relative to what employers are willing to hire at those overly-high wage rates, and this leads to lay-offs and an increase in unemployment. The degree of

unemployment that will occur depends on how much wages actually do fall towards the new market-clearing level. An exceedingly high amount of unemployment would be estimated under ACESA if we were to assume that there would be no decline at all in real wages to the levels shown in Figure 3.3 above. And, as noted, if we assume that workers would immediately absorb the full wage decline shown in that figure, there would be no involuntary job losses.

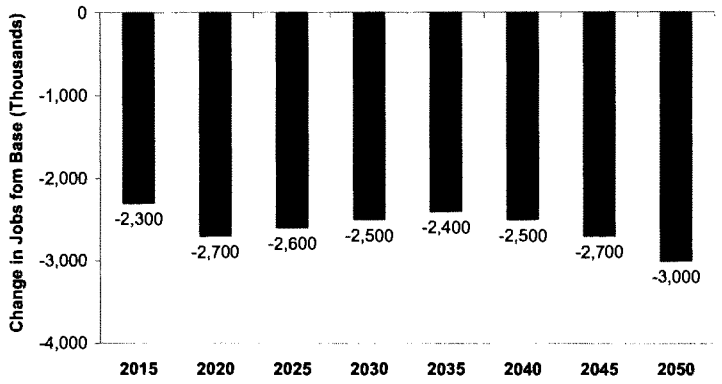
Figure 3.4 illustrates the employment impacts if only half of the decline in the market-clearing wage rate is absorbed by workers immediately. In this case, the other half of the reduction in payments to labor has to be achieved by eliminating job positions. The actual number of job positions that would have to be shed depends on whether higher-paying or lower-paying jobs are the ones that are eliminated. In our calculation in the figure, we assume that jobs would be shed in equal proportions across the entire wage distribution, and report the loss in "average jobs." (The precise number of jobs would be lower if ACESA would disproportionately affect the relatively higher-paid positions, and it would be higher if ACESA would cause a disproportionate loss of lower-paid types of jobs.) Figure 3.4 shows that in 2015, the number of people on the unemployment rolls is estimated to be approximately 2.3 million higher than in the baseline. It also shows that there would remain between about 2.5 to 3 million fewer average jobs in the economy far into the future relative to what would otherwise have been possible but for the requirements of ACESA.

Because these estimated employment impacts are based on the general equilibrium requirement that total payments to labor must fall to the new, lower level that can be supported by the reduced overall productivity of the entire economy, *they are necessarily inclusive of all increases in so-called "green jobs" that will be created as a result of the proposed legislation.*[9]

Also, because these average losses in employment assume that workers do absorb some of the reductions in equilibrium payments to labor, there is still some depression in the average salaries to those who would retain their jobs. The decline in average annual wages that is consistent with the employment reductions in Figure 3.4 is shown in Figure 3.5.

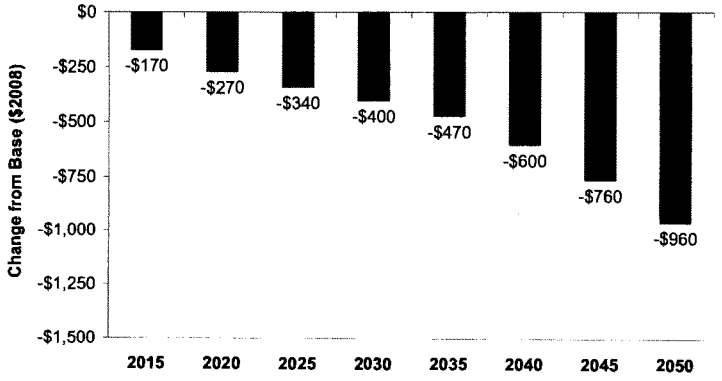
[9] CRA has made preliminary estimates of the number of average jobs directly associated with the increased payments to labor for increased renewable electricity, more efficient automobiles, biofuels, and energy efficiency improvements in its model scenario of ACESA. The preliminary estimate ranges from 1 million in 2015 to almost 2 million by 2030. The creation of a green job does not always mean the creation of a "new" job. For example, moving an autoworker from producing a vehicle powered by conventional fuels to a vehicle powered by a hybrid engine would not constitute a "new" job. Instead, it is a job transfer to what one might call a green job. Our estimate of green job creation includes green jobs that are both "new," which are incremental to a business as usual scenario, and "transfers," which are jobs shifted from part of an industry negatively impacted by a policy to another part of the industry that is positively impacted by the policy. Our net job loss estimates above are derived from the same model run that simultaneously contains this large number of implicit employment in "green jobs."

Figure 3.4: Projected changes to employment due to ACESA, assuming partial wage rate adjustments



Source: CRA Model Results, 2009

Figure 3.5: Projected impact on average annual wages due to ACESA for workers who remain employed, assuming partial wage rate adjustments

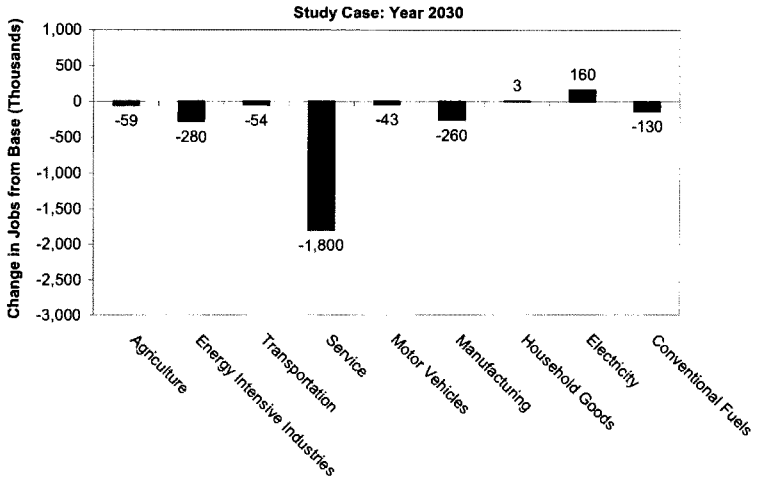


Source: CRA Model Results, 2009

It is noteworthy that the impact of a policy such as ACESA is not a short-term phenomenon that consists of a few years of belt-tightening, after which the economy will be on a different (lower-carbon) track. Rather, getting to the lower-carbon future will require a long-term, sustained effort to continue growing the investment in more costly forms of energy, and this

will mean that payments to workers will remain lower for many decades than would be the case if we were to continue to rely on the cheaper but higher-carbon conventional sources of energy. The growing decline in real wages is due to a slowdown in productivity growth that is a direct consequence of the success of the cap-and-trade program in transforming the U.S. economy into one with nearly zero carbon emissions.

Figure 3.6: Projected impact by sector to employment in 2030 due to ACESA



Source: CRA Model Results, 2009

Employment impacts will also vary by industrial sector. Figure 3.6 shows the job loss in 2030 by sector. About 65% of the job losses that would accompany ACESA are projected to be in employment opportunities in the services and commercial sectors. Service sector employment reductions reflect the cumulative impact of businesses having to pay more for their energy services, and facing higher costs for goods and services generally, almost all of which are made using more expensive energy. These will tend to be "silent" losses of opportunity in the relatively low-wage portions of the economy that are least often associated with either the emitting sectors who will face the direct cost of the policy or the activities where the most overt examples of new "green jobs" will be found. Energy-intensive industries will also be affected as their competitiveness relative to other producers' declines due to the increases in energy costs. Conventional fuels decline because of reduced demand for fuels in general and the substitution to various forms of biofuels. The electricity sector gains as a result of the need to replace existing generation plants with zero and low carbon emitting technologies, and also due to general equilibrium effects.

Discussion of green jobs prospects

To be sure, by mandating the use of the newer, more expensive energy sources and systems ACESA would create some new jobs. The difficulty is that the number of these new "green jobs" will be lower than the number of the other jobs that the bill would destroy elsewhere in the economy. The apparent discrepancy between our finding and estimates of large numbers of green jobs arises because the latter estimates are answering the wrong question. Those who claim there will be a job-creating attribute to a policy such as ACESA have asked whether it will require workers to carry out energy efficiency projects and produce biofuels and build and operate power plants using renewable energy. It will, but it will also require that those workers come from employment in other industries, some of which are directly targeted by a cap-and-trade program – such as fossil fuels production – and some of which will shrink because consumers can no longer afford their full production. The question that we have addressed is whether the balance of the many economic effects of a GHG cap is to increase or decrease total labor income in the United States, and the answer is that total labor income will decrease.

Whether green jobs will be lower-paying than the jobs they replace and require more labor per unit of output does not change the generally depressing effect of the cap-and-trade program on total labor income. It might lead to two low-paid workers moving out of unemployment while one worker who was earning more than twice their wages becomes unemployed. Only if this were to be the predominant pattern of the impact of the policy could one argue that there would be a net increase in total jobs under the policy concomitant with the inevitable decrease in total payments to workers. Whether that would be a desirable goal of social policy cannot be answered by economic analysis.

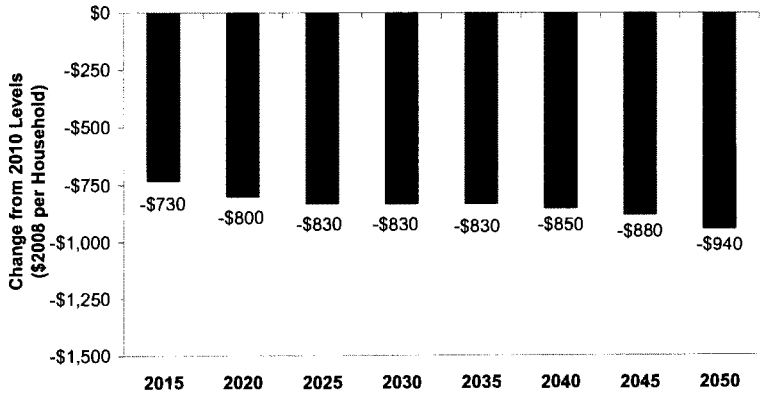
The debate is further confused by the lack of a clear definition of a "green job." For example, how would one classify a job supporting coal-fired power with carbon capture, or nuclear generation? How does one even tell if a given construction job is in "green" construction or not? Regardless of these definitional concerns, however, the fact remains that workers in aggregate will face lowered earnings potential under a policy that drives carbon emissions to much reduced levels. The net effect of lower productivity also ultimately translates into overall losses in average household spending power, and into reductions in GDP relative to what they would be if no such policy were in place. We turn to those cumulative macroeconomic effects in the next two sections.

3.1.3. Impacts on household consumption

Higher energy costs generally mean that consumers must spend a larger percentage of their income to maintain their current level of household energy services. At the same time, significant quantities of energy are needed to produce and transport the many non-energy goods and services. The projected higher costs of these goods and services would be expected to magnify the loss in household purchasing power associated with the direct purchase of energy services. At the same time, higher energy costs across the economy as

a whole would lower income. We have already discussed how average labor income would be reduced. Similarly, lower returns on investment would reduce household income from savings and retirement funds. Figure 3.7 shows the increasing erosion of household purchasing power that is projected as a result of ACESA, due to the combination of all these factors. These estimates of changes in household purchasing power are based on the assumption that all auction revenues are returned to households on a per capita basis and that the value of allocated allowances are also returned to households in the form of utility rebates and increased investment income from companies receiving allocations.

Figure 3.7: Projected impact on household purchasing power due to ACESA, stated in terms of 2010 income levels



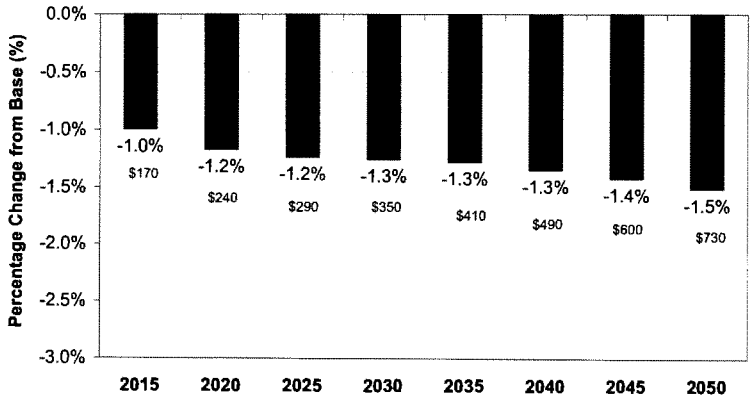
Source: CRA Model Results, 2009

Stated in terms of 2010 income levels, in 2015 the average household in the U.S. is estimated to experience a loss in purchasing power of roughly $730. This loss grows over time to $800 per household in 2020. In 2030, the estimated impact is projected to decline by roughly $830, and in 2050, the estimated impact reaches $940. A very large portion of the losses per household can be traced to the fact that a large fraction of total compliance is met by purchasing offsets from international sources. While these offsets lower the price of allowances, they also cause U.S. wealth to be given to other countries. More expensive compliance from domestic suppliers would at least keep that wealth from being transferred out of the pocketbooks of the average U.S. household.

3.1.4. Gross domestic product

The estimated impacts on GDP would follow the pattern already evident in the estimated results for consumption and employment. Higher production costs and lower household purchasing power interact; employment and consumption would fall; total economic activity, measured as GDP, would also decline. In 2015, the GDP is projected to decline by 1.0% ($170 billion) below the baseline level. In 2030, it is projected to decline further to 1.3% ($350 billion) below the baseline, reflecting the investment needed to build the infrastructure necessary to comply with future more stringent emission caps, and in 2050 the decline is 1.5% ($730 billion). Figure 3.8 illustrates the pattern of estimated GDP losses through time.

Figure 3.8: Projected impact on GDP due to ACESA, relative to the baseline

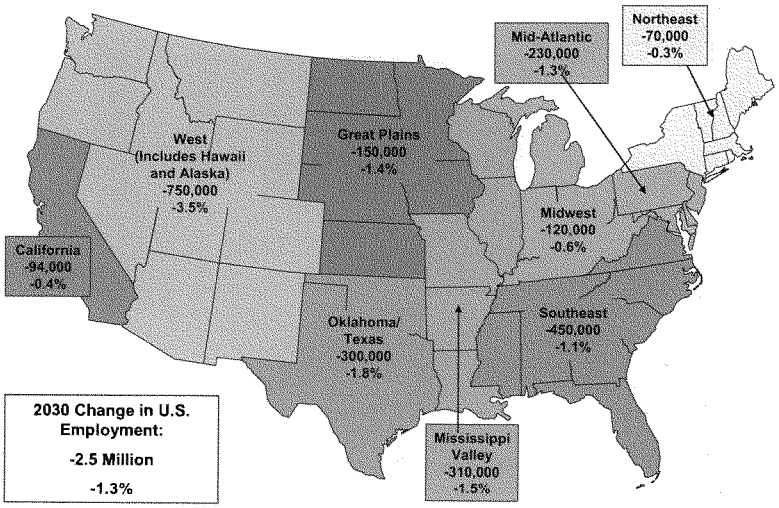


Source: CRA Model Results, 2009 *Values in Billions of $2008*

3.1.5. Impacts by Region

Figure 3.9 indicates that the projected job losses would be distributed throughout the country. Regions that experience a larger decline in employment relative to the U.S. average are the West, Oklahoma/Texas and the Mississippi Valley; regions that suffer a smaller decline than the U.S. average are the Midwest, Northeast, and California. Losses in the Great Plains, Mid-Atlantic, and the Southeast are near the national average for the U.S. as a whole.

Figure 3.9: Projected regional distribution of changes to employment in 2030 due to ACESA

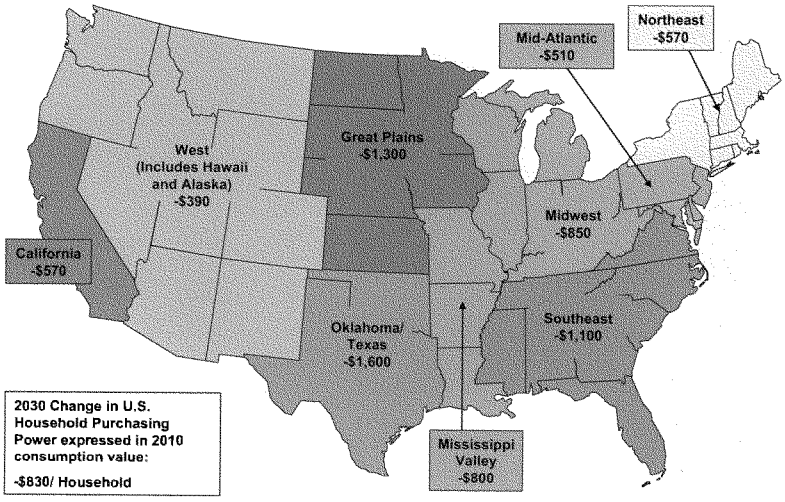


Source: CRA Model Results, 2009

A region's industrial impacts, and hence employment effects, strongly correlate with the region's composition of industries and the energy-intensity of these industries. The Northeast and California fare better than other regions because of their initial economic circumstances. Namely, these regions' industries are less energy-intensive, as is the overall composition of industry. At the other end of the spectrum are the Mississippi Valley, Oklahoma/Texas and West regions, which are more concentrated in conventional energy production activities and energy-intensive industries.

Figure 3.10 shows the loss in purchasing power by the regional household in 2030. Regions that experience a larger decline in purchasing power relative to the U.S. average are Oklahoma/Texas, Great Plains, and the Southeast; regions that suffer a smaller decline than the U.S. average are the West, California, Mid-Atlantic, and the Northeast. Losses in the Midwest and Mississippi Valley are near the national average for the U.S. as a whole. In general, households in regions that have to import higher-cost energy and those that face loss of domestic production incur the largest loss of purchasing power. (Changes in the regional distribution of permits could mitigate some of these disproportionate impacts, if designed effectively.)

Figure 3.10: Projected regional distribution of changes to 2030 household purchasing power due to ACESA, stated in terms of 2010 income levels



Source: CRA Model Results, 2009

Some of the distribution of regional impacts depends on the proposed permit allocation scheme. The West is an interesting case because it is on the low end of household impacts but on the high end in terms of job losses. This result illustrates the importance of permit allocations on welfare. The West receives a disproportionate share of the permits relative to its emissions. This wealth from permits mitigates this region's household impacts. The initial allocation of permits also greatly aids the Mid-Atlantic region. On the other end of the spectrum, the Great Plains region experiences greater household impacts because of its proportionately smaller allocation of emission allowances. These results highlight the great care that must be taken in deciding on the initial allocation of permits so that the policy equitably treats all concerned.

3.2 Uncertainties of Carbon Prices and Economic Impacts

Rigid caps on greenhouse gas emissions achieve certainty in emission levels over a period of time at the cost of large uncertainties about long-run carbon prices and costs to the economy, as well as short-term volatility in carbon prices.

3.2.1. Uncertainty about carbon prices and cost

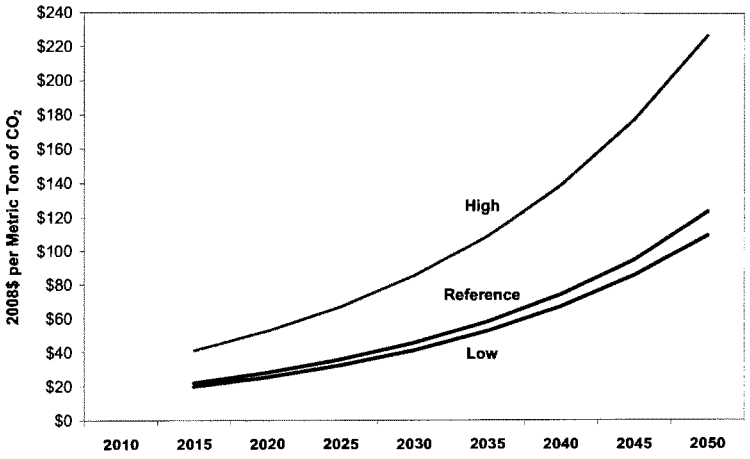
The uncertainty of outcomes from a rigid cap is illustrated by a pair of cases. These High and Low Cost cases were constructed by developing a range of assumptions about specific future economic and technology factors that will influence the level of carbon emissions and costs but cannot be predicted accurately in advance. Table 3-1 below describes the range of assumptions used to define the High and Low Cost cases, compared to Reference case assumptions.

Table 3-1: Range of assumptions in Low and High Cost cases compared to Reference case

	Low Cost	Reference	High Cost
Electricity Demand	AEO 2009 April Release (0.90% 2010-2030 CAGR)	AEO 2009 Early Release (1.00% 2010-2030 CAGR)	AEO 2009 Early Release + Difference b/w Early & April Release
Natural Gas Prices	Same as Reference	AEO 2009 Early Release through 2030, with a 2050 wellhead target of $9/MMBtu (in 2003$)	Same as reference
Demand Elasticity	Higher demand elasticity	CRA Standard	Lower demand elasticity
Low-Carbon Fuel Transportation Technology	Reduce zero- and low-carbon alternative fuels down to cost parity with motor gasoline	CRA Standard	Assume no zero-carbon fuel
Capital Costs for New Generating Technologies	Same as reference	AEO 2009 Early Release, save for nuclear (public filings) and geothermal (EPA NEEDS 2006)	Flat-line costs at first-year AEO 2009 Early Release
CCS Capacity Limits	270 GW by 2050	180 GW by 2050	Same as reference
Nuclear Capacity Limits	EPA W-M (266 GW by 2050)	206 GW by 2050	Allow existing nuclear fleet (103 GW) to be replaced, but no more
Offsets	Same as reference	Wealth transfers out of U.S. from international offset purchases priced at marginal cost of international offsets	Wealth transfers out of U.S. from international offset purchases priced at CO_2 allowance price, no international avoided deforestation offsets

Each of these factors represents a true uncertainty, about future growth in the economy and energy demand, about how energy use will respond to higher prices derived from the cap-and-trade system, about future developments in the performance and cost of electricity generation and transportation technologies, and about limits that may be imposed on key technologies due to regulatory action or litigation. These factors cannot be known in advance, and the assumptions chosen for the sensitivity analysis represent quite reasonable outcomes that many observers would see as likely. Figure 3.11 shows the range of carbon prices that this range of underlying uncertainty makes likely.

Figure 3.11: Carbon allowance prices by model scenario



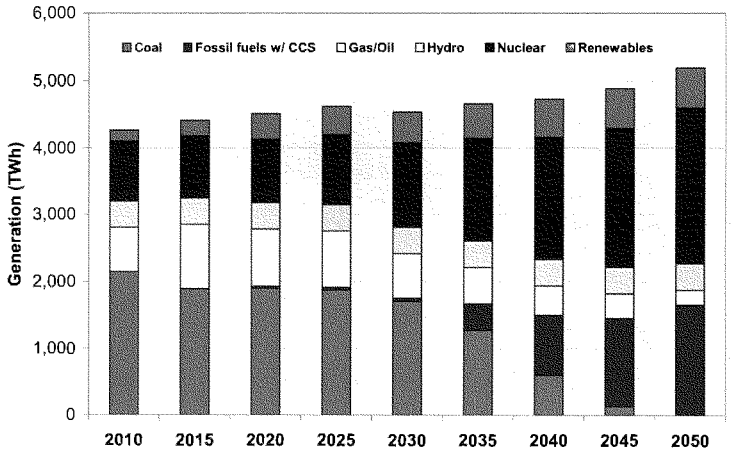
Source: CRA Model Results, 2009

The analysis reveals that the chance of higher prices and costs appears much larger than the chance of lower costs. In 2015 the High Cost assumptions lead to a carbon price about 90% higher than the Reference case, a percentage difference that is maintained out to 2050 because of the assumption that banking is utilized to minimize the overall cost of the cap. The Low Cost case only leads to carbon prices a few dollars lower, suggesting that the Reference case assumptions are about as favorable a set of relevant assumptions as it is possible to make about the factors considered, given current knowledge. (Some unanticipated, major breakthrough in technology might result in a lower cost than this range, but this would require very specific technology assumptions that are simply not justifiable with any current information. Such breakthroughs are unlikely without more emphasis on game-changing R&D than is found in ACESA and the stimulus package, which both concentrate on deployment of more mature technologies.)

Figure 3.12 and Figure 3.13 show differences in generation mix through 2050 and Figure 3.14 and Figure 3.15 show differences in technologies chosen for new capacity. The higher carbon allowance prices in the High Cost case (approximately double the carbon prices in the Low Cost case) call for considerably more renewables generation over the entire modeling horizon, and particularly for increased renewables investment from 2015 through 2020. The disparity in carbon allowance price projections makes investment planning for generators much more difficult in a cap-and-trade system that leaves future carbon allowance prices uncertain than it would be under an alternative, such as a carbon tax, that fixed the price in advance.[10] Investors who believed that carbon prices would follow the high track could find themselves with stranded renewable assets in the event lower carbon prices come about, and investors in other assets in the lower price cases could find themselves regretting the decision not to invest in renewables.

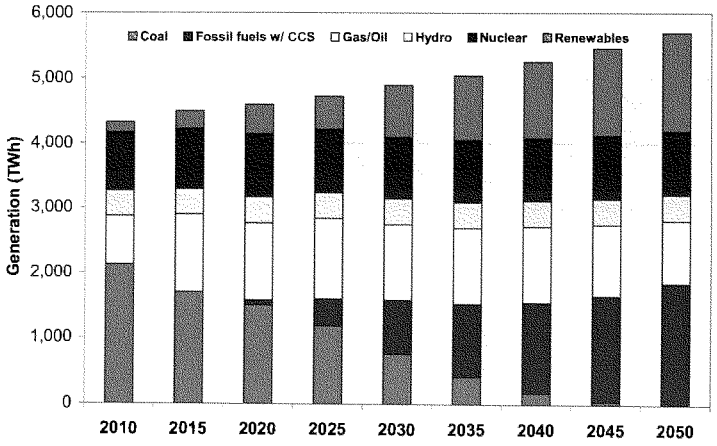
[10] Under a tax approach, there would also be uncertainties about long-run carbon price levels, because regulators would need to periodically reset the tax rate based on observed progress towards reducing emissions under initial tax rates. The tax policy approach offers short-term pricing stability, however, which helps with investment decisions, even though the long-term costs are unknown.

Figure 3.12: Generation by technology for the Low Cost case



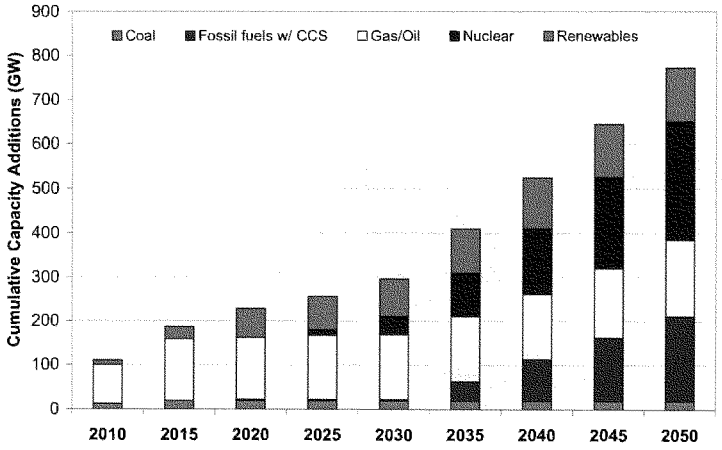
Source: CRA Model Results, 2009

Figure 3.13: Generation by technology for the High Cost case



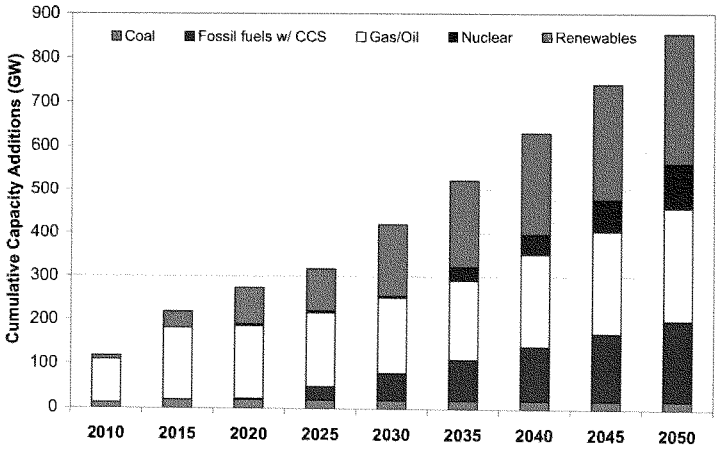
Source: CRA Model Results, 2009

Figure 3.14: Cumulative capacity additions by technology for the Low Cost case



Source: CRA Model Results, 2009

Figure 3.15: Cumulative capacity additions by technology for the High Cost case



Source: CRA Model Results, 2009

Moreover, investors' mistakes can contribute to volatility. If, for example, investors were convinced that carbon prices would remain at levels estimated in the Reference case for a decade, then they would build limited renewables. Later if it became clear that carbon prices were more similar to those in the High Cost case, then carbon prices could spike well above the estimated High Cost case levels until sufficient renewable generation is built to catch up with the High Cost case projection.

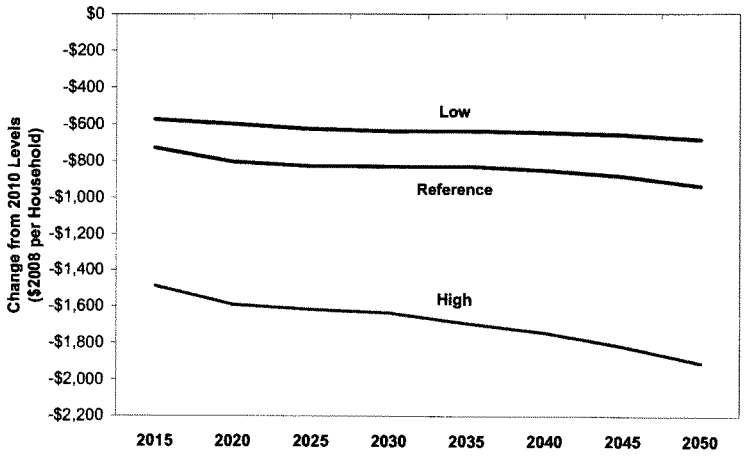
If, in contrast, the carbon price is known in advance – including how it can be expected to change many years into the future – covered emitters can plan compliance more easily and efficiently. They will be far more willing to undertake major capital investments in advanced, low-carbon technologies if they have some confidence that the carbon price level will either rise to or continue to remain at levels that make such investments cost-effective. They may also find it easier to obtain funding for such investments, if they are subject to less market risk.

The EU-ETS experience has also demonstrated that even very high carbon prices do not necessarily translate into a willingness of the private sector to make investments in new, lower-carbon technologies. Despite the fairly high average prices in the EU-ETS, there has been no serious degree of private sector investments in cleaner technologies.[11] The usual explanation for the failure of the EU-ETS to motivate investments in clean energy technologies is the uncertainty in its carbon price levels and the potential impermanence of the scheme. Even if investments in some clean technologies might be justifiable under the average carbon prices of about €20 per ton that have been experienced over the past four years, they have not been forthcoming. Uncertainty on what the carbon price level will be – not just for the next few years but for 10 to 20 years into the future – appears to be inhibiting private sector investments in low-carbon technologies.

[11] The fairly high rate of investment in renewables such as wind and solar in Germany is traceable to the very high guaranteed returns known as "feed-in tariffs" for such generation, and is not attributed to carbon prices.

Figure 3.16 shows the differences in household purchasing power under the three cases. These reveal that costs per household to meet the targets could be from $600 in the low case to $1,600 in the high case in 2020, depending on uncertain future developments. This is the kind of unavoidable uncertainty about impacts on their constituents that policymakers face in deciding on whether to adopt a cap-and-trade system and where to set the caps. Again, alternatives such as a carbon tax can greatly narrow the range of costs and economic impacts that a policymaker must deal with.

Figure 3.16: Impact on household purchasing power by model scenario based on 2010 consumption levels



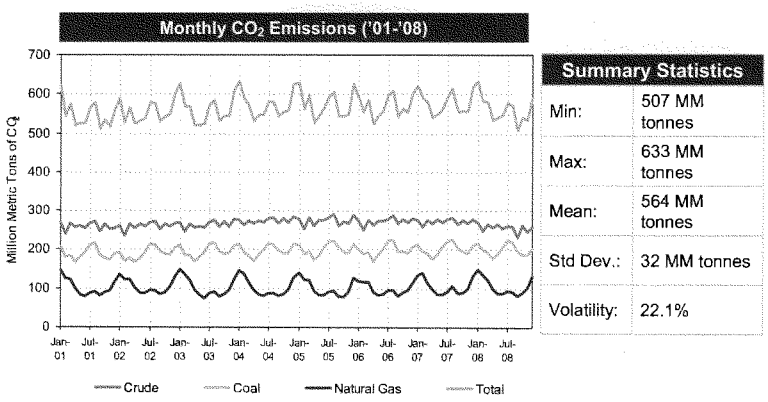
Source: CRA Model Results, 2009

3.2.2. Carbon price volatility

It is also quite likely that prices will move up and down within the range of possible futures, rather than settling down to one clear track after a few years. A major reason is that the banking provisions, relied on in many minds to reduce costs and uncertainty, themselves introduce significant additional uncertainty into near-term prices. Banking connects expected market conditions in the future to current willingness to pay for allowances, so that different or changing expectations about future technology costs, availability of offsets, or policy changes will be communicated immediately into current prices.

Carbon price volatility can also come from the normal factors that lead to swings in oil, natural gas and electricity demand and to volatility in refined product, natural gas and coal prices. Figure 3.17 shows monthly changes in emissions from oil, natural gas and coal consumption over the past decade, and the resulting monthly movements in total carbon emissions. This volatility in use is driven by changes in weather, overall economic activity, and fuel prices. These factors will continue to drive carbon emissions up and down unpredictably even with a cap on emissions, and carbon prices can be expected to rise when events that led to high CO_2 emissions in the past recur and to fall when events that led to low emissions occur. This volatility will be smoothed by the ability to bank allowances and by compliance periods of a year or more, but experience in other energy markets in which storage is possible, such as natural gas, and in Title IV sulfur dioxide markets demonstrates that even with such smoothing mechanisms volatility will appear.

Figure 3.17: Monthly CO_2 emissions from oil and gas and coal combustion



Source: Energy Information Administration, CRA Analysis

In all, a cap-and-trade program is effectively another market on which financial institutions can bet. Though the cap-and-trade program does not allow borrowing from the government, an over-the-counter market could conceivably arise where one could trade swaps and hence borrow. In addition, squeezes could occur near dates where entities need to true up their emissions and permits. All of this increases volatility and the costs of a cap-and-trade program.

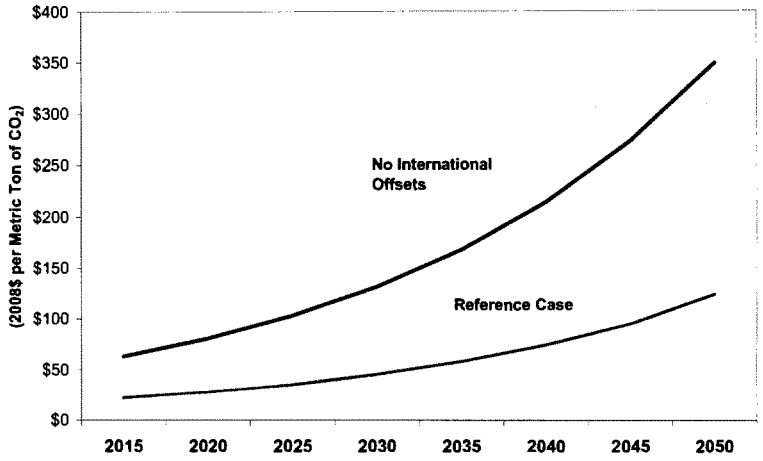
Businesses and consumers already have to live with substantial volatility in commodities markets, such as for fuels. Companies are generally able to cope with unavoidable volatility in natural commodities; but that is no reason to intentionally create volatility in a new, major input (i.e., allowances) given that policymakers can establish the same carbon price incentive without any volatility at all. No matter how manageable carbon price volatility is, it has a cost,

and no benefits are derived from that cost. Therefore, it is desirable to minimize carbon price volatility wherever possible. Carbon policy is one of the rare situations where price volatility can be eliminated altogether while still having a clear price signal.

3.2.3. Sensitivity: no international offsets

The cost and availability of international offsets is perhaps the most uncertain of all the factors influencing the cost of the policy. To understand how large a role international offsets play, we analyzed an alternative scenario to the Reference case in which no international offsets were allowed. Results from this scenario reveal that without use of the full amount of international offsets allowed by the bill, carbon prices would more than double. The reasons why international offsets might not be available at as low a cost and in as large quantities as assumed in the Reference case are discussed in Section 3.3.4.

Figure 3.18: Comparison of carbon allowance prices with and without international offsets



Source: CRA Model Results, 2009

3.2.4. Alternatives to reduce costs of uncertainty

The uncertainty of carbon prices under a cap-and-trade program imposes real economic costs. The uncertainty exemplified by the High and Low cases leads to an absence of clear signals for investors in low-carbon fuels and energy efficiency, as well as related R&D. This will slow progress toward developing efficient new technologies and raise overall economic costs.

Uncertainties that are expected to be resolved, such as rules implementing certain standards or offset calculations, could create a significant option value to an entity if it were to delay investments until uncertainties are reduced.[12]

There is also a potentially significant cost of bearing or mitigating the risks that carbon price volatility creates for companies with a compliance obligation. When companies need to buy allowances to cover their emissions, as with a full auction, their new expenditure may be large compared to their current net revenue. For example, the cash needed by an electricity generating company that has a diversified mix of coal, gas and zero-carbon generation similar to the U.S. average would face new outlays for allowance purchases of $35 per ton that are approximately 20% of its gross revenues, and perhaps 200% of its net revenues. Any delays in the pass-though of such costs to customers could seriously disrupt their financial position. Volatility exacerbates this situation by causing continual variations in cash flow needs. For example, fluctuation in the allowance price between $15 per ton and $50 per ton would mean that the cash flow requirements might vary from 85% to 350% of pre-policy cash flows. Even after price pass-through has occurred, delays in adjustments of the retail rates could translate into see-sawing profitability.[13]

Oil refiners, who are responsible for emissions from the fuels they sell and not just facility emissions, would be in a similar but probably more risky situation. Refiners could face even larger cash flow requirements relative to their profit margins to purchase their required allowances (refiners are to receive 2% of the total allowances from 2014 through 2026). Similarly, if a company has any substantial bank of allowances, it could face large swings in its balance sheet situation. Conditions such as these could translate into companies facing reduced credit ratings and more difficulties in raising capital. This possibility has not been studied at all yet, but certainly requires some careful investigation, including gaining an understanding of the extent to which trading in futures contracts and other derivatives could reduce risks, and what the cash flow and balance sheet effects of such trading might be.

Proposals to limit this uncertainty include safety valves and carbon taxes. A carbon tax would allow emissions to fluctuate year by year rather than prices and economic costs, but if chosen to match the Reference case carbon price would be expected to lead to the same cumulative emissions as the Reference case caps by 2050 (given the realization of other key assumptions). If uncertainties about some of the factors were reduced over time, such that it became clear that emissions were coming in higher or lower than expected at the chosen price, then the tax rate could be adjusted at intervals to aim for the desired cumulative emissions budget. Such tax rate adjustments would not be as disruptive to planning and operations as the volatility likely under a hard cap.

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[12] *Climate Policy Uncertainty and Investment Risk*, William Blyth, Ming Yang and Richard Bradley, International Energy Agency, 2007. Available at http://www.iea.org/textbase/nppdf/free/2007/Climate_Policy_Uncertainty.pdf.

[13] Smith, Anne E., "Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues," Statement to the U.S. Senate Committee on Finance, May 7, 2009.

3.3 Discussion of Key Issues

3.3.1. Costs should be considered in relation to benefits

ACESA is estimated to raise domestic energy costs. The objective of the policy is to reduce greenhouse gas emissions by creating a mandated ceiling for these emissions. In so doing, it forces energy producers to either purchase allowances in order to continue to produce using their current practices or alter their production technologies through added costs in order to reduce their emissions. In either case, the cost of providing energy would increase and a portion of these costs would likely be borne by consumers.

The benefits of ACESA take the form of a reduced contribution of the United States to global concentrations of greenhouse gases, and the damages from climate change that these reduced concentrations would avoid. Because of the large share of GHG emissions over the next century that will come from other countries, particularly rapidly developing countries like China and India, any action by the U.S. will avoid only a small portion of the damages that have been attributed to global warming. The magnitude of the costs estimated in this study can only be judged to be large or small in comparison to these benefits, not by comparisons to other government programs.

3.3.2. Allowance allocations

This analysis includes the allowance allocation provisions in ACESA. Highlights include allocating 35% of allowances to the electricity sector, 15% of allowances to the energy-intensive industries, and smaller allocations to natural gas distributors, automotive companies and oil refiners. These allocations have a significant impact on the regional distribution of impacts, and could affect how regressive the overall impacts will be on different income groups.

Based on stated intentions in the bill, CRA's analysis has assumed that, except for allocations to industries, the value of all allowances would be rebated to households on a per capita basis. Allowances to oil refining, trade exposed industries, merchant coal generators, and the automobile industry serve to offset losses to businesses in those industries. Since any gains or losses ultimately affect share values, these amounts are assumed to be distributed among the population in proportion to ownership of financial assets, for which consumption is taken as a surrogate.

Changes in allowance allocations decisions will change the regional distribution of impacts, but will not materially change overall national economic impacts.

3.3.3. Costs of a duplicate regulatory system

ACESA establishes both a GHG cap-and-trade and a series of command-and-control mandates. The latter are, at best, redundant to the cap-and-trade. They regulate activities that are also subject to the proposed GHG cap. These include the RES and the coal-fired power plant performance standard, which are included in this analysis, as well as a series of more detailed and specific energy efficiency standards and programs that it was not possible to model due to their narrow application. The more detailed provisions are listed below:

TITLE II—ENERGY EFFICIENCY
Subtitle A—Building Energy Efficiency Programs
Sec. 201. Greater energy efficiency in building codes.
Sec. 202. Building retrofit program.
Sec. 203. Energy efficient manufactured homes.
Sec. 204. Building energy performance labeling program.

Subtitle B—Lighting and Appliance Energy Efficiency Programs
Sec. 211. Lighting efficiency standards.
Sec. 212. Other appliance efficiency standards.
Sec. 213. Appliance efficiency determinations and procedures.
Sec. 214. Best-in-Class Appliances Deployment Program.

Subtitle C—Transportation Efficiency
Sec. 221. Emissions standards.

PART B—MOBILE SOURCES
Sec. 821. Greenhouse gas emission standards for mobile sources.
Sec. 222. Greenhouse gas emissions reductions through transportation efficiency.

PART D—PLANNING REQUIREMENTS
Sec. 841. Greenhouse gas emissions reductions through transportation efficiency.
Sec. 223. SmartWay transportation efficiency program.
Sec. 822. SmartWay transportation efficiency program.
Sec. 224. State vehicle fleets.

Subtitle D—Industrial Energy Efficiency Programs
Sec. 241. Industrial plant energy efficiency standards.
Sec. 242. Electric and thermal waste energy recovery award program.
Sec. 243. Clarifying election of waste heat recovery financial incentives

The rationale of cap-and-trade is that it allows the market to select the lowest cost means, whatever they may be, for reaching a given GHG reduction target. By superimposing regulatory mandates on that system, Congress substitutes its own judgment for that of the market.

The provisions that were modeled, in particular the RES, appear to be binding only in a few years (*i.e.*, the cap might, by itself, motivate all of the actions needed to meet the standard). In these instances, the standards would have no effect on emissions. They would waste resources on needless monitoring, measuring, enforcement and compliance, but they would not affect the pattern of GHG reductions.

When efficiency or other standards are binding, they would affect the allocation of abatement resources. They would compel industry to buy more renewable energy, say, or to invest more in CCS than it would otherwise do to comply with the total GHG cap. However, while the pattern of emission reductions would change, the total amount reduced would not. The cap sets the total GHG cutback. If the regulations mandate more change in one area, less will take place somewhere else. Standards, therefore, can add costs but they will not add to the program's environmental benefits. They can only substitute more costly GHG cuts for those that could have been made at lower cost.

For the detailed standards mandated in Title II, it is impossible to tell by examining aggregate levels of energy efficiency whether or not the standards are binding. Even if the cap-and-trade program would be sufficient on its own to lead to similar or larger reductions in energy use in the specified sectors, the standards are very likely to mandate a different set of changes in energy use than consumers and businesses would choose on their own. This can only increase costs of complying with the overall cap, unless businesses and consumers are consistently making wrong decisions and the government agencies put in charge of the regulations can consistently make better decisions by substituting their regulatory authority for the decisions of those who know their own situations and alternatives.

These added costs are beyond what can be addressed in CRA's models -- or EPA's models used to produce their analysis of the draft Waxman-Markey bill -- at this point. But that implies that any bill including a significant number of detailed efficiency standards will have a cost greater than these modeling systems estimate.

3.3.4. Wealth transfers abroad

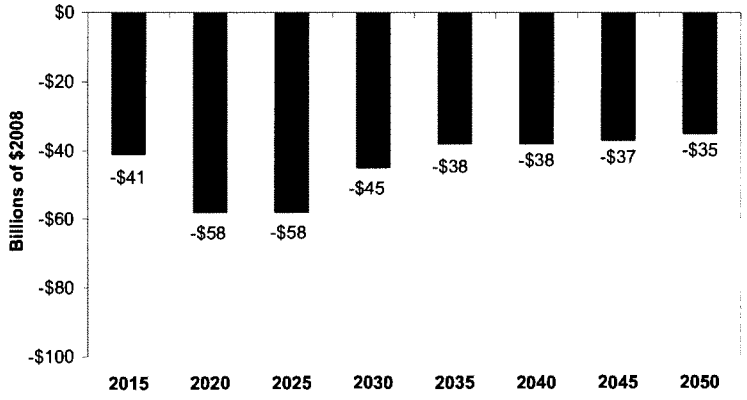
ACESA contains several provisions that entail wealth transfers from the U.S. to other nations. For example, it would sell "strategic reserve allowances" to covered entities, and use the revenues to purchase international offset credits issued for reduced deforestation. The strategic reserve will comprise 1% of each year's total allowance pool from 2012 through 2019, 2% of each year's total allowance pool from 2020 through 2029, and 3% of each year's total allowance pool from 2030 through 2050.

The bill mandates minimum auction prices for the strategic reserve allowances. In 2012 the minimum strategic reserve auction price will be double the EPA-modeled allowance price for that year. Minimum strategic reserve auction prices in 2013 and 2014 will rise by the rate of inflation plus 5%. For 2015 and thereafter, the minimum strategic reserve auction price will be 60% above the rolling 36-month average of the daily closing price for that year's allowances, calculated in constant dollars. EPA is to issue regulations governing both strategic reserve credits and private sector purchases of offsets.

The largest wealth transfers from the U.S. to other countries will be associated with purchases of international offsets. In effect, avoided deforestation becomes another U.S. import in an economy that has been struggling with a chronic structural trade deficit. As such, foreign offsets would be an added drag on U.S. terms of trade with the rest of the world. The

transfers that they entail lower the prices that U.S. exporters can obtain and raise the prices that Americans must pay for imports. The result is a further decline in U.S. standard of living that is reflected in the results reported in this study. The annual wealth transfer is shown in Figure 3.19.

Figure 3.19: Wealth transfer overseas from purchases of international offsets and internationally-allocated allowances under ACESA



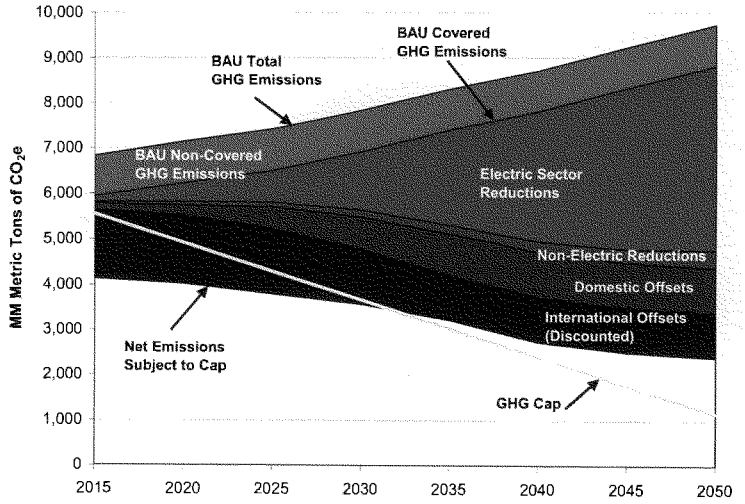
Source: CRA Model Results, 2009

While it is true that international offsets increase the potential supply of allowances and, hence, hold down allowance prices, the wealth transfer is a net loss to the U.S. Further, the bill's effective discounting of offsets, and the artificially high prices imposed on the strategic reserve allowance auction will rob offsets of much of their potential to control costs.

It is also possible that the U.S. will find it difficult to obtain the volume of offsets that this study estimates would be economic to purchase if their prices were reflective of only the cost of the associated emissions reduction projects in other countries. Based on experience in oil and mineral leasing, those countries that could sell permits are likely to want a substantial margin above cost to agree to supply offsets. That would increase the magnitude of wealth transfers, as well as the cost of meeting the domestic policy's requirements. One of the serious limits on production of oil resources worldwide is that in addition to insisting on a very large share of the economic rents from oil production, host countries are frequently politically unstable with unreliable legal systems, making long-term contracts difficult to rely on. Exactly the same conditions can be expected to prevail in many countries that could provide offset credits.

ACESA is so generous in its ceilings on international allowances that a significant amount of the required reduction will come from that source. Figure 3.20 shows the distribution of emission reductions between the electric sector, transportation, other energy use, domestic offsets and international offsets. International offsets provide 83% of the realized reduction in 2015, 36% in 2030 and 16% by 2050.

Figure 3.20: GHG emission reductions



Source: CRA Model Results, 2009

The large quantity of international offsets is at variance with the very strong sentiment in international negotiations – and reiterated in the most recent meetings of the ad hoc working group on long term cooperation – that developed countries should achieve most of their emission reductions through domestic measures. Combined with the observed wealth transfers and desire of host countries to maximize their take, the prospect of tightening the limits on international offsets seems plausible.

EPA regulation casts another cloud over offsets as a means of keeping policy costs down. Under ACESA, EPA would have a great deal of discretion to limit the effective supply of allowances. The effectiveness of measures to prevent deforestation and forest degradation are notoriously difficult to measure, and EPA may be very reluctant to (and face much external pressure not to) approve a very large share of the potential supply of these types of offsets that are assumed to be fully available in EPA's and our cost analyses.

Institutions greatly compound the scientific difficulties. In many developing countries, large disparities can exist between statute books and *de facto* practice. These disparities can cause gaps in the system of property rights. Thus, the ownership of forest land, let alone that of any value in the carbon content of standing trees, is often unclear.[14] There are often strong economic temptations to over-exploit resources that fall within lacunae in the system of property rights. Since governments can find it costly to define property rights and to enforce those that it has created, the task of curtailing this resource over-use is intractable.[15] In such cases laws intended to establish clear property rights and curb forest decline may have little real world effect. It would, then, not be surprising for EPA to adopt a highly skeptical attitude toward claims of avoided deforestation emissions. That stance, however, could well make forestry offsets very scarce despite the large potential for emission reduction that exists in principle. If this happens, estimated costs of ACESA would be greatly increased.

[14] Cotula, L. and Mayers, J., *Tenure in REDD – Start-point or afterthought?*, Natural Resource Issues No. 15. International Institute for Environment and Development, London, UK, 2009.

[15] Libecap, Gary D., "Contracting for Property Rights" in *Property Rights: Cooperation, Conflict and Law*, Terry L. Anderson and Fred S. McChesney editors, Princeton University Press, Princeton, 2003.

4. UNFINISHED BUSINESS

The results presented in this report represent our initial estimate of the economic impact resulting from ACESA. It represents our best efforts to model the provisions of the proposed legislation with the information and time available to us. At the time that we performed this analysis, information on the particulars of the proposed legislation was still evolving. Provisions of the bill are still being negotiated. When the bill becomes more definitive, we will review its final provisions and may revise this analysis.

In addition, there are a number of issues related to ACESA that are not included in this report due to time limitations, but which we hope to address in a follow-on report:

- We will extend the regional results by providing estimates of key state-level impacts.
- In a future report, we intend to analyze in more detail the uncertainty about carbon prices and costs that is inherent in any policy that sets rigid caps on emissions that must be met over a relatively short measurement period, and discuss the likely volatility of GHG allowance prices given the normal fluctuations in economic activity and energy supply.
- We also intend to estimate impacts by income group of the cap-and-trade program under different allocation systems and approaches to recycling auction or carbon tax revenues. We will also look at how these impacts vary by regions and the reasons for the variation.

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APPENDIX A: REPRESENTATION OF ACESA IN MRN-NEEM

This analysis measures the effects of certain provisions in the ACESA bill released by Reps. Waxman and Markey.[16] ACESA contains several provisions aimed at reducing emissions of greenhouse gases. This appendix describes the provisions of ACESA that we have modeled in this study.

ACESA includes several provisions aimed at reducing emissions of greenhouse gases. Some of these provisions are relatively well defined, while others only specify future regulations to be determined at a later date. This initial report focuses on two of the most important provisions of the proposed bill, including:

- Economy-wide cap-and-trade for greenhouse gases (GHGs) and
- Federal renewable electricity standard (RES).

A.1 A Cap-And-Trade Policy for Greenhouse Gases

Title III of the proposed ACESA calls for imposition of an economy-wide cap-and-trade policy for GHGs. A cap-and-trade policy sets a total limit on emissions of GHGs. To legally emit GHGs that are subject to such a cap, a source must submit to the government a permit for each ton that it emits. In any given year, the government auctions or allocates only the number of greenhouse gas emission permits that equals the target set by the cap. Once the government has auctioned or allocated the emission permits, the permits can be freely traded among entities.

In the case of ACESA, the GHG cap would initially apply in 2012. At its onset, it would limit emissions to 3% below the level that had prevailed in 2005. By 2020, the cap on emissions would fall to 17% below the 2005 level, and by 2050, the cap on emissions would fall to 83% below the 2005 level. ACESA's cap-and-trade provisions include offsets and allow permits to be banked from one year to the next. The offsets provisions allow a quantity of offsets to be used to meet each emitter's compliance obligation. This annual offset limit is 2 billion tons, split evenly between domestic offsets and international offsets. There is a discounting of international offsets defined in the bill such that the purchase of 5 tons of offsets is allowed to meet 4 tons of compliance obligations (the discounting does not apply before 2018 and does not apply to domestic offsets). Therefore, nationally there would need to be purchases of 2.25 billion tons of offsets to achieve 2 billion tons of reductions from offsets.

[16] The version of the bill analyzed within this report is one that was released on May 15, 2009.

CRA has included these detailed offsets provisions in our analysis of ACESA. The analysis also includes unlimited banking of allowances.

Table A-1 includes the annual caps specified in the bill.

Table A-1: GHG cap (MM metric tons of CO_2)*

Year	Cap	Year	Cap	Year	Cap
2012	4,627	**2025**	4,294	**2038**	2,534
2013	4,544	**2026**	4,142	**2039**	2,409
2014	5,099	**2027**	3,990	**2040**	2,284
2015	5,003	**2028**	3,837	**2041**	2,159
2016	5,482	**2029**	3,685	**2042**	2,034
2017	5,375	**2030**	3,533	**2043**	1,910
2018	5,269	**2031**	3,408	**2044**	1,785
2019	5,162	**2032**	3,283	**2045**	1,660
2020	5,056	**2033**	3,158	**2046**	1,535
2021	5,903	**2034**	3,033	**2047**	1,410
2022	4,751	**2035**	2,908	**2048**	1,285
2023	4,599	**2036**	2,784	**2049**	1,160
2024	4,446	**2037**	2,659	**2050**	1,035

* CRA's MRN-NEEM models every five years and the first year in which the cap is in place in the model is 2015. In 2015, local distribution companies' emissions associated with natural gas are not covered, but coverage of these emissions begins in 2016. For simplicity, CRA has assumed that these emissions are covered in 2015. To account for this change in coverage we also increased the cap in 2015 to 5,589 MM metric tons, which was derived as the 2016 cap plus the change in the 2016 and 2017 caps.

A.2 Federal Renewable Electricity Standard

Title I of ACESA includes the establishment of a combined Federal RES and energy efficiency standard. The combined standard requires retail electricity suppliers to meet a certain percentage of their customer load with electricity generated from qualified renewables resources or from electricity savings gained through energy efficiency programs. This percentage increases from 6.0% in 2012 to 20.0% in 2020 through 2039, when the program ends.

The percentage requirement is applied to a base amount that is total sales less sales from non-qualified hydroelectric power and municipal solid waste. Also, smaller retail electricity suppliers (less than 4 million MWh) are not required to comply. The types of renewable resources that are eligible to meet the requirements include: wind energy, solar energy, geothermal energy, biomass/landfill gas, qualified hydropower, and marine/hydrokinetic

renewable energy. In addition, as new nuclear units and units with CCS are built their generation is also subtracted from the base amount.

In addition to the RES requirements, ACESA specifies an ACP whereby suppliers can purchase an ACP in lieu of holding a renewable energy credit. The price of the ACP is $25/MWh (in 2009$) growing with inflation. In addition, up to 25% of the requirement (*e.g.*, 5% of the 20% in 2020) can be met with energy efficiency savings. Table A-2 includes the annual percentage requirements that are applied to the base amount.

Table A-2: Federal renewable electricity standard

Year	% Requirement
2012-2013	6.0%
2014-2015[17]	9.5%
2016-2017	13.0%
2018-2019	16.5%
2020-2039	20.0%

A.3 Allowance Allocation Methodologies

ACESA specifies allowance allocations to certain sectors and groups to help in mitigating the cost increases they are likely to incur, while also assisting these industries in making a transition to a lower-carbon economy.

The electric sector is slated to receive 35% of the allowances through 2025, with the allowance allocation declining to 0% by 2030. This allocation is given to merchant coal-fired generators (5%) and local distribution companies (LDC). The allocation to local distribution companies is based on both sales and historical emissions. The LDC allocation cannot be used to reduce rates based on quantity of electricity consumed, but is intended to be used to rebate consumers based on some fixed portion of bills.

The other sectors that receive allocations are: energy-intensive industries, natural gas distributors, the automotive sector and oil refiners. All of these allocations decline to zero by 2030.

Allowances are also allocated to spur investments in CCS. In our analysis, these allowances help to bring about 3 GW of new CCS in 2020 and assist in the capital cost declines over time.

[17] In 2015, CRA modeled a 8.5% requirement, which was the requirement in the earlier March 31, 2009 draft of the bill, rather than a 9.5% requirement. The 8.5% requirement was not binding and it is unclear if increasing the requirement to 9.5% would result in a binding limit.

ACESA also specifies that some allowances are to be used to prevent tropical deforestation and assist in international adaptation. We have assumed that the value of these allowances would accrue to countries other than the United States, and therefore these dollars are wealth transfers from the United States.

Remaining allowances are allocated to a number of other areas including renewable energy and efficiency, research and development, low- and moderate income households, users of home heating oil, domestic adaptation, and worker assistance and job training. Also, any remaining allowances are used to ensure that ACESA is budget neutral. All of these allowances are grouped in Table A-3 as "Auction."

Table A-3: ACESA allowance allocations

	2015	2020	2025	2030	2035	2040	2045	2050
Total Electricity	35%	35%	35%	0%	0%	0%	0%	0%
Natural Gas	9%	9%	9%	0%	0%	0%	0%	0%
EIS Sector	15%	15%	15%	0%	0%	0%	0%	0%
Automotive Sector	3%	1%	1%	0%	0%	0%	0%	0%
Oil Refiners	2%	2%	2%	0%	0%	0%	0%	0%
CCS Investment	2%	5%	5%	5%	5%	5%	5%	5%
Preventing Tropical Deforestation	5%	5%	5%	3%	2%	2%	2%	2%
International Adaptation	1%	1%	2%	4%	4%	4%	4%	4%
Clean Technology Transfer	1%	1%	2%	4%	4%	4%	4%	4%
Auction	27%	26%	24%	84%	85%	85%	85%	85%
Total	100%	100%	100%	100%	100%	100%	100%	100%

APPENDIX B: BASELINE ASSUMPTIONS

The effects of the provisions that we have modeled are presented relative to a base case without any of these provisions. The base case is built upon many of the projections of the 2009 *Annual Energy Outlook* (AEO) Early Release produced by the Energy Information Administration (EIA) of the U.S. Department of Energy.[18] Several of the key baseline assumptions are described in this Appendix.

B.1 Cost and Performance Characteristics

The first-year technology capital cost assumptions (*i.e.*, the year in which a technology is first available) were based mainly on costs provided in EIA's AEO 2009 Electricity Market Module. In general, we found that EIA's capital costs assumptions for AEO 2009 fairly represented the capital costs being quoted in the trade press and in public filings. The exceptions were nuclear and geothermal. For nuclear, we relied upon capital cost data extracted from public filings that showed costs to be approximately 16% higher than EIA's estimates. For geothermal, we extracted data from Table 4.17 of EPA's NEEDS 2006 data source documentation, which provides capital cost by region and by potential capacity as opposed to the point estimate provided in EIA's Electricity Market Module. All capital costs include adders for fuel delivery infrastructure, transmission interconnection, and owners costs.[19]

For future capital costs, we trended costs downward to the AEO 2009 capital cost twenty years after the first-year. We then kept the technology's capital costs flat in subsequent years. For example, the first-year that Combined Cycle with CCS is available in MRN-NEEM is 2020. In 2040 and thereafter, the Combined Cycle with CCS capital costs are based upon the 2030 capital costs in AEO 2009 plus the adders described above (see Table B-1).

[18] Energy Information Administration, *Annual Energy Outlook 2009, Early Release with Projections to 2030*, prepared by U.S. Department of Energy, Energy Information Administration, December 2008.

[19] Owner's costs includes, but is not limited to land acquisition and right-of-way, permits and licensing, royalty allowances, economic development, project development costs, legal fees, and owner's engineering.

Table B-1: Total overnight capital costs excluding interest during construction (2008$/kW)

Technology	2010	2015	2020	2025	2030	2035	2040	2045	2050
Super Critical Pulverized Coal	2,404	2,296	2,187	2,079	1,970	1,970	1,970	1,970	1,970
IGCC	2,742	2,593	2,443	2,293	2,144	2,144	2,144	2,144	2,144
IGCC w/ CCS	N/A	N/A	3,952	3,711	3,470	3,229	2,988	2,988	2,988
Nuclear	N/A	N/A	4,800	4,625	4,450	4,275	4,100	4,100	4,100
Combustion Turbine	845	814	784	754	693	693	693	693	693
Combined Cycle	1,151	1,094	1,037	980	867	867	867	867	867
Combined Cycle w/ CCS	N/A	N/A	2,167	2,022	1,878	1,733	1,588	1,588	1,588
Biomass	4,265	3,988	3,711	3,435	2,881	2,881	2,881	2,881	2,881
Landfill Gas	3,082	2,948	2,813	2,678	2,408	2,408	2,408	2,408	2,408
Wind Cost Class 1-3	2,457	2,399	2,341	2,283	2,167	2,167	2,167	2,167	2,167
Wind Cost Class 4	3,932	3,839	3,746	3,653	3,467	3,467	3,467	3,467	3,467
Wind Offshore		4,590	4,339	4,087	3,836	3,585	3,585	3,585	3,585
Geothermal	Ranges from $3,155/kW to $8,783/kW depending on location								
Photovoltaic	6,228	5,706	5,184	4,663	4,141	4,141	4,141	4,141	4,141
Solar Thermal	6,034	5,732	5,430	5,129	4,827	4,827	4,827	4,827	4,827

Variable operating and maintenance (VOM) costs, fixed operating and maintenance (FOM) costs, and plant net heat rates on a higher heating value (HHV) basis are based mainly upon the AEO 2009 Early Release. FOM includes 'going-forward' costs that are required to maintain plant performance. For nuclear, we include levelized cost adders in the FOM for in-core carrying charges and for the spent nuclear fuel removal fee. The geothermal FOM is based on data from EPA NEEDS 2006. See Table B-2 which shows VOM, FOM, and heat rate assumptions by technology.

Table B-2: Operating and maintenance costs and plant efficiency

Technology	VOM (2008$/MWh)	FOM (2008$/kW-y)	Heat Rate – HHV (Btu/kWh)
Super Critical Pulverized Coal	4.4	41.8	9,200
IGCC	2.8	52.5	8,765
IGCC w/ CCS	4.3	62.0	10,781
Nuclear	0.5	111.8	10,434
Combustion Turbine	3.0	16.3	10,810
Combined Cycle	2.0	18.1	7,000
Combined Cycle w/ CCS	3.1	27.1	8,613
Biomass	7.1	83.3	13,000 (2010) 9,646 (2030)
Landfill Gas	0.0	109.6	13,648
Wind Cost Class 1-3	0.0	29.1	0
Wind Cost Class 4	0.0	29.1	0
Wind Offshore	0.0	94.3	0
Geothermal	0.0	134.3 – 292.1	0
Photovoltaic	0.0	11.2	0
Solar Thermal	0.0	54.5	0

B.2 Limits on Cumulative Capacity Additions

The cumulative capacity constraints in MRN-NEEM are based on a variety of public resources and CRA's own estimates and are shown in the table below. These limits serve as a ceiling on how much can be built over time as a matter of reasonableness. However, MRN-NEEM decides whether to build up to these limits, and may project much lower builds than these maxima.

Table B-3: Limits on U.S. cumulative capacity additions (GW)

Technology[20]	2010	2015	2020	2025	2030	2035	2040	2045	2050
SCPC and IGCC	12	30	90	150	210	270	330	390	450
Coal/gas with CCS	0	3	10	30	60	90	120	150	180
Nuclear	0	0	2	17	46	86	126	166	206
Offshore Wind	0	6	34	62	90	90	90	90	90
Total Wind	17	70	124	177	231	231	231	231	231
Biomass	6	33	60	87	113	113	113	113	113
Landfill Gas	0.3	2	3	4	5	5	5	5	5
Geothermal	1	3	6	10	15	15	15	15	15
Solar Thermal	No cumulative limits, but there are total capacity limits by region								
Photovoltaic	No cumulative limits, but there are total capacity limits by region								

[20] Sources of these capacity penetration rates are as follows: SCPC/IGCC (CRA), Coal/Gas with CCS (CRA and EPA analysis of Waxman-Markey), Nuclear (EPA analysis of Waxman-Markey), Offshore Wind (National Renewable Energy Lab), Total Wind (NREL, EIA, NYISO), Biomass (NREL, EIA), Landfill Gas (EPA NEEDS 2006), Geothermal (CRA), Solar Thermal (EPA NEEDS 2006), and Photovoltaic (CRA).

B.3 Other Major Input Assumptions

We calibrated our model baseline to closely match the outputs of EIA's *AEO 2009 Early Release*. The following table provides the major baseline indicators to which we calibrate:

Table B-4: Other major input assumptions

Indicator	Units	2010	2015	2020	2025	2030	2035	2040	2045	2050
Growth Rates										
GDP	%	2.0%	3.1%	2.5%	2.5%	2.7%	2.6%	2.6%	2.6%	2.6%
Electricity Demand	%	1.70%	0.88%	1.00%	1.00%	1.05%	1.02%	1.02%	1.02%	1.02%
Consumption										
Crude	Quads	34.6	33.8	32.1	31.9	33.0	33.9	34.8	36.4	36.9
Gas (Non-Electric Sector)	Quads	16.6	17.3	17.8	18.3	18.7	19.0	19.3	19.7	20.0
Oil	Quads	37.2	37.7	37.0	36.9	38.2	39.5	40.8	41.7	42.8
Transport Fuels	Quads	29.8	30.5	31.2	31.9	33.6	34.8	36.0	36.9	38.1
Driving Statistics										
VMT from Light Duty Vehicles (LDVs)	billions of miles	2,752	2,887	3,165	3,489	3,807	4,049	4,263	4,467	4,693
MPG of LDV Stock	MPG	20.3	21.9	25.0	29.0	32.2	33.4	34.1	35.1	36.5
Fuel Prices										
Natural Gas (Henry Hub)	2008$/MMBtu	$6.68	$7.06	$7.62	$8.25	$9.48	$9.98	$10.52	$11.08	$11.67
Natural Gas (Wellhead)	2008$/MMBtu	$5.90	$6.24	$6.73	$7.29	$8.37	$8.82	$9.29	$9.78	$10.30
Low Sulfur Crude	2008$/MMBtu	$13.41	$18.91	$19.89	$20.89	$22.44	$25.52	$29.03	$33.02	$37.56
Nuclear Fuel	2008$/MMBtu	$0.74	$0.74	$0.78	$0.81	$0.79	$0.79	$0.79	$0.79	$0.79
Biomass	2008$/MMBtu	$6.29	$6.29	$6.29	$6.29	$6.29	$6.29	$6.29	$6.29	$6.29
Coal	2008$/MMBtu	Computed endogenously in the model								

APPENDIX C: COMPARISON OF CRA RESULTS TO OTHER ANALYSES

At the time of this analysis there has been one other publicly-released, relevant analysis to which we can compare our results. EPA released an analysis of the cap-and-trade provisions of the draft Waxman-Markey bill.[21] EPA's study is based on the March 31, 2009 draft of the bill, which contains some slightly different provisions.

EPA's core analysis of the draft Waxman-Markey bill resulted in CO_2 allowance prices in 2015 of between $13 and $17 per metric ton of CO_2 (in 2005$). The high end of EPA's range of CO_2 allowance prices is only slightly below the CO_2 allowance prices in this study, based on the reference case assumptions.

This similarity in prices, however, is somewhat misleading. The provisions that EPA modeled within the cap-and-trade portion of the bill contain some important differences from the provisions modeled in this analysis. In particular, there are three key differences:

1. EPA's analysis did not include the RES provisions, which could lower their modeled allowance prices slightly.

2. The cap modeled by EPA is slightly tighter than that modeled in this study. H.R.2454 increased the cap in 2020 such that the cap is a 17% reduction from 2005 levels. This also changed the cap from 2012 through 2029. The cumulative cap from 2012 through 2050 in H.R.2454 is almost 2% higher than that in the draft Waxman-Markey bill that EPA modeled.

3. H.R.2454 includes a provision that allows for up to 1.5 billion metric tons of offsets from international sources, if domestic offsets are not fully utilized (up to 1 billion tons). In this analysis, this provision led to an increase in international offsets of 500 million metric tons in 2015 and 2020, 440 million metric tons in 2025 and 220 million metric tons in 2030. The availability of these international offsets effectively loosened the cap by almost 10% over the period from 2015 through 2030. This likely put significant downward pressure on the CO_2 prices in this analysis.

If EPA were to have modeled these three provisions as they are in H.R.2454, each would likely result in lower CO_2 allowance prices, and we would see a greater divergence between their CO_2 allowance prices and those included in this study. Therefore, it is important to understand the sources of the differences.

[21] EPA's study is available at: http://www.epa.gov/climatechange/economics/economicanalyses.html#wax.

On May 17, 2009, EPA released a qualitative assessment of the revisions to ACESA, relative to what they modeled. Their conclusion is, "On balance, compared to the draft bill, H.R. 2454 would likely result in lower allowance prices, a smaller impact on energy bills, and a smaller impact on household consumption, based on EPA's preliminary reading of the bill."[22] EPA focused on four areas that had changed to support their conclusion. The four areas of change are: 1) Cap level, 2) Offsets provisions, 3) Allowance allocations for protection from electricity price increases, and 4) Incentives for CCS. EPA did not list the RES provisions, which it did not model from the draft bill.

With respect to item 3, we believe that EPA has mischaracterized the provisions on the allowance allocations to electric local distribution companies. The specific provisions on the use of the allowances do not allow the use of the allowances for rebates based "solely on the quantity of electricity delivered to such ratepayer."[23] Since the rebate is not to be based on electricity use it should not distort the incentive for consumers to conserve electricity.

Both EPA's analysis and this analysis show significant reductions in the electric sector, limited reductions in the non-electric sectors and significant uptake of offsets (including the full utilization of international offsets in all years). CRA's analysis utilizes more domestic offsets than EPA.

A detailed review of EPA's results reveals the primary source of the difference leading to EPA's low CO_2 allowance prices. EPA's analysis was performed with two different economy-wide models – ADAGE and IGEM. EPA did sensitivity analysis using results from the ADAGE model so we will focus on that model. The ADAGE model is a similar model to CRA's older MRN model in that both are computable general equilibrium (CGE) models. ADAGE lacks a detailed technology representation of the electric sector. MRN suffered from the same problem and this weakness led CRA to develop the MRN-NEEM model which pairs the CGE framework for the non-electric sectors (MRN) with a detailed electric sector model (NEEM).

Without a detailed technology representation for the electric sector CGE models forecast too great of an ease of making reductions from the sector. This is demonstrated by EPA's own modeling. To validate its modeling of the electric sector, EPA took the CO_2 allowance prices and percentage changes in electricity demand and ran its detailed electric sector model, IPM.[24] EPA's analysis using the detailed technology representation (IPM) yields significantly

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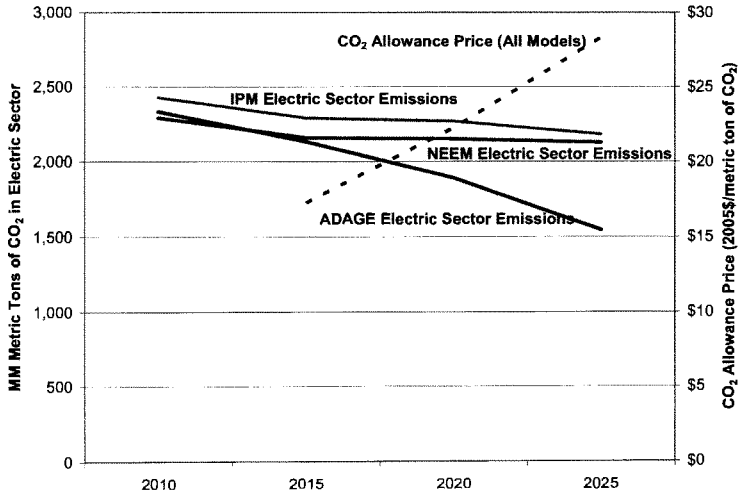
[22] "Ways in Which Revisions to the American Clean Energy and Security Act Change the Projected Economic Impacts of the Bill," U.S. EPA, May 17, 2009, available at: http://www.epa.gov/climatechange/economics/pdfs/EPAMemoonHR2454.pdf.

[23] H.R.2454, p. 559.

[24] See slides 19-25 in *EPA Preliminary Analysis of the Waxman-Markey Discussion Draft*, for a detailed discussion of EPA's approach.

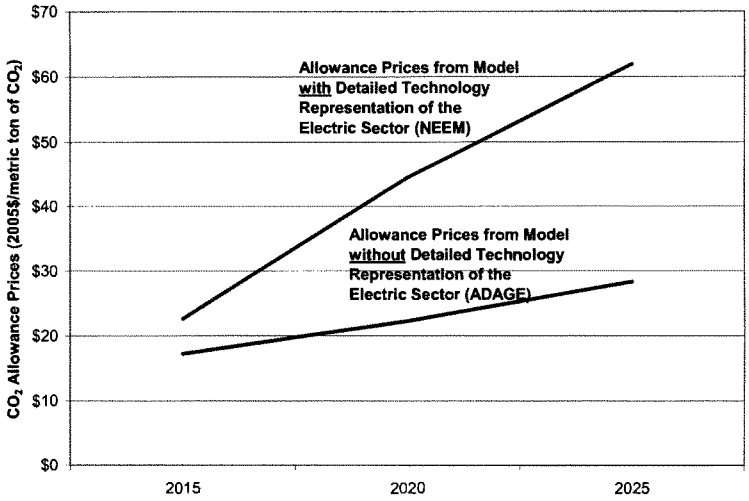
fewer CO_2 reductions from the electric sector as compared with a model without a detailed technology representation (ADAGE), at given CO_2 price levels. CRA used its NEEM model to do the same test that EPA did using IPM. We took the same CO_2 allowance prices and the percentage changes in electricity demand that EPA used in IPM. Our results were similar to those from EPA's analysis using IPM, as seen in Figure C.1. (Note that EPA's analysis using IPM only continued through 2025.)

Figure C.1: Comparison of electric sector emissions – ADAGE, IPM and NEEM



To evaluate just how much the ADAGE model might be overstating the ease with which electric sector reductions could be achieved, we used the resulting electric sector emissions from EPA's ADAGE analysis of the draft Waxman-Markey bill and implemented them as an electric sector cap in the NEEM model. Given the electric sector caps, NEEM then produced the marginal costs of abatement in the electric sector to achieve the level of electric sector emissions from ADAGE.

Figure C.2: Comparison of CO_2 allowance prices – ADAGE and NEEM



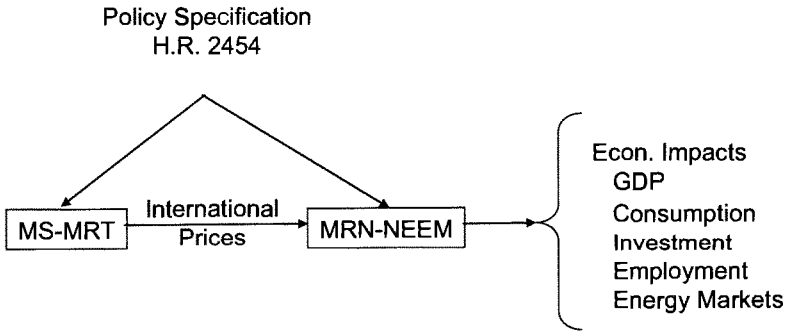
As seen in Figure C.2, the cost of achieving the electric sector emissions projected using ADAGE is significantly higher when evaluated with a model that contains a detailed technology representation of the electric sector. Thus, if EPA had coordinated its IPM and ADAGE models to produce consistent electric sector results, we would expect that EPA would have found significantly higher CO_2 prices for ACESA than they are currently reporting. Given that EPA says the IPM model is more "realistic" for the near-term, one can conclude that its ADAGE-based impact estimates are "not realistic" until they are made consistent with their IPM model projections.

APPENDIX D: MODEL DESCRIPTION

D.1 MODEL FRAMEWORK

In conducting this analysis for the National Black Chamber of Commerce, CRA combined three of its widely accepted state-of-the-art economic models: the Multi-Sector, Multi-Region Trade (MS-MRT) model, the Multi-Region National (MRN) model, and the North American Electricity and Environment Model (NEEM). The linked model approach accounts for the international feedback effects of the U.S. adopting ACESA. As Figure D.1 illustrates, MS-MRT is used to compute the effect on international prices from the U.S.'s adoption of ACESA. These prices are fed into the MRN-NEEM modeling system, which has a much more detailed representation of the U.S. economy and hence allows for more detailed analysis of the effects of ACESA.

Figure D.1: Linkage between MS-MRT and the MRN-NEEM modeling framework



This section briefly describes the three models: MS-MRT, MRN, and NEEM. It also provides more information on how the models are linked.

Overview of the MS-MRT sub-model

MS-MRT represents the entire world at an extremely aggregated level. It is built upon the GTAP6-IEA database,[25] which includes 83 countries/regions and 23 industries. For this project, we aggregated the dataset into the following regions: USA, Europe, Other OECD, Eastern Europe and Former Soviet Union, Middle East, China and India, high income East Asia, and the rest of the world. To be consistent with the MRN model, the dataset included the following sectors: coal, crude oil, electricity, natural gas, refined petroleum products, agriculture, energy-intensive sectors, manufacturing, services, and commercial transportation.

The model is fully dynamic, which means the agents in the model have perfect foresight and therefore perfectly anticipate all future policies. In other words, there are no surprises in the model, and saving and investment decisions are based on full inter-temporal optimization. MS-MRT belongs to the class of models referred to as general equilibrium.

Conceptually, as a fully dynamic general equilibrium model, the MS-MRT model computes a global equilibrium in which supply and demand are equated simultaneously in all markets for all time periods. There is a representative agent in each region, and goods are indexed by region and time. The incorporated budget constraint implies that there can be no change in any region's net foreign indebtedness over the time horizon of the model. Changes in the prices of internationally traded goods produce changes in the real terms of trade between regions. All markets clear simultaneously, so that agents correctly anticipate all future changes in terms of trade and take them into account in making saving and investment decisions. The model computes, among other variables, investment, industry output, changes in household welfare, gross domestic product, terms of trade, wage impacts, and commodity price changes.

In order to capture some of the short-run costs of adjustment, elasticities of substitution between different fuels and between energy and other goods vary with time. The model is benchmarked to assume baseline rates of economic growth based on official government statistics and a common rate of return on capital in all countries. The rate of growth in the effective labor force (population growth plus factor-augmenting technical progress) and the consumption discount rate are calibrated to be consistent both with the assumed rates of growth and return on capital, and with zero capital flows between regions on the balanced growth path.

ACESA was analyzed under the assumption that the U.S. economy would evolve in accordance with the Energy Information Agency's *Annual Energy Outlook 2009*'s reference case. These forecasts provide the baseline growth rate, energy consumption, energy

[25] Dimaranan, Betina V., "The GTAP 6 Data Base: (Global Trade, Assistance, and Production)." Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University, December 2006.

production, and energy prices to which the model is benchmarked. The macro economic sub-model MS-MRT is benchmarked to the same economic forecast used in the MRN sub-model to maintain consistency between the models.

MS-MRT includes the markets for three fossil fuels and their products. Electricity and all other non-energy sectors (*e.g.*, agriculture) are produced using these fuels, capital, labor, electricity, and materials as inputs. The model allows for complete bilateral trade in all goods produced by all industries.[26] The MS-MRT model uses an Armington structure in its representation of international trade in all goods except crude oil, which is treated as a homogeneous good perfectly substitutable across regions. The Armington structure assumes that domestically produced goods and imports from every other region are differentiated products. Domestic goods and imports are combined into Armington aggregates, which then function as inputs into production or consumption.

Because crude oil is treated as a homogeneous good, it trades internationally under a single world price. Conversely, representing natural gas and coal as Armington goods allows the model to approximate the effects of infrastructure requirements and high transportation costs between some regions. World supply and demand determine the world price of fossil fuels in the model. Current taxes and subsidies are included in each country's prices.

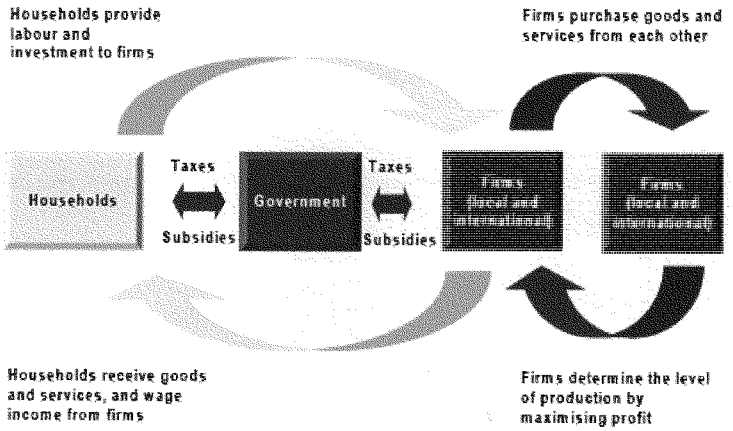
MRN-NEEM accounts for the added costs to U.S. refiners of the requirement that U.S. refineries hold allowances to cover their direct GHG emissions. This creates a competitive disadvantage relative to foreign refineries in countries not subject to emission limits. Since refined product imports are treated as Armington goods in the CRA model, that cost disadvantage does not lead to wholesale shutdown of U.S. refineries. If it were possible to obtain refined product imports meeting U.S. standards at a constant price lower than the cost of continued operation of U.S. refineries, there could be a larger switch from crude oil imports to refined product imports and further loss of jobs in the refining industry.

Overview of the MRN sub-model

The top-down component of the integrated MRN-NEEM model is tailored from CRA International's Multi-Region National (MRN) model, which is similar to MS-MRT in structure. MRN is a forward-looking, dynamic computable general equilibrium (CGE) model of the United States. It is based on the theoretical concept of an equilibrium in which macro-level outcomes (*e.g.*, consumption and investment) are driven by the decisions of self-interested consumers and producers. The basic structure of CGE models, such as MRN, is built around a circular flow of goods and payments between households, firms, and the government, as illustrated in Figure D.2.

[26] Where the data show no trade in a particular good occurs between two regions, such as electricity between Europe and the U.S., the model ensures that no trade can occur in the future.

Figure D.2: Circular flow of goods and services and payment figure



Overview of the NEEM sub-model

The North American Electricity and Environment Model (NEEM) fills the need for a flexible, bottom-up partial equilibrium model of the North American electricity market that can simultaneously model both system expansion and environmental compliance over a 50-year time frame.

The model employs detailed unit-level information on all of the generating units in the United States and large portions of Canada. In general, coal units over 200 MW are represented individually in the model, and other unit types are aggregated. NEEM models the evolution of the North American power system, taking account of demand growth, available generation, environmental technologies, and environmental regulations both present and future. The North American interconnected power system is modeled as a set of regions that are connected by a network of transmission paths.

D.2 Integration Methodology

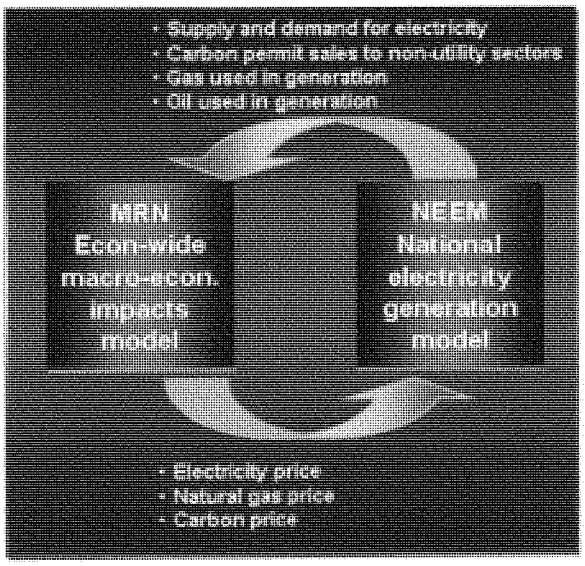
Linking MS-MRT and MRN-NEEM

There is a one-way link between the MS-MRT and MRN-NEEM models. The change in international prices from the U.S. adopting ACESA becomes an input to MRN-NEEM. This model represents the U.S. and assumes perfectly elastic supply and demand curves for imports and exports. The prices for these curves are determined by MS-MRT.

Linking MRN and NEEM

The MRN-NEEM integration methodology links the top-down and bottom-up models. The linking method utilizes an iterative process where the MRN and NEEM models are solved in succession, reconciling the equilibrium prices and quantities between the two. The solution procedure, in general, involves an iterative solution of the top-down general equilibrium model given the net supplies from the bottom-up energy sector sub-model followed by the solution of the energy sector model based on a locally calibrated set of linear demand functions for the energy sector outputs. The two models are solved independently using different solution techniques but linked through iterative solution points (see Figure D.3).

Figure D.3: MRN-NEEM iterative process



A more complete documentation of the MRN-NEEM model is available on CRA's website.[27]

[27] http://www.crai.com/uploadedFiles/RELATING_MATERIALS/Publications/BC/Energy_and_Environment/files/MRN-NEEM%20Integrated%20Model%20for%20Analysis%20of%20US%20Greenhouse%20Gas%20Policies.pdf.

APPENDIX E: ESTIMATION OF GREEN JOBS IN MRN-NEEM RESULTS

This appendix summarizes the methods CRA has developed to estimate the number of "green jobs" implicit in the MRN-NEEM results. These estimates of green jobs are preliminary and subject to further review and refinement, as they were very recently developed as an analytical component of CRA's modeling capability. All of our estimates of green jobs created are still consistent with the estimated net job losses that we have reported for the economy as a whole.

Estimating Employment Impacts of ACESA 2009 on the Renewable Electricity Industry

The imposition of a binding cap on GHG emissions incentivizes the deployment of renewable electricity sources such as wind and solar power, leading to an increase in employment in the sectors associated with the construction and operation of those technologies. Our analysis relies upon publicly-available data to estimate the number of direct jobs that would be created from the expanded use of renewable sources for generating electricity. Our methodology estimates new jobs associated with the manufacturing, construction, installation, and operation of five different technologies: wind, photovoltaic, solar thermal, biomass, and geothermal. Using CRA's MRN-NEEM modeling system to forecast new capacity additions along with public estimates of the relationship between new capacity and employment, we are able to estimate the number of full-time employment (FTE) years created as a result of ACESA 2009 in the renewable energy industry.[28,29] We also compared our results to those produced by the Department of Energy's Job and Economic Development Impact (JEDI) models for wind and solar and obtained similar results.[30]

It should be noted that there are limitations to estimating such employment impacts. The number of jobs associated with building and operating any industrial facility will vary by project, so applying a uniform assumption to all new projects represents a "best-guess" of the impacts.

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[28] "The Work That Goes Into Renewable Energy," Renewable Energy Policy Project (2001), Virinder Singh and Jeffrey Fehrs, Washington, D.C.

[29] Daniel M. Kammen, Kamal Kapadia, and Matthias Fripp (2004) *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* RAEL Report, University of California, Berkeley.

[30] See http://www.nrel.gov/analysis/jedi/.

Estimating Employment Impacts of ACESA 2009 on the Biofuels Industry

Using MRN-NEEM results, we are able to estimate the number of jobs created as a result of ACESA 2009 in the biofuels industry. The model is capable of estimating the amount of biofuels – including corn ethanol and cellulosic ethanol – demanded annually in the U.S. in the future. We then use publicly-available sources to estimate the number of employees needed to operate a 40-million-gallon per year ethanol plant operating at 95% capacity and extrapolate to estimate overall employment impacts on a national level.[31]

The ACESA scenario predicts the same amount of biofuels being consumed in a business-as-usual scenario as in a policy scenario with a binding carbon cap. This is not surprising given the ambitious biofuels production mandate set forth Energy Independence and Security Act of 2007 (EISA 2007) and the duplicative nature of adding a carbon policy on top of pre-existing standards. EISA 2007 mandates the production of 36 billion gallons of corn and cellulosic ethanol by 2022.[32] The model results show that these mandates – even though the EIA estimates that they will not be met[33] – drive the amount of biofuels consumed and, therefore, employment levels in the industry. As a result, we have projected no change in biofuels employment as a direct result of ACESA.

Estimating Employment Impacts of ACESA 2009 on the Automobile Industry

We used an approach similar to the biofuels methodology to estimate the employment impacts of ACESA 2009 on the "green" automobile industry. We considered vehicles that run on biofuels to be included in this "green" classification. However, because very few vehicles currently run solely on biofuels, we estimated the number of "biofuel car equivalents" that would be needed to consume the biofuels produced in MRN-NEEM. To do this, we used public data to determine the average annual vehicle miles traveled (VMT) per vehicle in the U.S. and assumed that this would remain constant over time.[34] Then, by using MRN-NEEM to estimate total U.S. VMT in each year, along with modeled biofuels production estimates, we are able to estimate the number of "biofuel car equivalents" sold in a given year. This information, combined with an estimate of the average productivity of a U.S. automotive worker,[35] leads to an estimate of the number of jobs created in the "green" automobile sector.

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31 "Economic Impacts of Ethanol Production," Ethanol Across America (2006), Washington, D.C.

32 The biofuels in the baseline are calibrated to the levels in AEO 2009 Early Release.

33 *Annual Energy Outlook 2009, Early Release with Projections to 2030*, prepared by the U.S. Department of Energy, Energy Information Administration, January 2009.

34 *Annual Energy Outlook 2009, Early Release with Projections to 2030*, prepared by the U.S. Department of Energy, Energy Information Administration, January 2009.

35 "Wages and Employment of Workers in Automobile Manufacturing," U.S. Bureau of Labor Statistics, Jeffrey Holt, 2005, Washington, D.C.

Since the use of biofuels, and therefore the production of biofuel and hybrid vehicles, is driven by the production mandates in EISA 2007, we again find that the impact of ACESA on employment in the "green" automobile industry will be small relative to a business-as-usual, no-policy scenario.

Estimating Employment Impacts of ACESA 2009 from Energy Efficiency

The vast majority of the green jobs that we have estimated in our ACESA scenario are associated with increased energy efficiency-related spending. As the carbon costs force energy cuts in production, firms will react by including more non-energy inputs, which are relatively cheaper. The general equilibrium effects show that output decreases as the cost of production rises and income drops, suggesting lower employment as the end result of the policy. If we assume that output remains at the same (baseline) level, we can determine how many more jobs would be needed to work with less energy in producing the same level of output given the relative changes in prices of energy and non-energy inputs.

It should be noted that the jobs created in relation to the energy efficiency in this study refer to the increase in employment when less energy is used to produce the same level of output. We do not distinguish between the increases in employment due to the energy-efficient technical/behavior changes from the increases due to the substitution of energy with more employment of labor from a pure cost perspective.

Results

CRA has made preliminary estimates of the number of average jobs directly associated with the increased payments to labor for increased renewable electricity, more efficient automobiles, biofuels, and energy efficiency improvements in its model scenario of ACESA. The preliminary estimate ranges from 1 million in 2015 to almost 2 million by 2030. The creation of a green job does not always mean the creation of a "new" job. For example, moving an autoworker from producing a vehicle powered by conventional fuels to a vehicle powered by a hybrid engine would not constitute a "new" job. Instead, it is a job transfer to what one might call a green job. Our estimate of green job creation includes green jobs that are both "new," which are incremental to a business as usual scenario, and "transfers," which are jobs shifted from part of an industry negatively impacted by a policy to another part of the industry that is positively impacted by the policy. Our net job loss estimates above are derived from the same model run that simultaneously contains this large number of implicit employment in "green jobs."

Environment and Public Works Committee Hearing
July 16, 2009
Follow-Up Questions for Written Submission

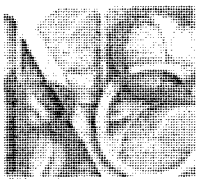
Questions for Alford

Questions from:

Senator James M. Inhofe

1. Mr. Alford, during the hearing, I asked you a question to take to your Board of Directors and respond with that question in the record. I stated that "in order to reduce costs to our manufacturing sector from the provisions of this so-called jobs bill, and other sectors, the bill authorizes an international offsets program that allows our industries covered under the cap, including the manufacturing and refinery and other energy-intensive industries, to indirectly pay for offset projects that originate in China, India or Malaysia. The question I want you to take back is, do you think that helps to create more American jobs or Chinese jobs?" Were you able to ask this to your Board of Directors, and if so what was there response?

2. Can you talk about the regressive nature of cap-and-trade legislation; specifically the Waxman-Markey bill?



National Black Chamber of Commerce
1350 Connecticut Avenue NW Suite 405, Washington DC 20036
202-466-6888 202-466-4918fax www.nationalbcc.org info@nationalbcc.org

August 12, 2009

FOLLOW UP QUESTIONS FOR WRITTEN SUBMISSION:

1. I discussed this with a majority of our Board of Directors. They find the whole matter somewhat confusing. It appears to them that the United States is going to fund work and projects that are located in China, India or Malaysia. Obviously, if this is the case it is going to help create more Chinese jobs and, in fact, suppress the possibility of jobs in America. They don't like this prospect in the least.

2. The cap and trade system proposed by the American Clean Energy and Security Act, or the Waxman-Markey bill, imposes substantial and unnecessary cost burdens on the U.S. economy – specifically through increased energy prices.

On behalf of the National Black Chamber of Commerce, the economic consulting firm of CRA International examined the impact of those costs through 2050. Their analysis reveals that the increased energy costs associated with Waxman-Markey will lower household disposable income, reduce wages and jobs, and disproportionately increase the cost of electricity, natural gas, and motor fuel nationwide.

We have all been reminded by the current recession, that it is those at the bottom of the socio-economic ladder who are hardest hit by downturns in the economy. Those making the least inevitably spend the greatest percentage of their income on energy, and have fewer resources to compete in a shrinking job market. Yet, in the midst of the worst recession since the Great Depression, the Waxman-Markey bill threatens to cripple low-income families by driving up the costs of virtually all goods and services, while simultaneously reducing wages and job opportunities.

What is worse, the cap-and-trade program established under Waxman-Markey seems to impose these unnecessary costs on small business and hard-working families, while actually benefiting special interests and the politically well-connected. It's evident from the some 85 percent of emissions permits that supporters have already given away for

free to favored industries that this bill is about enriching Wall Street while shuttering Main Street.

While the National Black Chamber applauds Congress' commitment and belief in the power of U.S. innovation, we do not find this bill to be a suitable engine for it. Congress can and must address climate change without placing the burden on the shoulders of those who can least afford to pay for it.

These findings add to a growing body of evidence that demonstrates cap-and-trade would make American consumers poorer and the products they buy more expensive. The following summary of CRA's analysis of Waxman-Markey quantifies the projected economic impacts of this regressive bill over time: (see attached sheet)

Harry C. Alford
President/CEO

Table 1-1: Summary of projected economic impacts (change from projected baseline)

	2015	2020	2030	2040	2050
CO_2 Allowance Price (2008$/metric ton)	$22	$28	$46	$74	$124
Change in U.S. jobs (Millions)	-2.3	-2.7	-2.5	-2.5	-3.0
Change to Average Worker's Annual Wages: *Assumes Partial Wage Adjustment* ($2008)	-$170	-$270	-$390	-$600	-$960
Change in U.S. Purchasing Power ($2008 per Household)	-$730	-$800	-$830	-$850	-$940
Percentage Change in U.S. GDP	-1.0%	-1.2%	-1.3 %	-1.3 %	-1.5%
Percentage Change in Natural Gas Retail Rates*	10% ($1.20/MMBtu)	14% ($1.60/MMBtu)	16% ($2.30/MMBtu)	25% ($3.70/MMBtu)	34% ($5.40/MMBtu)
Percentage Change in Motor Fuel Cost	3% (12¢/Gallon)	4% (14¢/Gallon)	5% (23¢/Gallon)	7% (37¢/Gallon)	11% (59¢/Gallon)
Percentage Change in Electricity Retail Rates*	7.3% (1.1¢/ kWh)	16% (2.0¢/ kWh)	22% (2.8¢/ kWh)	34% (4.5¢/ kWh)	45% (6.1¢/ kWh)

* Percentage increases in utility bills will be smaller to the extent there are free allowance allocations to load-serving entities and natural gas local distribution companies and/or reduced energy consumption.

Senator BOXER. Thank you. We are going to start 7-minute rounds.

I just want to say, Mr. Alford, I want to share with you the Pew Charitable Trust study from California which shows that in this terrible economy, the only, as Senator Merkley has said about Oregon, the only area of growth in jobs, the only one, has been clean energy. And Mr. Doerr knows this because he has been following a very tough time right now in our State, tough, tough, tough. And the only bright light for job creation has been that.

Also, what I want to encourage you to do, I understand that the Black Chamber of Commerce hired Charles River Associates to do their study. I would love you to see who did hire them to do the study.

Mr. ALFORD. We teamed with Charles River Associates.

Senator BOXER. OK, then you and Charles River Associates did the study. I would like to suggest that you look at the other studies, and we will make them available, because you are clearly an outlier on that. You know, we actually have not had anyone that we know challenge the fact that in the Waxman-Markey bill, the poorest households actually come away with a surplus of $40 because of the rebates in the bill.

So, we will share all of that with you in the hopes of opening up your mind to what we see, many of us here, not the minority side but the majority side, see as a major opportunity.

The other thing I want to share with everyone here is one of the great things that we have on our side is that we heard these same arguments when we wrote the Clean Air Act Amendments in 1990, and we set up, in America, the first cap-and-trade system to combat acid rain.

Let me tell you what the Chamber of Commerce said back then. Industry has estimated that the total cost, and they made this prediction as you are here, the total cost of the new Clean Air Act as high as $91 billion annually by the year 2005. The last cost estimate that we did on the bill, we are talking about the Clean Air Act Amendments, was around $50 billion a year once the major controls kick in. That was a statement by Mary Bernhard of the U.S. Chamber of Commerce.

In reality, because we have had all of these years to look at it, here is what happened. Actual costs were only 4 percent of original industry estimates, one-quarter of what the Government estimated. The benefits of the program exceeded the costs 40 to 1, resulting in more than $70 billion in human health benefits.

Now, I have been around for a while, and I started in local government way back before, just as the environmental movement started. And every argument was always about when you go after pollution, you are going to hurt the economy. At the end of the day, many, many jobs have been created and actually, if you look at the ratio, whenever we pass a well thought out piece of legislation, a landmark piece of legislation if you will, we see jobs grow.

The basic fact is, if you cannot breathe, you cannot work. The fact is, when you talk about global warming and you look at even George Bush's administration's predictions of high tides and more hurricanes and all the rest, it is really hard to get to work in a hurricane.

We need to stop the ravages of global warming, and as we do that, create the kinds of jobs about which Mr. Doerr, Mr. Krenicki and Mr. Wong have so ably testified.

I will say that the Congressional Record is littered with gloomers and doomers. And we have got some great ones here. Gloomers and doomers. And if you go back to their predecessors, you will see the same exact thing, every time we have passed a landmark law.

And as we get deeper into this debate, I will be putting all of those in the record because the beauty of it is many years have passed. So, we can see who was wrong and who was right, the gloomers and doomers or the optimists that said when we do this, we will create jobs.

Now, I would like to ask Mr. Doerr this question. If we say, do not do anything because China is not doing exactly what we are doing, it seems to me we hurt ourselves. It seems to me that we are essentially saying that China should lead the world. It really bothers me to think that people would sit and here and say China should lead the world.

Do you agree that, if we do not do anything, the winner will be countries like China and the losers will be countries like America who sit back and say, we will just wait and see what they do? Could you comment on that?

Mr. DOERR. Absolutely, Senator. Thank you. I would like to comment with two points.

I want to go from China to Denmark for a moment, because before the rest of the world did anything, Denmark put in place standards, as well as policies, caps and incentives around carbon. They started that in 1970, and it has made a huge difference. Today, one-third of all terrestrial wind turbines in the world come from Denmark.

Denmark's energy technology exports last year were $10 billion. They are No. 1 in wind. And that is from a country that is smaller than Missouri or Tennessee or Michigan. It has resulted in jobs. Unemployment in Denmark was 2 percent last year. And they moved before anyone in the rest of the world moved.

Now my second point goes directly to China. I believe that you can, we can, carefully design these policies to bring in other nations. And we can look at Copenhagen as an opportunity to create really worldwide markets with worldwide momentum for a low carbon future, in exactly the same way that the Internet created worldwide markets and worldwide momentum for information technology.

I have heard, and some people say, that we should not move ahead unless China moves. Well, I want you to know that China is moving full speed ahead right now, with or without us.

Senator BOXER. Any comments from the rest of the panel on that question about China? Mr. Krenicki.

Mr. KRENICKI. The only thing I would add is that as we look at the market for power generation equipment for the next 3 years, India will be twice as large as the United States, and China will be 5 to 6 times as large. So, given a scale business, we need to act very quickly and decisively just because they have such greater growth going forward is another dynamic we have to phase into.

Senator BOXER. Yes, Mr. Alford, and then Mr. Wong.

Mr. ALFORD. I do not believe that there is any argument that we should be doing more and we should be aggressive in pursuing answers. I certainly think we should compete with China and India and other countries. I think that is what we are saying. But we need to do it intelligently and need to do it without hurting ourselves.

I am still trying to find out what a green job is, and I have asked the green job gurus from various sources to draw me pictures as to what a green job is. I have yet to understand it. It reminds me of the dot-com bubble. You know, everything is going to be seamless, and it is all virtual. There are no green jobs. And, for us to say, leave Detroit, go to Montana and get a wrench and work on a windmill, and that is going to be a green job, it is not going to happen.

Senator BOXER. Well, sir, I would invite you to come to my home State. And I am sincere about this.

Mr. ALFORD. I am a native Californian, madam.

Senator BOXER. Well, then, let us go.

Mr. ALFORD. I go all the time.

Senator BOXER. Let us go to the Apollo Alliance. Come with me. I spent a whole week looking at young people getting trained. The last one was on Richmond, California, and we saw the training to put the solar rooftops on, to do the insulating, all of the energy efficiency.

I am stunned that you would say what you say coming from my home State, given the fact that the small business, and this is important, the California Small Business Association says California small businesses' competitive edge over their counterparts is because while they are wasting money on inefficiency, we are spending it on employees building a better product because they are making their offices efficient.

I also would be kind of shocked that you would dismiss the computer revolution as you did.

But the last word on this, Mr. Wong.

Mr. WONG. Yes, thank you.

Well, just to follow up on Mr. Doerr's point. Yes, China is exactly moving ahead, whether we like it or not and whether we move ourselves. I think it is really important to separate the rhetoric and politicized nature of the international climate process from what is actually happening on the ground in China. They are two very different things, and you cannot mix the two.

What I described earlier in my testimony about what is happening in China is happening today. These are not pie in the sky goals or statements. These are real wind farms and real solar farms that are being deployed and manufactured today.

To Mr. Alford's point, I would like to refer you to a report that the University of Massachusetts did in conjunction with the Center for American Progress that looked at a State by State level, and also a clean energy sector by sector and almost component by component level, about where these green jobs are being created.

The conclusion of the report is that 1.7 million new net jobs, that is net, will be created with appropriate and proper investments in the clean energy sector.

Mr. ALFORD. May I respond to that since my name was called, Madam Chairman?

Senator BOXER. Well——

Senator INHOFE. I will give you a chance.

Senator BOXER. Senator Inhofe will give you a chance to respond. Since I have gone over time, I am going to give you an extra couple of minutes.

Senator INHOFE. Three minutes, yes.

Senator BOXER. Three minutes minus several seconds because I did not go all the way.

Senator INHOFE. Minus 3 seconds, that is right.

Well, there is just too much to respond to here, and I think everyone kind of feels the same thing. Let me just mention a couple of things.

Where is that statement from the, yes, I will just read this here. A recent study by economists from California State University found that small businesses would be destroyed by California's global warming regulation. Now, they are talking about what they have already adopted there in California.

The professor found that the State would face an annual loss of $183 billion in gross output from the small business sector, or a 10 percent drop in total State output. And it goes on and on. I wanted to get that statement into the record because I think that is significant.

The next thing that I would like to get in, there is all this talk about the wonderful things that China is going to do, out of the goodness of their heart, and that sounds good. But let us keep in mind that, if they are doing anything now, as you claim they are, both Mr. Wong and Mr. Doerr, they are doing it without caps, without a cap-and-trade.

Now, I would like to read, because it needs to be in the record at this point since we are talking about China, their statement of position in the post-Kyoto Treaty that will be discussed in Copenhagen, and that is that the right to develop is a basic human right, and it is undeprivable. Economic and social development and poverty eradication are the first and overriding priorities of developing countries. That does not surprise us. The right of developing countries shall be adequately and effectively respected and ensured in the process of global common efforts.

They go on to say, and I do not know how else you can interpret it, that the Chinese and other developing countries collectively argue that the price for reducing their emissions, in other words, what they demand to get for this, is 1 percent of the GDP of the United States and of all developed countries. Now, I have done a calculation, and we are talking about something in excess of $200 billion a year. And I do not think that is really sellable to the American people.

Let me do this. I do not want to be discourteous, let me just compliment you. I would say to Mr. Krenicki, I was 25 years in the corporate world. I know how it works. I have served on boards of directors.

If I served on the Board of Directors of GE, instead of being in the U.S. Senate, I would be here today testifying as you are testifying, because you guys are going to make a fortune off this thing,

if it comes. You have been in on the negotiations, and it is very clear. And that is not just me saying it. I just want to get into the record, Madam Chairman, that the CEO of GE stated in his shareholders meeting that the current events present an opportunity of a lifetime because capitalism will be reset.

It goes on to say, well, here is another one. This is Mr. Steve Sargent. He was head of your operations in Australia and New Zealand. He says that for us, we look at this, climate change, as the biggest business opportunity of the century for your company.

Now, I know the response would be, and I will let you respond for the record because we are under time constraints here, but you stand to make a lot of money, and if I were on your Board of Directors, I would be encouraging you to do exactly what you are doing today.

I want to turn to Mr. Alford because I appreciate your being here. You have been once before, and I wonder sometimes, I expected you to have in your written statement a little more attention to the regressive nature of the tax that we are talking about passing here, in terms of a percentage of expendable income, I would have to say, looking after the Black Chamber of Commerce, lower income level in many cases, is it not true that a larger percentage of expandable income would come from the poor people with this kind, any kind, of an energy tax?

Mr. ALFORD. Without a doubt. Sixty percent of black households earn less than $50,000 a year——

Senator INHOFE. They have to heat their homes, use the fuel to get to their jobs——

Mr. ALFORD. We are not talking about spending too much energy or being wasteful. We are talking about keeping your kids warm, or cooking dinner, or getting to work. Going back to these jobs, I have got 18 chapters in California, and I want them to go and find these green jobs. I want these green jobs in their face. I want them to see these green jobs, including Richmond and Oakland and San Francisco and others. I want to go out there personally and see these green jobs. I have been looking. I have not seen them yet.

Senator INHOFE. I assume that you agree with the statement of the professor from California State University that questions the jobs and the net loss that they are already experiencing from just what California has done on its own.

Mr. ALFORD. The last time I checked, Senator, California is an economic basket case, and these green jobs are not going to solve it.

As we do know today, we need to find a green solution, true. We need an energy policy. And this law, as it is written, is not a policy, it cannot compete with Brazil and other countries, it overlooks, or underlooks, nuclear energy and other phases.

We need to look at this thing intelligently. I do not think we need to argue. But I think if we go down this path, it is going to be bad. And African-Americans are going to pay, and Hispanics, are going to pay a disproportionate share.

Senator INHOFE. Well, I would say that just looking at energy policy that, I think I could speak for myself and everyone to my right at this podium, we have an energy proposal, a policy, and it is called all of the above. We want green jobs. We want wind. We

want geothermal. We want solar energy. But we also want oil and gas. We have all of these opportunities right now. We could become energy sufficient in a matter of 1 year if were to open up the opportunities and exploit our own resources in this country.

We need clean coal technology. We cannot do it without coal. Right now, we are 50 percent dependent on coal. And we are working on clean coal technology. We have got to have, of course you are going to hear a lot about this, you have to have the nuclear aspect of this thing.

But before my time runs out, I want to get into one other thing. We had a quite a week last week because we had the EPA Administrator. I just applaud her for her honesty in response to the question that I asked. And that question was, if we were to pass the bill that was passed in the House, the Waxman-Markey bill, would that have a net reduction in CO_2 emissions? She thought, and she said, no, it would not.

Now, I have seen studies that show that it would have the opposite effect. You drive our manufacturing jobs overseas, they are going to go where they do not have the emissions standards that we have in this country, and the regulations, and those other things.

So, I think last Tuesday, the EPA Administrator confirmed that the cap-and-trade tax bill, whether it is Waxman-Markey or Warner-Lieberman or McCain-Lieberman or any of the rest of them, or any of the new iterations of that, is no longer about solving global warming.

The following day, the G8 announced, and I read some of the reports there, they vehemently deny any interest, and I am talking about developing countries, in doing this. If they do not do it, we are going to have a net increase.

So, I guess this is now a jobs bill and that is what this is all about now. And I would like you, because I read your study that you had, is there anything that you did not have time to talk about in terms of this study and how it affects the jobs?

Mr. ALFORD. It is going to affect the jobs immensely. I think we are being very conservative when we say a 2.5 million net loss. We are going to come out with some other studies that are going to zero in on the city of Chicago, or the State of Michigan, to be more specific, and also to hit home on African-American communities.

But I think, getting back to the loss, if Brazil does not import a drop of oil in the next 15 years, they are going to be OK. They have got the reserves because they have got a strategy. Petrobras has a strategy for that. We do not have a strategy. If the sheiks wake up tomorrow morning mad at us, we are in trouble.

Senator INHOFE. Or Chavez. But at least you are aware that there is a strategy that we have been trying desperately, I know a day does not go by that one of us is not down on the floor saying what I just said a minute ago about how we can be energy independent.

Last, since I am running out of time, and I assume that you have a Board of Directors that meets and talks about these issues——

Mr. ALFORD. Yes, sir.

Senator INHOFE. I want you to take back a question to that Board of Directors and then, for the record, send me back the an-

swer. That would be, and I think you are aware that, in order to reduce costs to our manufacturing sector from the provisions of this so-called jobs bill, and other sectors, the bill authorizes, now listen to this, Mr. Alford, the bill authorizes an international offsets program that allows our industries covered under the cap, including the manufacturing and refinery and other energy intensive industries, to indirectly pay for offset projects that originate in China, India or Malaysia.

The question I want you to take back is, do you think that helps to create more American jobs or Chinese jobs?

Mr. ALFORD. We have a board meeting next Wednesday at 4 p.m. I see some of our board members saying, I see some of our board members doing, taking their business to China and Singapore and places for opportunities and leaving the United States. No, I think it is going to have net loss and ill effect on the United States.

We talk about China, Brazil and India. These are countries that we have not built out yet. But there is another 20 or 25 percent of this world that does not even have access to energy, and when they decide to have roads and running water and electricity, that is another impact that is going to be a strain on this world. And we need to take all that into effect.

Senator INHOFE. One last thing, Mr. Alford. I will not be able to respond to it because it has not been said yet, but I suspect that when it is someone else's turn to ask questions, they are going to comment on the NAACP. I have a copy of the resolution that was passed and nowhere in that resolution do they endorse in any way any type of a cap-and-trade bill. And I think you are aware of that. So, anticipate that question will come up. I hope that you will have an answer ready.

Mr. ALFORD. Yes, sir.

Senator BOXER. Since Senator went over 1 minute and 20 seconds, I will add that to my time.

Senator INHOFE. One minute 13 seconds.

Senator BOXER. So, here is the thing. I am going to place in the record of a couple of important documents. Mr. Alford, we have your address as Washington, DC——

Mr. ALFORD. That is correct, madam.

Senator BOXER. You live in Washington, DC, or California?

Mr. ALFORD. Personally? I live in Bethesda, Maryland.

Senator BOXER. OK, because you said you were from California.

Mr. ALFORD. I am a native Californian, born and raised.

Senator BOXER. Yes, but right now——

Mr. ALFORD. I was there when you came.

Senator BOXER. You do not know when I came.

Mr. ALFORD. It was 1962.

Senator BOXER. Actually, you are right on target.

[Laughter.]

Mr. ALFORD. It is all in the manual, Madam.

Senator BOXER. Actually, it was 1965.

Here is what I want to tell you. You do not live there now——

Mr. ALFORD. I am a property owner and I pay taxes in California.

Senator BOXER. Sir, let me talk to you.

Mr. ALFORD. Yes, madam.

Senator BOXER. This is friendly.

[Laughter.]

Senator BOXER. I want us to go back there together. I want you to come with me and John, and let us go see those jobs that you say do not exist. So, we are going to——

Mr. ALFORD. Yes, madam.

Senator BOXER. Good. Put in the record the Pew Charitable Trust report which says, and I am reading one sentence, jobs in the clean energy economy grew at a faster rate than total jobs in the Golden State between 1998 and 2007. And it talks about all of that, and being driven by venture capital and the laws on the books. So, we are going to put that in the record.

Then we are going to put the NAACP resolution that passed, saying this: the NAACP approved a historic resolution addressing climate change legislation for the first time in the organization's history.

Mr. ALFORD. What does that mean?

Senator BOXER. Sir, we are going to put that in the record, and you can read it because I do not have the time but I will——

Mr. ALFORD. But what does that mean though? I mean, NAACP has a resolution. What does that mean?

Senator BOXER. Sir, they could say the same thing about what do you mean? I am just telling you——

Mr. ALFORD. I have got documentation.

Senator BOXER. Sir, they passed it. Now, also, if that is not interesting to you, we will quote John Grant who is the CEO of 100 Black Men of Atlanta. "Clean energy is the key that will unlock millions of jobs and the NAACP support is vital to ensuring that those jobs help to rebuild urban areas." So, clearly, there is a diversity——

Mr. ALFORD. Madam Chair, that is condescending to me. I am the National Black Chamber of Commerce, and you are trying to put up some other black group to pit against me.

Senator BOXER. If this gentleman were here, he would be proud that he was being quoted, just——

Mr. ALFORD. Then he should have been invited.

Senator BOXER. He would be proud just——

Mr. ALFORD. It is condescending to me.

Senator BOXER. Just so you know, he would be proud that you are here. He is proud, I am sure, that I am quoting him——

Mr. ALFORD. Proud. Proud. All that is condescending, and I do not like it——

Senator BOXER. Well, sir——

Mr. ALFORD. It is racial. I do not like it.

Senator BOXER. Excuse me, sir.

Mr. ALFORD. I take offense to it.

Senator BOXER. OK.

Mr. ALFORD. As an African-American, and a veteran of this country, I take offense to that.

Senator BOXER. Offense at the fact that I would quote——

Mr. ALFORD. You are quoting some other black man. Why do you not quote some other Caucasian or some other——

Senator BOXER. No, well let me——

Mr. ALFORD. You are being racial here.

Senator BOXER. Let me be clear——

Mr. ALFORD. And I think you are getting on a path here that is going to explode in the Post.

Senator BOXER. I am going to respond right now. I am going to ask everyone to listen to what I said.

First, I placed in the record the Pew Charitable Trust study, a very important study for our State, our home State of California. Then I wanted to make a point that the fact is, there is definitely differing opinions in the black community, just as there are in my community.

Mr. ALFORD. You are speaking on behalf of the black community?

Senator BOXER. No, I am putting in the record a statement by the NAACP.

Mr. ALFORD. Why?

Senator BOXER. Because I think it is quite relevant. I think——

Mr. ALFORD. I understand the Pew study. But why are you doing the NAACP? Why are you doing the Colored People Association's study with the Black Chamber of Commerce?

Senator BOXER. I am trying to show the diversity of support——

Mr. ALFORD. Diversity?

Senator BOXER. And I will go ahead and do one more diversity of support. The oil companies. The oil companies. I think they are an important part of this conversation. The oil companies are the ones who funded the very first CRA report that you support. I think it is important to note——

Mr. ALFORD. I have no idea of it.

Senator BOXER. I am putting it in the record, sir. Exxon Mobile gave hundreds of thousands of dollars for that report. So, I think it is important, when we have a debate here, that we look at the diversity of opinion and who agrees and disagrees——

Senator INHOFE. Madam Chairman, I have something to put in the record.

Senator BOXER. And that is what I have decided to do.

Senator INHOFE. I have something to put in the record.

Senator BOXER. Yes.

Senator INHOFE. I think if you are going to enter the NAACP paper in the record, I want to enter the actual resolution——

Senator BOXER. Absolutely.

Senator INHOFE. Because it does not endorse this. And I would also say that CRA is well-respected, it represents a broad group of, whoever goes to them and wants a study, they do it.

Mr. ALFORD. Senator, as I said, we have been looking at energy policy since 1996. We are referring to the experts, regardless of their color. And for someone to tell me, an African-American, college-educated veteran of the United States Army, that I must contend with some other black group and put aside everything else in here, this has nothing to do with the NAACP and really has nothing to do with the National Black Chamber of Commerce. We are talking energy. And that, that road the Chair went down, I think it is God awful.

Senator BOXER. OK, let me say, as someone who is married to a veteran, that has nothing to do with this conversation. I just want to say to you, sir, and all of my panelists, how much I respect your views. I will put a number of other documents into the record

from many other organizations because right now the whole point is to build support. I am trying to build support. Your organization opposes. I am showing you organizations that support. And I will continue to do this. And they are diverse. They represent America, just as the opposition does. And that is what I will continue to do.

Now we will move forward, and we will hear from Senator Carper.

[The referenced documents follow:]

THE PEW CHARITABLE TRUSTS

The Clean Energy Economy
California

California has the largest clean energy economy of the 50 states. Jobs in this sector grew at a faster rate than total jobs in the Golden State between 1998 and 2007. California's clean energy economy has been driven by significant investment, attracting more than $6.5 billion in venture capital in the past three years. It also has been driven by public policies, from financial incentives for clean energy development and energy efficiency to renewable portfolio and energy efficiency standards. California's Green Building Action Plan—a goal for public buildings to be 20 percent more energy efficient by 2015—could save the state $100 million annually.[1]

BY THE NUMBERS, THE CLEAN ENERGY ECONOMY:

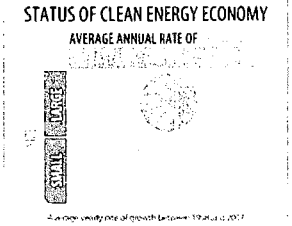
Jobs (2007): **125,390**

Businesses (2007): **10,209**

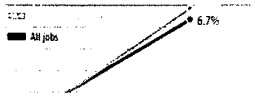
Venture Capital Funds (2006-2008)*: **$6,580,426,908**

Patents (1999-2008): **1,401**

STATUS OF CLEAN ENERGY ECONOMY



10-YEAR GROWTH

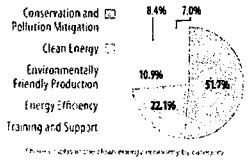


EXAMPLES OF COMPANIES:**

Bridgelux, *Sunnyvale* (Energy Efficiency): designs and manufactures LED lighting

Zpower, *Camarillo* (Clean Energy): designs and manufactures silver zinc batteries for next generation cell phones and computers (formerly known as Zinc Matrix Power)

JOB CATEGORIES***



MORE ABOUT THE FACTSHEETS

Download the full report by visiting www.pewtrusts.org/cleanenergyeconomy

NOTES: *Values reported in 2008 dollars. **Information current as of May 8, 2009. This report is intended for educational and informational purposes. References to specific products, services, companies and policy makers have been included solely to advance these purposes and do not constitute an endorsement, sponsorship or recommendation by The Pew Charitable Trusts. ***These numbers may not add up to 100 percent due to rounding. ****Financial incentives include residential, commercial and industrial loan financing, rebate programs and tax incentives.

SOURCES: Jobs and establishment data from The Pew Charitable Trusts, 2009; based on the National Establishment Time Series Database; analysis by Pew Center on the States and Collaborative Economics. [1] State of California: Office of the Governor press release, "Executive Order S-20-04," December 14, 2004, http://gov.ca.gov/executive-order/3360/ (accessed May 13, 2009).

CLEAN ENERGY POLICIES

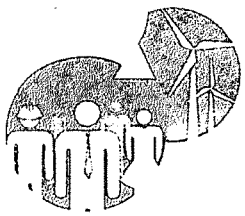
Financial Incentives****

Renewable Portfolio Standards

Energy Efficiency Resource Standards

Regional Cap and Trade Program

the Clean Energy Economy



Repowering Jobs, Businesses and Investments Across America

THE PEW CHARITABLE TRUSTS

Executive Summary

America's clean energy economy is dancing as a critical component of the nation's future.

Research by The Pew Charitable Trusts shows that despite a lack of sustained policy attention and investment, the emerging clean energy economy has grown considerably—extending to all 50 states, engaging a wide variety of workers and generating new industries. Between 1998 and 2007, its jobs grew at a faster rate than overall jobs. Like all other sectors, the clean energy economy has been hit by the recession, but investments in clean technology have fared far better in the past year than venture capital overall. Looking forward, the clean energy economy has tremendous potential for growth, as investments continue to flow from both the government and private sector and federal and state policy makers increasingly push for reforms that will both spur economic renewal and sustain the environment.

By 2007, more than 68,200 businesses across all 50 states and the District of Columbia accounted for about 770,000 jobs that achieve the double bottom line of economic growth and environmental sustainability (Exhibit 1).

In today's tough financial climate, when millions of jobs have been lost, those numbers may sound modest. Three quarters of a million jobs represent half a percent of all jobs in the United States today. But Pew's research shows that between 1998 and 2007, clean energy economy jobs—a mix of white- and blue-collar positions, from scientists and engineers to electricians, machinists and teachers—grew by 9.1 percent, while total jobs grew by only 3.7 percent. And although we expect job growth in the clean energy economy to have declined in 2008, experts predict the drop in this sector will be less severe than the drop in U.S. jobs overall.

Pew's research indicates a strong start for a new economy still very much in its infancy. To put our clean energy economy numbers in perspective, consider the following. Biotechnology, which has developed applications for agriculture, consumer products, the environment and health care and has been the focus of significant public policy and government and private investment, employed fewer than 200,000 workers, or about a tenth of a percent of total U.S. jobs in 2007, according to a 2008 Ernst & Young report. And the well-established traditional energy sector—including utilities, coal mining and oil and gas extraction, industries that have received significant government investment—comprised about 1.27 million workers in 2007, or about 1 percent of total employment.

Growing attention and financial support from both the private and public sectors indicate that the clean energy economy is poised to expand significantly. Signaling interest in new market opportunities, venture capital investment in clean technology crossed the $1 billion threshold in 2005 and continued to grow substantially, totaling about $12.6 billion during the past three years. Although they have dropped significantly in recent months because of the recession, investments in clean

technology are actually faring better than other industries: They were down 48 percent in the first three months of 2009 compared with a year earlier, while total venture capital across all sectors was down 61 percent for the same period. "It's important not to miss the forest for the trees," Nicholas Parker, executive chairman of the Cleantech Group, said in January 2009. "In 2008, there was a quantum leap in talent, resources and institutional appetite for clean technologies. Now, more than ever, clean technologies represent the biggest opportunities for job and wealth creation."

Between 2006 and 2008, 40 states and the District of Columbia attracted venture capital investments in technologies and industries aimed at economic growth and environmental sustainability. And all states will receive a major infusion of federal funds through the recently enacted American Recovery and Reinvestment Act (ARRA), which allocates nearly $85 billion in direct spending and tax incentives for energy- and transportation-related programs.

Every State Has a Piece of the Clean Energy Economy

With traditional manufacturing jobs declining during the past decade, states have been working aggressively to develop new industries and create jobs that will endure—and remain within U.S. borders. They also have been working to address the public's concerns about high energy prices, national security and our dependence on foreign oil, and global warming—all with an understanding that America is on its way to being a carbon-constrained country. "While our economic engine has for years been powered by relatively inexpensive energy, there is evidence that this era is coming to a close," a National Governors Association report noted in 2007. "Meanwhile, we are increasingly aware of the serious impacts of global climate change—and how America's consumption of fossil fuels is contributing to a warming Earth."

Pew's analysis shows that every state has a piece of America's clean energy economy. Texas, for instance, generates more electricity from wind than any other state, had more than 55,000 clean energy economy jobs in 2007, and attracted more than $716 million in venture capital funds for clean technology between 2006 and 2008. Tennessee has succeeded in cultivating jobs in recycling, waste treatment and water management, among other conservation industries; jobs in Tennessee's clean energy economy grew by more than 18 percent between 1998 and 2007, compared with 2.5 percent growth in all jobs in the state. Colorado has raised the amount of power electricity providers must supply from renewable energy sources to stimulate job growth in solar and wind power and other forms of clean energy generation. Ohio ranked among the top five states with the most jobs in clean energy, energy efficiency and environmentally friendly production in 2007. Idaho, Kansas, Mississippi and South Dakota are among more than a dozen states where the number of jobs in the clean energy economy in 2007 was modest, but the average annual growth rate of those jobs was among the highest in the country. All told, in 38 states and the District of Columbia, job growth in the clean energy economy outperformed total jobs growth between 1998 and 2007. In a number of states, job gains in the clean energy economy have helped lessen total job losses.

Defining the Clean Energy Economy

Pew partnered with Collaborative Economics, Inc., a public policy research firm based in California, on the research. While organizations on both sides of the political spectrum have weighed in with forecasts and economic modeling to estimate the size of the clean energy economy, Pew's analysis is the first of its kind to count actual jobs, businesses and investments for each of the 50 states and the District of Columbia. Our numbers are conservative and may be lower than some other reports for three reasons: First, we developed a stringent definition of the clean energy economy; second, we used a new, labor-intensive methodology that counted only companies that we could verify online as being actively engaged in the clean energy economy; and third, we counted businesses and jobs supplying products and services generated by the clean energy economy, not the companies using these products and services to make themselves "greener" (i.e., we counted only companies and jobs on the supply side, not the demand side, of the clean energy economy).

Policy makers, business leaders and the public need credible, reliable data to ground their policy deliberations and choices, and to understand where emerging economic opportunities lie. They also need a clear, concrete and common definition of what constitutes the clean energy economy so they can track jobs and businesses and gauge the effectiveness of public policy choices and investments.

Based on significant research and input from experts in the field, including the advisory panel that helped guide this study, Pew developed the following definition:

A clean energy economy generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources.

The clean energy economy cuts across five categories: (1) Clean Energy; (2) Energy Efficiency; (3) Environmentally Friendly Production; (4) Conservation and Pollution Mitigation; and (5) Training and Support.

While specific jobs and businesses will change in the coming decades, the five categories of the clean energy economy will not—providing a clear, practical and consistent framework for federal, state and local policy makers and the private sector to track investments, job and business creation, and growth over time.

Jobs of Today, and Jobs of Tomorrow

Pew's framework takes into account that technology, scientific research, market forces and public policy will continue to drive innovation and competition, so the largest segments of today's clean energy economy may not be its driving forces tomorrow.

Our data show that 65 percent of today's clean energy economy jobs are in the category of Conservation and Pollution Mitigation—a sector that reflects the growing recognition among the public, policy makers and business leaders of the need to recycle waste, conserve water and mitigate emissions of greenhouse gases and other pollutants. But three other categories—Clean Energy, Energy Efficiency and Environmentally Friendly Production—are growing at a far faster clip. And about 80 percent of venture capital investments in 2008 were in the sectors of Clean Energy and Energy Efficiency: businesses and jobs working to develop clean, renewable energy

sources such as wind and solar and products and services that reduce our overall energy consumption—all of which will help meet the demands of a carbon-constrained economy.

The flow of venture capital indicates which sectors are most attractive to investors and have the greatest growth potential. The number of jobs and businesses in Clean Energy and Energy Efficiency will grow over time—and as the country increases the amount of power it draws from renewable sources, we will generate less waste, reduce our reliance on foreign oil and produce fewer carbon emissions that cause global warming. That does not mean that jobs in the Conservation and Pollution Mitigation category will disappear. As other countries seek to follow America's lead, they increasingly will need help managing their finite natural resources and addressing the adverse effects of their use of fossil-fuel energy sources—creating a new market for our products, technology and know-how.

Public Policy's Role in Driving the Clean Energy Economy

Public policy is another important indicator of the future of the clean energy economy.

Policies intended to advance the clean energy economy—from comprehensive energy plans, renewable energy standards and energy efficiency measures to the development of alternative fuels, job retraining and waste reduction efforts—have been adopted or are being actively considered by both the federal government and states. It is too early to tell to what degree these efforts will succeed in stimulating U.S. job growth, strengthening America's competitiveness, curbing pollution and conserving resources. But Pew's analysis indicates such policies have great potential because they create significant incentives for both the private and public sectors to develop new technologies, infrastructure and processes for clean energy, efficiency and conservation. Now that we have baseline data in hand, Pew will conduct follow-up research to assess which approaches are particularly effective in generating jobs, businesses and investments in the clean energy economy.

State policies. Governors and legislators across the country are seeking to get to the double bottom line of economic growth and environmental sustainability by adopting policies to advance the clean energy economy.

- *Financial incentives.* Forty-six states offer some form of tax incentive to encourage corporations and residents to use renewable energy or adopt energy efficiency systems and equipment. Thirty-three states provide residential, commercial and industrial loan financing for the purchase of renewable energy or energy efficiency systems or equipment. And 22 states and the District of Columbia offer rebate programs to promote the installation of solar water heating or solar panels for electricity generation.
- *Renewable portfolio standards.* Twenty-nine states and the District of Columbia have adopted renewable portfolio standards, which require electricity providers to supply a minimum amount of power from renewable energy sources.
- *Energy efficiency standards.* Nineteen states have established energy efficiency standards for energy generation, transmission and use.

- *Regional clean energy initiatives.* Twenty-three states are participating in three major regional initiatives seeking to increase renewable energy generation and reduce carbon pollution from power plants that causes global warming.
- *Vehicle emissions standards.* Fourteen states and the District of Columbia have adopted (and three more states are poised to adopt) California's vehicle emissions standards, which allow states the right to require automakers to reduce carbon emissions from new cars and light trucks more aggressively than federal standards mandate. On May 19, 2009, President Barack Obama established national limits on vehicle emissions by adopting fuel efficiency standards that match California's.

Federal policies. The federal government also has played a critical role, adopting policies and making investments that have spurred economic growth and environmental protection from coast to coast. Laws enacted in the 1960s and 1970s helped develop the recycling, waste reduction and waste management industries. The EPA's Energy Star and Water Sense certification and labeling initiatives long have helped consumers choose and use products that conserve energy and water. And for almost two decades, the U.S. Department of Commerce has helped manufacturers improve efficiency, reduce waste and develop clean technologies and products.

In the last three years, federal policy makers have taken major steps to drive the clean energy economy forward. President Obama's recent efforts to enact stronger fuel efficiency standards built on earlier legislation. In 2007, President George W. Bush signed into law the first congressionally mandated increase in fuel efficiency standards for cars and light trucks in more than 30 years. The Energy Independence and Security Act of 2007 is projected to save consumers $25 billion at the gas pump, save 1.1 million barrels of oil a day and reduce greenhouse gas emissions.

Enacted in February 2009, ARRA—the federal stimulus bill—includes an array of provisions to spur clean energy generation and energy efficiency businesses, jobs and investments. Among the almost $85 billion the package allocates to energy- and transportation-related spending, about $21 billion is dedicated to extending tax incentives for wind, solar and other renewable energy manufacturers. ARRA also provides more than $30 billion for direct spending on clean energy programs, including $11 billion to modernize the nation's electricity grid; $2 billion for advanced battery technology; more than $6 billion for state and local efforts to achieve energy efficiency; $5 billion for weatherization of low-income homes; $500 million for job training to help workers participate in the clean energy economy; and $300 million to purchase thousands of new, fuel-efficient vehicles for the federal fleet from American auto companies.

Moving forward. Given America's need to create enduring jobs and industries while conserving natural resources and reducing carbon emissions, federal leaders are deliberating additional measures to spur the clean energy economy.

President Obama has signaled his support for a federal clean energy plan to reduce greenhouse gas emissions by at least 80 percent by 2050, and a national renewable

portfolio standard that would require that 25 percent of the nation's energy supply be derived from renewable sources by 2025. At this writing, the U.S. House of Representatives is considering the American Clean Energy and Security Act, a market-based proposal that would limit overall greenhouse gas emissions and distribute tradable federal allowances for each ton of pollution emitted. The program would apply to electric utilities, oil companies and other entities that produce more than 25,000 tons of carbon dioxide each year. The bill would increase significantly the amount of energy derived from low- or zero-carbon sources, including renewables—meaning that businesses and jobs would be generated to develop clean energy sources to meet the demand.

EXHIBIT 1

THE U.S. CLEAN ENERGY ECONOMY BY THE NUMBERS

By 2007, 68,203 businesses in the United States had generated more than 770,000 jobs in the clean energy economy. And between 2006 and 2008, about $12.6 billion of venture capital investments was directed toward clean technology businesses in 40 states and the District of Columbia. The U.S. clean energy economy is an emerging source of jobs that achieve the double bottom line of economic growth and environmental sustainability. Every state has a piece of America's clean energy economy.

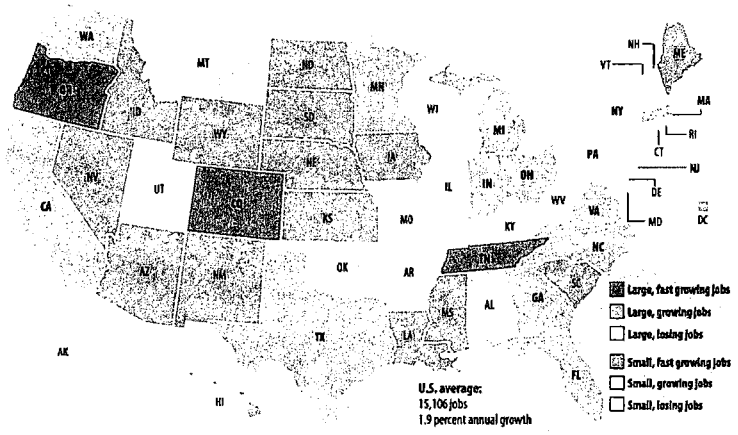
	CLEAN BUSINESSES 2007	CLEAN JOBS 2007	CLEAN JOB GROWTH 1998-2007	OVERALL JOB GROWTH 1998-2007	VENTURE CAPITAL 2006-2008 (thousands)
Alabama	799	7,849	2.2%	1.6%	$0
Alaska	350	2,140	9.4	15.7	0
Arizona	1,123	11,578	21.3	16.2	31,106
Arkansas	448	4,597	7.8	3.5	22,845
California	10,209	125,390	7.7	6.7	6,580,427
Colorado	1,778	17,008	18.2	8.2	622,401
Connecticut	857	10,147	7.0	-2.7	30,050
Delaware	211	2,368	-2.3	-8.9	3,342
District of Columbia	280	5,325	18.8	-7.1	89,877
Florida	3,831	31,122	7.9	22.4	116,980
Georgia	1,827	16,222	10.8	15.7	179,686
Hawaii	356	2,732	43.6	7.3	12,304
Idaho	428	4,517	126.1	13.8	27,890
Illinois	2,176	28,395	-2.5	-2.5	108,519
Indiana	1,268	17,298	17.9	-1.0	26,008
Iowa	729	7,702	26.1	3.6	149,237
Kansas	591	8,017	51.0	-0.3	13,275
Kentucky	778	9,308	10.0	3.6	0
Louisiana	995	10,641	19.5	3.0	0
Maine	725	6,000	22.7	3.3	0
Maryland	1,145	12,908	-2.4	1.3	323,996
Massachusetts	1,912	26,678	4.3	-4.4	1,278,462
Michigan	1,932	22,674	10.7	-3.6	55,099
Minnesota	1,206	19,994	11.9	1.9	49,938
Mississippi	454	3,200	24.8	3.6	30,384
Missouri	1,062	11,714	5.4	2.1	24,480
Montana	408	2,155	0.2%	12.7%	$0
Nebraska	368	5,292	108.6	-4.9	0
Nevada	511	3,641	28.8	26.5	19,804
New Hampshire	465	4,029	2.0	6.8	66,917
New Jersey	2,031	25,397	-9.6	-2.7	282,568
New Mexico	577	4,815	50.1	1.9	147,913
New York	3,323	34,363	-1.9	-2.6	209,590
North Carolina	1,783	16,997	15.3	6.4	82,571
North Dakota	137	2,112	30.9	9.4	0
Ohio	2,513	35,267	7.3	-2.2	74,224
Oklahoma	693	5,465	6.8	2.4	5,192
Oregon	1,613	19,340	50.7	7.5	70,002
Pennsylvania	2,934	38,763	-6.2	-3.1	232,897
Rhode Island	237	2,328	0.7	0.6	22,845
South Carolina	884	11,255	36.2	2.2	0
South Dakota	169	1,636	93.4	4.9	0
Tennessee	1,090	15,507	18.2	2.5	16,329
Texas	4,802	55,646	15.5	6.7	716,894
Utah	579	5,199	-12.4	10.8	26,957
Vermont	311	2,161	15.3	7.4	53,747
Virginia	1,446	16,907	6.0	6.6	70,828
Washington	2,008	17,013	0.5	1.3	635,109
West Virginia	332	3,065	-4.1	0.7	5,741
Wisconsin	1,294	15,089	-5.2	3.4	46,743
Wyoming	225	1,419	56.4	14.0	6,942
U.S. Total	68,203	770,385	9.1	3.7	12,570,110

NOTE: Venture capital values are adjusted for inflation and reported in 2008 dollars. See appendixes for the complete data sets.
SOURCE: Pew Charitable Trusts, 2009, based on the National Establishment Time Series Database and data from the Cleantech Group™ LLC; analysis by the Pew Center on the States and Collaborative Economics

EXHIBIT 10

WHERE ARE THE JOBS IN THE CLEAN ENERGY ECONOMY?

Looking simultaneously at the total number of jobs (large or small) and their average annual growth rate (fast growing, growing or losing), states' clean energy economies fall into six groups: large and fast-growing jobs, growing jobs or losing jobs; and small and fast-growing jobs, growing jobs or losing jobs. Large states had more jobs in their clean energy economies in 2007 than the national average of 15,106 jobs. Small states had fewer than the national average of clean energy economy jobs. States with fast-growing clean energy economies experienced average annual growth between 1998 and 2007 that exceeded the national average of 1.9 percent. Growing states had a positive average annual rate of growth less than 1.9 percent and losing states have experienced negative growth.



STATE	TOTAL CLEAN JOBS 2007	AVG. ANNUAL GROWTH 1998-2007
Alabama	7,849	0.31%
Alaska	2,140	1.14
Arizona	11,578	2.19
Arkansas	4,597	0.99
California	125,390	0.88
Colorado	17,008	1.98
Connecticut	10,147	1.11
Delaware	2,368	0.23
District of Columbia	5,325	2.13
Florida	31,122	0.90
Georgia	16,222	1.18
Hawaii	2,732	4.29
Idaho	4,517	10.11
Illinois	28,395	−0.25
Indiana	17,298	1.88
Iowa	7,702	2.66
Kansas	8,017	4.74
Kentucky	9,308	1.09%
Louisiana	10,641	2.06
Maine	6,000	2.34
Maryland	12,908	−0.11
Massachusetts	26,678	0.52
Michigan	22,674	1.20
Minnesota	19,994	1.38
Mississippi	3,200	2.57
Missouri	11,714	0.71
Montana	2,155	0.15
Nebraska	5,292	10.00
Nevada	3,641	3.15
New Hampshire	4,029	0.44
New Jersey	25,397	−1.08
New Mexico	4,815	4.73
New York	34,363	−0.14
North Carolina	16,997	1.62
North Dakota	2,112	3.17%
Ohio	35,267	0.85
Oklahoma	5,465	0.89
Oregon	19,340	4.77
Pennsylvania	38,763	−0.48
Rhode Island	2,328	0.37
South Carolina	11,255	3.56
South Dakota	1,636	7.89
Tennessee	15,507	2.14
Texas	55,646	1.70
Utah	5,199	−1.31
Vermont	2,161	1.69
Virginia	16,907	0.66
Washington	17,013	0.23
West Virginia	3,065	−0.36
Wisconsin	15,089	−0.55
Wyoming	1,419	5.16

SOURCE: Pew Charitable Trusts, 2009, based on the National Establishment Time Series Database; analysis by Pew Center on the States and Collaborative Economics.

EXHIBIT 8

STATE LEADERS IN JOBS ACROSS THE CLEAN ENERGY ECONOMY BY CATEGORY

Although California leads in overall employment in each category, a closer look reveals other notable trends. Arizona makes the top 10 in Clean Energy but in no other category. Massachusetts, New York and Ohio are among the top 10 in all but one category.

While Arizona, Arkansas, Iowa, Maine, Nebraska, Wisconsin and the District of Columbia each have fewer than 15,106 jobs in the clean energy economy—the national average—they rank among the top 10 states in one of the five categories. In all, nearly half the states rank among at least the top 10 states in at least one category of the clean energy economy.

Clean Energy	JOBS 2007	Energy Efficiency	JOBS 2007	Environmentally Friendly Production	JOBS 2007	Conservation and Pollution Mitigation	JOBS 2007	Training and Support	JOBS 2007
California	27,672	California	10,510	California	13,666	California	64,799	California	8,743
Pennsylvania	10,099	Texas	6,353	Minnesota	3,815	Texas	40,617	New York	3,499
Minnesota	4,030	Ohio	5,367	Oregon	3,304	Pennsylvania	24,703	Illinois	3,216
Ohio	3,653	Oregon	4,893	Ohio	2,800	Florida	24,686	Massachusetts	3,155
Texas	3,479	New York	3,311	Iowa	2,237	New York	23,082	District of Columbia	3,130
New York	3,421	Wisconsin	2,801	Texas	2,223	Ohio	22,296	Texas	2,974
Michigan	2,941	Maine	2,560	Nebraska	2,162	New Jersey	20,060	Florida	2,249
Massachusetts	2,890	Massachusetts	2,553	Illinois	1,921	Illinois	19,631	Virginia	1,755
District of Columbia	2,728	Virginia	2,135	Colorado	1,361	Massachusetts	17,374	Pennsylvania	1,742
Colorado	2,639	Florida	2,071	Arkansas	1,303	Michigan	15,852	North Carolina	1,659

SOURCE: Pew Charitable Trusts, 2009, based on the National Establishment Time Series Database; analysis by Pew Center on the States and Collaborative Economics.

economy as of that year, it was a close second with 0.85 of its overall jobs dedicated to the clean energy economy. At the other end of the spectrum, 0.24 percent of Mississippi's total jobs were part of the clean energy economy in 2007, although the state's number of jobs in this area was growing.

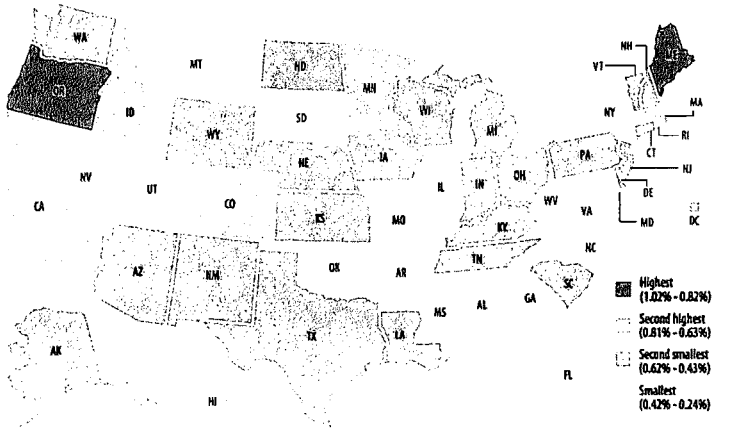
Analysis Three: Growth of Jobs in the Clean Energy Economy Compared with Overall Jobs Growth

Nationally, jobs in the clean energy economy grew by an average of 1 percent annually during the past 10 years, while total employment grew by an average of 0.4 percent annually. In 38 states and the District of Columbia, job growth in the clean energy economy outperformed total job growth between 1998 and 2007. In a number of states, job gains in the clean energy economy have helped lessen total job losses.

Job growth in the clean energy economy eclipsed growth for all jobs by more than 2 percent in 11 states: Hawaii, Idaho, Iowa, Kansas, Mississippi, New Mexico, North Dakota, Oregon, South Carolina, South Dakota and Wyoming. Oregon's large and fast-growing clean energy economy, for example, has dwarfed the growth of overall jobs in the state, expanding by an average of 4.8 percent compared with an average of less than 1 percent annually. This growth is not limited to one industry or job type: Oregon's jobs in the clean energy economy have experienced marked growth during the past 10 years in all five of Pew's categories. And although North and South Dakota have very small clean energy economies, the growth of these jobs in both states has outpaced their growth of total jobs. In North Dakota, overall jobs grew by 1.0 percent, but jobs in the clean energy economy grew by an average of 3.2 percent. In South Dakota, overall jobs grew by

EXHIBIT 6
CLEAN ENERGY ECONOMIES AS A SHARE OF STATES' OVERALL ECONOMIES

It is important for states to know just how many of their total jobs fall within the clean energy economy. Nationally, jobs in the clean energy economy accounted for 0.49 percent of all jobs in 2007; 22 states exceeded that national average.



	TOTAL JOBS	PERCENT CLEAN		TOTAL JOBS	PERCENT CLEAN		TOTAL JOBS	PERCENT CLEAN
Alabama	2,193,589	0.36%	Kentucky	2,069,602	0.45%	North Dakota	422,054	0.50%
Alaska	388,361	0.55	Louisiana	2,326,888	0.46	Ohio	6,304,302	0.56
Arizona	2,661,437	0.44	Maine	707,195	0.85	Oklahoma	1,784,492	0.31
Arkansas	1,366,809	0.34	Maryland	3,108,256	0.42	Oregon	1,902,294	1.02
California	17,556,872	0.71	Massachusetts	3,870,356	0.69	Pennsylvania	6,542,137	0.59
Colorado	2,668,069	0.64	Michigan	5,279,234	0.43	Rhode Island	549,754	0.42
Connecticut	2,150,723	0.47	Minnesota	3,143,012	0.64	South Carolina	2,059,151	0.55
Delaware	502,773	0.47	Mississippi	1,356,603	0.24	South Dakota	444,659	0.37
District of Columbia	1,021,958	0.52	Missouri	3,178,657	0.37	Tennessee	3,144,614	0.49
Florida	9,903,922	0.31	Montana	512,093	0.42	Texas	11,726,811	0.47
Georgia	4,955,677	0.33	Nebraska	1,038,673	0.51	Utah	1,291,211	0.40
Hawaii	651,894	0.42	Nevada	1,280,532	0.28	Vermont	365,646	0.59
Idaho	718,373	0.63	New Hampshire	735,051	0.55	Virginia	4,238,337	0.40
Illinois	6,792,326	0.42	New Jersey	4,957,892	0.51	Washington	3,098,042	0.55
Indiana	3,348,351	0.52	New Mexico	970,632	0.50	West Virginia	792,474	0.39
Iowa	1,800,264	0.43	New York	9,964,700	0.34	Wisconsin	3,150,000	0.48
Kansas	1,531,164	0.52	North Carolina	4,629,118	0.37	Wyoming	302,245	0.47

SOURCE: Pew Charitable Trusts, 2009, based on the National Establishment Time Series Database; analysis by Pew Center on the States and Collaborative Economics

of Columbia have had at least one registered clean technology patent in the past 10 years. Exhibit 15 shows the 10 states with the highest number of patent registrations from 1999 to 2008. See Appendix E for the 50-state table.

EXHIBIT 14
VENTURE CAPITAL INVESTMENTS

Top 10 states attracting venture capital investments in companies in the clean energy economy, 2006-2008. In millions.

California	$6,580
Massachusetts	1,278
Texas	717
Washington	635
Colorado	622
Maryland	324
New Jersey	283
Pennsylvania	233
New York	210
Georgia	180

NOTE: Investment values are adjusted for inflation, reported in 2008 dollars and rounded to the nearest $1,000,000.

SOURCE: Pew Charitable Trusts, 2009, based on data from The Cleantech Group™ LLC; analysis by Pew Center on the States and Collaborative Economics.

EXHIBIT 15
CLEAN TECHNOLOGY PATENTS

Top 10 states in clean technology patent registrations 1999-2008

California	1,401
New York	909
Michigan	749
Texas	414
Connecticut	404
Massachusetts	384
Ohio	309
Illinois	297
Georgia	256
New Jersey	248

SOURCE: Pew Charitable Trusts, 2009, based on data from 1790 Analytics; analysis by Pew Center on the States and Collaborative Economics.

NAACP Joins the Fight for Clean Energy At Centennial Convention, NAACP Partners with National Wildlife Federation

To Support New Energy Economy and Combat Climate Change

New York (July 14) – The ranks of clean energy advocates now includes the NAACP, signaling that Americans from all walks of life support taking action to combat global warming and recharge America's economy. Today the NAACP approved a historic resolution addressing climate change for the first time in the organization's history.

During the legislative session of the NAACP Centennial Convention, delegates ratified a climate change resolution "to work with the National Wildlife Federation" to support legislation that curbs global warming pollution. Calling on our nation's elected leaders, the NAACP resolution pledges to "ensure that the response to climate change can take a higher ground than business as usual – one that ensures that we capture the real public benefits from the new energy economy."

"At its Centennial Convention, the NAACP has opened a new front in the fight for clean energy," said Jerome Ringo, past chairman of the National Wildlife Federation Board of Directors and president of the Apollo Alliance. "When the United States negotiates an international treaty in Copenhagen this year, Americans must be united in our commitment to curb global warming pollution. NAACP is signaling that unity will include the African American grassroots."

"This is a breakthrough moment on the path to our clean energy future," said John Grant, National Wildlife Federation Board of Directors and CEO of 100 Black Men of Atlanta. "Clean energy is the key that will unlock millions of jobs, and the NAACP's support is vital to ensuring that those jobs help to rebuild urban areas."

"Although everyone feels its effects, the impacts of global warming are disproportionately severe among communities of color," said Marc Littlejohn, manager of Diversity Partnerships, National Wildlife Federation. "We need to protect low-income Americans, who spend a much larger share of income on energy-related expenses. We need to help Americans working in carbon-intensive industries transition to clean energy jobs."

Passage of the American Clean Energy & Security Act in the U.S. House has provided a major opportunity to move legislation to the President's desk this year. The White House and Congressional leaders are committed to making clean energy a priority. Now, we need to keep the clean energy bill moving in the Senate – and make it even stronger. Clean energy will allow us to begin cutting the pollution that is already affecting our communities and natural world, reinvest in our economy, and help families and workers.

National Wildlife Federation is America's conservation organization inspiring Americans to protect wildlife for our children's future.

Contact: Aileo Weinmann, Communications Manager, 202-538-5038, weinmanna [at] nwf [dot]org

NWF/NAACP JOINT RESOLUTION ON CLIMATE CHANGE

WHEREAS, the impacts of climate change disproportionately impacts the communities of color; and

WHEREAS, globally, climate change is likely to cause damage in excess of $600 billion per year, with particularly negative effects in Africa

WHEREAS, about 160,000 people die every year worldwide from side-effects of global warming ranging from malaria to malnutrition and reduction of agricultural output in many poorer countries; and

WHEREAS, an additional 80-90 million poor people could be at risk of hunger and malnutrition later in the 21st century and poorer countries are much less able to withstand the devastation caused by extreme weather events, and climate change is likely to increase such events; and

WHEREAS, over 70 percent of African Americans live in counties in violation of federal air pollution standards; and

WHEREAS, in every one of the 44 major metropolitan areas in the U.S., African Americans are more likely than Whites to be exposed to higher air toxic concentrations. As a result, African Americans are nearly three times as likely to be hospitalized or killed by asthma.

WHEREAS, solving the climate crisis can create 5 million 'green' jobs that will be in places where they are needed most

WHEREAS, a new energy policy can reduce the burden of low and moderate-income households spending a larger share of their budgets on energy and other basic costs of living than better-off households; and

WHEREAS, the Intergovernmental Panel on Climate Change reports that the average surface temperature of the earth increased nearly 1.4 degrees Fahrenheit in the 20th century, due primarily to human caused climate change.

WHEREAS, scientists project an increase of 3.2-7.2 degrees Fahrenheit in the 21st century, depending upon the extent to which climate change pollution is reduced.

WHEREAS, we have an opportunity to end energy policies that drain jobs from our economy, put our communities at risk of heat waves and flooding, and drag America into conflicts over energy resources overseas; and

WHEREAS, meaningful climate change policy can create real public benefits including millions of good green-collar jobs and build an inclusive green economy strong enough to lift people out of poverty; and

WHEREAS, energy prices are already rising dramatically as the world's supply of fossil fuels to keep pace with increasing demand

BE IT THEREFORE RESOLVED THAT, the NAACP will call on our nation's elected leaders to ensure that the response to climate change can take a higher ground than business as usual – one that ensures that we capture real public benefits from the new energy economy; and

BE IT THEREFORE FURTHER RESOLVED THAT, the NAACP supports climate change policy that will build a new generation of good jobs, rebuild urban areas and support rural areas, and protect families, communities and public health, and help elevate our nation as a world leader

BE IT THEREFORE FINALLY RESOLVED THAT, the NAACP resolves to work with the National Wildlife Federation and will urge all of its units to support legislation and other efforts to curb greenhouse gas emissions, reverse the process of climate change and promote the new green economy

Senator CARPER. Thank you very much.

I have a question. I want to ask Mr. Doerr and Mr. Krenicki to talk to us a little about the green jobs that you are creating, and seeing created.

But before I call on you to do that, let me just note that, on the issue of whether or not global warming legislation, cap-and-trade legislation, cap-and-trade regime, would somehow disproportionately impact minority families, or low income families for that manner, I believe that in the legislation that the House has sent, it is not a perfect bill, I am not here to say it is a perfect bill, and there are ways that we can improve it, and hopefully we will get some good ideas from the four of you today as we will from others, but I believe they have tried to address the concerns that low income families would bear a disproportionate burden here.

I believe that they have crafted the legislation so that the lowest 20 percent income families would basically get a pass in terms of any increase in their energy costs because of this legislation. For those who are not covered, who are not among the lowest quintile, the lowest 20 percent, I am told the CBO, which is not a Democrat, not a Republican, but is non-partisan, in looking at the legislation, they have estimated that the impact on the average American family for the legislation on the utility bills would be about $170 a year. That is about, it works out to about, $1 or $1.20 per day. It may be not even that much, it may be half that much.

Congressman Rick Boucher, who comes from the coal part of Virginia, told us earlier this week it is about the cost of a postage stamp for most families. That is not a huge burden, even on folks who might be in the lowest 20 percent, but certainly not for those of use who might be more fortunate.

Let me just hear from our first two witnesses. Talk to us a little bit about some of the green jobs that you have been involved in creating, and others. I was with the DuPont Company about a week ago. They are working on a very thin film that will be used on their solar operations, a permeable film that is about one-three-thousandths the thickness of a hair.

Part of what they hope to be able to do with that is to enable us to create power generation capabilities, solar power generation capabilities, for our soldiers. Instead of carrying around these battery packs that weigh 30 or 40 pounds, they will carry around something that weighs a couple of pounds.

We are going to be building a DuPont windmill farm off the coast of Delaware, the first in the Nation, about 3 years from now, providing about 20 percent of our energy needs in the DelMarVa Peninsula. We hope to actually build a steel mill in Northern Delaware that will actually build the windmills, the foundations for the windmills, and provide a lot of jobs for that.

The DuPont Company out in Tennessee, they started working with the energy research grant for DuPont with energy several years ago on the idea of how do we use biofuels, how do we use corncobs, cornstalks, and so forth, to actually create a more energy efficient biofuel, and that, we think if it will take off, it will be a big deal for not just for DuPont but for our country.

So, those are just a couple of the ideas that I have seen in the last week in my own little State. Let me ask Mr. Doerr and Mr. Krenicki for some of your examples.

Mr. DOERR. Thank you, Senator. I will take your question in three parts: jobs, costs and then innovations.

On the job costs, Ranking Member Inhofe, in California, the global warming bill has not yet been started. We have not pressed the start button. The surveys I saw, I was involved in working on this legislation, showed that it would generate 84,000 net new jobs in California and almost $100 billion a year in additional income. And of course we have not seen it yet because we have not pushed the start button on that important legislation.

I said besides jobs, I would speak to costs. Senator Carper, you are exactly right. And by the way, I have read all of these cost studies. We could get into dueling modeling wars until the sun sets, but I want to say very clearly about the CBO study of Waxman-Markey, which is respected, that for the lowest income quintile——

Senator INHOFE. Madam Chairman, since our witness mentioned my name, I want to at least respond.

Senator CARPER. Wait, wait, wait, wait, wait. I was very patient, listening to others talk. I want to have him respond to my questions. I am a very patient guy but, damn it, I want to be given the respect that I gave you.

Senator INHOFE. You are implying that the study, it was a study that was made by California State University, not studying what is already happening.

Senator BOXER. Let me talk.

Senator INHOFE. I will submit this for the record.

Senator BOXER. I am going to add just 60 seconds, Senator Carper, because you could lose your train of thought by being interrupted.

Senator CARPER. Sure.

Senator BOXER. Interruption is not appropriate, regardless of who is interrupting whom. So, Senator Carper, please continue.

Senator CARPER. Thank you very much. I ask our witness to proceed.

Mr. DOERR. Senator Carper, to your point, the CBO study showed that, in fact, there would be a net benefit of $40 per year per household by 2020 of the Waxman-Markey legislation.

What I want to say about all of these modeling studies, to everyone here in the room, and I read them all, is none of them, not any of them, factor in any kind of innovation. They assume that Americans do not invent, or that costs get lower as we saw with the sulfuric rain emissions legislation.

So, I see entrepreneurs today working on technologies that will lower the costs by 90 percent of separating the CO_2 from coal to make carbon capture and sequestration economic. I see entrepreneurs today working on these third generation solar films, so that we can have solar across the country, not just in sunny Nevada, that is equivalent to the grid prices.

I have seen entrepreneurs who are working to take CO_2 and instead of burying it under the ground, turning it into valuable products, building products like asphalt for roads. All of this innovation

is possible. But it is not enough, and we do not have strong domestic markets, to encourage its development without this legislation.

So, whether it is on the point of view of the costs and its effect on the lowest incomes in our country, from the point of view of the jobs, or the possibility of innovation, we need to put a price on carbon and a cap on carbon emissions or, as Mr. Krenicki said, we will not develop the large domestic markets that will give us a chance to lead.

Thank you.

Senator CARPER. Thank you.

Mr. Krenicki.

Mr. KRENICKI. Senator, GE Energy employs approximately 65,000 employees. Seventy percent of our revenues come from outside of the United States. So, we are an export-oriented American business. I will give you just a couple of quick examples.

Greenville, South Carolina, is one of our large manufacturing sites. We make heavy duty gas turbines. But it is also our second largest wind turbine site. We entered the wind turbine business 7 years ago. We brought Enron's wind turbine business out of bankruptcy. Today, we are vying for No. 1 worldwide in wind and have created several thousand direct jobs on the GE payroll as well as indirect jobs based on our purchases of raw materials in the United States, including things like transportation. Our transportation bill alone in wind turbines is over $700 million a year. So, you can see what we feed into the economy building up that business.

But it is not just wind. In Greenville, South Carolina, we are manufacturing heavy duty gas turbines that will supply the largest combined water and power plant in the world in Saudi Arabia, 10 percent of the electricity and 20 percent of the water for the kingdom of Saudi Arabia.

We are also building, with our customer Duke Energy and Bechtel, the world's largest coal gasification plant in Indiana, which is employing many thousands of construction jobs on sites. So, there are many ways to turn some of these older sites and give them new purposes going forward.

In Schenectady, New York, where we started GE, Thomas Edison started GE over 100 years ago, we are building and will be dedicating the largest wind technology center in the world, which will employ 500 engineers this year.

So, we are creating new jobs, and a lot of it is driven based on activity outside of the United States, and we would like to make sure that we are participating in the U.S. market as well.

Senator CARPER. A number of us on this panel, certainly my colleague Lamar Alexander and I, are strong advocates of nuclear energy. We have about 104 power plants that currently create nuclear energy. We have got 17 applications to build 26 new nuclear power plants. I understand GE is still in the nuclear business. As far as I am concerned, that is an area that we want to continue to develop. Do you want to comment on that for us, please?

Mr. KRENICKI. I totally agree with Senator Alexander that nuclear has to be part of the mix in the United States. It also requires very strong clear policy. The 2005 Energy Policy Act was 4 years ago, and we still are not moving forward aggressively on nuclear. It needs more support, more certainty.

It also is critical that we are competing on a global scale. We are chasing projects in the Middle East today, where we compete against sovereign companies. We need strong signals from an energy security standpoint, from technology, climate change, but also to be active in the proliferation discussions going forward. We need a healthy, vibrant civilian nuclear industry. So, I agree with Senator Alexander that nuclear has to be a big part of the solution as well.

Senator CARPER. So, what I think I hear you saying is that if we are interested in meeting our energy needs, nuclear has got to be part of it, wind has to be part of it, solar has to be part of this, clean coal has to be part of this, and conservation.

No one has really talked about conservation. We just bought a new refrigerator. I have told my colleagues about it. It reminds me of our new air conditioner that we bought about a year ago. It cuts our electricity almost in half by virtue of both of those.

One of my friends likes to say that the cleanest, most affordable form of energy is the energy that we never use. And I do not want us to forget about conservation. Mr. Wong, you were trying to say something. I have about 50 seconds. Please.

Mr. WONG. Just a comment on nuclear energy. You know, this cap-and-trade aspect of the energy bill that we are considering, it does not pick technology winners. In fact, if it is true that nuclear is going to be the solution, or part of the solution, and science bears this out and the costs bear it out, then putting a price on carbon is going to benefit nuclear. It is going to be good for nuclear.

That being said, I think it is important to be cautious about nuclear for two reasons: costs and water. Studies have shown that the costs of nuclear, of just putting up one plant, is going to be anywhere between $8 billion and $10 billion. So, to build 100 nuclear plants, that is going to cost $1 trillion.

Senator CARPER. Mr. Wong, my time has expired. Let me just say thank you.

Thank you for the extra minute, Madam Chair. This has been a good exchange.

Senator BOXER. Thank you so much, Senator.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Madam Chairman.

Senator Carper earlier asked why he was the only one quoting Einstein. Well, my crack staff got me this quote from Einstein: When one considers the difficulty of predicting the outcome of a complex system, one need only think of the weather, in which case the prediction, even for a few days ahead, is impossible. So, as we are here discussing and debating these kinds of issues, I will kind of get back to Einstein.

Mr. Alford, I appreciate your being here today. In your written testimony, you talked about green jobs gain would be swamped by jobs lost in old industries and businesses, leading to a net loss, I think you said, of 2.3 million to 2.7 million jobs. You went on to say that the impact would differ across regions, across industries and across income levels.

I wonder if you would just take a little bit of time to elaborate further on what regions of the country you think might lose some

of these jobs, where that would be the greatest, and if you think small businesses would be disproportionately affected.

Mr. ALFORD. Yes, I think it was Senator Bond who had a map, a chart, up there that identified various States. If you look at the geography, the demographics of black population of the United States, the worst hit areas happen to be these areas, such as Illinois, Michigan and Ohio. Then you look at the renewable energy standards. Yes, that map there. Those darker colors are probably the most populated, the biggest black populations in the United States. You have Texas, Illinois, Indiana, Michigan, Ohio and such. Those are going to be affected.

Is there going to be a mass migration? Is this going to be the Grapes of Wrath where you leave Detroit and Cleveland and head out to Idaho where the green jobs are and start over again? I do not think so. What is going to happen to those families? What is going to happen to those children, what is going to happen to their futures?

I think we need to look at this, take a hard look, and come up with a strategy. As we do make a better world, a cleaner world, I think we also should make a world that has opportunity for all of us.

Senator BARRASSO. In looking through the report by your Chamber, one of the quotes was, the judgment about what action to take cannot be made simply on the grounds that a cap-and-trade program will create additional jobs and stimulate economic growth. It will not, you say, but on whether the benefits are worth the cost.

That is where I spend a lot of time, on the benefits as well as the costs. Are the benefits of this bill worth the cost to you and also to the small business community and the American economy?

Mr. ALFORD. What are the benefits? The U.S. would produce less carbon than we are today, but what is the benefit worldwide? What does that do to Los Angeles County Basin, where I used to play football and used to have to cough during a football game immensely because of the smut coming across the Pacific Ocean, not because of what Los Angeles was doing, but because of what was coming from elsewhere, from the other parts of the world?

So, what is the benefit? If China, and frankly, if I were China, if I were India, yes, I am going to build out, and I will deal with the United States on the top of the mountain, not while I am climbing the mountain, but when I get to the top of the mountain. I understand that philosophy.

We need to come up with a solution that is going to be a win-win for everyone. But the benefits do not meet the costs, especially for urban communities. And let me speak for the African-American community since I am African-American.

Senator BARRASSO. Thank you very much, Mr. Alford.

Mr. Krenicki, I am impressed with the commitment to try to keep cleaner sources of energy. I have been saying we want to make energy as clean as we can as fast as we can without raising the costs to American families.

You have a project going on right now in Wyoming to use coal, which is an affordable, available, reliable and secure source of energy, but do it in a cleaner way. I was wondering if you could give us an update and talk about that a bit.

Mr. KRENICKI. Yes. We are working with the State and the University of Wyoming to develop advanced technology for Powder River Basin coal and also carbon capture and sequestration. What the coal industry needs is a future and a future technology, a new branch of the tree. We think gasification with captured storage is the way to go. We can create a synthetic natural gas.

I think one idea, also in concert with what we are doing in Indiana with Duke, is we ought to build a half a dozen large scale demonstration projects in this country and get China to go along with us. I think if we did six, they would do six. And we can put in place a technology future for the next 100 years.

So again, we appreciate the support from the State, and we are working very closely there. But it is a linchpin of our strategy of a diversified solution.

Senator BARRASSO. Great. Thank you.

Thank you, Madam Chairman.

Senator BOXER. Thank you very much, Senator Barrasso.

And we will go to Senator Whitehouse.

Senator WHITEHOUSE. Thank you very much, Madam Chair.

I saw in the news the other day that the Toyota automobile company has just filed its two-thousandth patent for its hybrid motor technology, which obviously represents an enormous store of intellectual property now protected by law. And that seems to be a pretty stark example of the advantages versus the disadvantaged of being the tailing versus the leading edge of technology. The intellectual property you gain at the front can have enormous future value. We do not seem to be adequately aware of that in this discussion.

It comes home to me because on Aquidneck Island in the middle of Narragansett Bay we have just put up two enormous wind turbines. The people who live on Aquidneck Island are very proud of them. When they were being assembled and put up, crowds came to watch. People brought sandwiches to see it. I mean, it was sort of a community event. It was almost like a barn raising. So we are very, very proud of it.

And for the folks who put them up, it is a good financial proposition. One of them estimates a 100 percent payback in 5 years, and after that a pure profit at about a quarter of a million dollars a year in electricity savings. So it is a good business proposition on that element of it.

But one of them was manufactured by a Danish company. It was put up in Rhode Island, but the manufacturer was Danish. And the other one was manufactured by a Canadian company that had licensed Austrian technology, and the turbine was assembled in Austria, shipped over to Canada for further assembly, and then just the big pieces put together onsite. So, even our good stories have, right behind them, a story of lost competitiveness.

I would like to ask you to go back to my earlier question, during the opening statements, about what the opportunity costs are. Because, as you have seen in this incredibly frustrating room, there is a very strong do nothing caucus in the Senate. Their emotion is fear, their goal is doubt, and their arguments are precisely aligned with the polluting industries and with big oil. But the premise of their arguments is that it is going to be just OK if we do nothing.

If you could comment on that, I would appreciate it.

Mr. DOERR. Thank you, Senator. We need to look no further than the U.S. automobile industry to see what the consequences, the enormous consequences, are of doing nothing. Our policies sheltered the U.S. automobile manufacturers from meeting high standards for emissions, for fuel efficiency, every year, year after year, in defense of American jobs. The European and Japanese automobile manufacturers rose to high levels of efficiency and were certainly not put at a disadvantage as their nations enacted those standards.

I am confused. The private sector is confused. And we are waiting. And honestly, we are also frustrated. If a large number of multi-national companies, if six to eight American utilities who reach into 35 States in our country, have all endorsed the Waxman-Markey bill, they are in favor of that specific piece of legislation, does that matter at all? Does that mean anything about America's economic future and jobs? I think it should.

Pacific Gas & Electric, National Semiconductor, eBay, Starbucks, the U.S. Conference of Mayors, the FPL Power Group, Siemanns, the Evangelical Lutheran, it goes on and on and on and on. There is not one of these organizations that does not care about jobs or does not care about America's future.

I submit that this should not be a partisan matter. This is about whether or not our country is going to be one of, I did not say the hands down, but just one of the worldwide winners in the next great global industry.

The wind is free that you spoke about. Let me name the top five producers of wind in our country. No. 1 is Vestas. No. 2, GE. There is Gamessa, there is Intercon and there is Suzlon. Only one of the five is American. That is not acceptable.

Senator WHITEHOUSE. Mr. Krenicki.

Mr. KRENICKI. I agree with Mr. Doerr that these are highly competitive global industries. We compete against a multiple number of competitors in the United States, also in Europe and China. Let me give you an example. In the wind industry, we have 70 Chinese competitors that we compete against. So, the stakes are high, and it is tremendously competitive.

But I think that one advantage of acting sooner rather than later, acting now, making a down payment on climate change, taking advantage of a softer environment when commodity prices are lower, we could install and change the energy mix of this country earlier and make a down payment on where we want to take this country going forward. Because that is what other countries are doing.

China installs, per year, the equivalent capacity to the U.K. grid per year. And I can tell you, as a company that operates in China fairly effectively, they are moving forward on all fronts, on nuclear, on wind, on hydro, on biomass, because one of the key elements of their 5-year plan is self-sufficiency. They want to be energy independent. I think we can learn from them. And they will execute and follow through and get it done.

Senator WHITEHOUSE. I just would like to conclude my time with the observation that I think we would do better if we had a common understanding of what our situation is. I see it as time sweep-

ing us relentlessly into a point of change in which a decision has to be made.

It is not enough to say, stop the world I want to get off, as the do nothing caucus would have us do, however beneficial that might be for the polluting industries that would like the status quo to continue. The status quo simply will not continue. That is not a live option. Even though, if we fail, certain industries might benefit, we have to take the view that we have to put in place the parameters for America to succeed as a Nation.

In addition to the economic point of it, some of us, particularly me from a coastal State, I come from the Ocean State, our capital has been leveled by hurricanes. If the ocean level increase that is widely anticipated happens, we will lose whole towns to the encroachment of the sea. For our Ocean State, this is, in many respects, a life and death matter.

And the notion that we can hear these alarm bells going off from very responsible sectors of the scientific community and not act, and not feel any urge to an appropriate precaution, seems to be completely at odds with the reality of this situation.

I would suggest that many of my friends on the other side would be far more cautious in their own lives. I do not think there is one of them, if they woke up in the middle of the night in their home with their family and heard the smoke alarm going, would say, well, I have here a report from the Department of Firefighters Who Would Rather Stay in Bed which says that, you know, 9 percent of these are because of battery failure, so I am not going to check it out, I am not going to wake up the kids. Do not worry; we are just going to stay here in bed.

It would be irresponsible. It would be reckless. It would be taking risks with an important trust, the health of their children. I do not know why it is that, in this room, we behave differently than we would in our own lives if we had a real appreciation of what the circumstances were.

Senator BOXER. Senator, thank you.

Senator Alexander.

Senator ALEXANDER. Thanks, Madam Chairman, and thanks again to the witnesses for coming.

Senator Whitehouse got fired up there as far as his friends on the other side. Here is our policy. We have a low cost, rather than a high cost, clean energy policy.

No. 1, all 40 of us want to build 100 new nuclear power plants in 40 years. That is 70 percent of our carbon-free electricity today, and it would double it to 40 percent of our total electricity.

No. 2, we would like to electrify our cars and trucks for conservation. I believe, personally, that we can electrify half of them in 20 years without building one new power plant if we plug them in at night.

No. 3, we would explore offshore for natural gas, which is low carbon, and oil. We need to use more of our own. And No. 4, we would double research and development for energy. In my view, we should launch several mini-Manhattan Projects on grand challenges such as solar batteries, advanced biofuels, making solar costs competitive, fusion even for the long term, etc.

So that is our position. And I would rather characterize it myself rather than have someone who apparently had not read it characterize it.

Now, let me ask Mr. Doerr a question. The Senator from Rhode Island talked about inaction. I say this as someone who would like to see a climate change solution. I have sponsored one ever since I have been here. I am trying to still figure out why this deafening silence about nuclear power. Not only did the three of you not write about it much in your testimony, you did not even talk about it except when asked.

Let me ask you, Mr. Doerr, do you consider nuclear power a renewable energy?

Mr. DOERR. Nuclear power is a carbon-free energy. My focus and expertise is renewable energies. I am not an expert in nuclear. But I want to tell you this, Senator. I do believe it needs to be part of our portfolio of low carbon solutions for the energy problem.

I would also like to tell you further that I am a supporter of Senator Bingaman's CEDA, the Clean Energy Deployment Act. I understand that is developed in another committee here, but these issues are so important that I know they are coming together. Climate and energy are very complimentary policies, and as I understand it, the Nuclear Energy Institute supports the CEDA because it can help——

Senator ALEXANDER. Well, that is not my question——

Mr. DOERR. Help meet those goals. I am telling you where I stand, Senator.

Senator ALEXANDER. Well, I asked you if you believed it was a renewable energy.

Mr. DOERR. It is a low carbon energy.

Senator ALEXANDER. Right. Well, I want to talk, and I am honestly trying to understand this, I am trying to get the bottom of this, if nuclear energy produces 70 percent of our carbon-free electricity, and our goal is to reduce carbon, why is it not at the top of your list, is it not the major thing you would want us to do?

Would you agree, you did say it was carbon-free and ought to be included, does that mean you think it ought to be part of the renewable energy resources like wind and solar and geothermal and renewable biomass that are encouraged in the renewable energy mandates that the Waxman-Markey bill contains?

Mr. DOERR. My personal opinion? Sure. I think it ought to be encouraged. The scientists would tell us that it actually is not renewable. We are expending resources, uranium, when we are producing this energy. But that is not the reason that it is not at the top of the list.

The reason it is not at the top of my list is it takes 20 years to permit, approve and build a new plant. We need more nuclear in our country. But we also need action on the matter that I came here to talk about today and that matters the most, and that is competitiveness. If we wait a decade to get America in this race, we are out of it. It is gone. As Tom Friedman said, China is going to clean our clock.

Senator ALEXANDER. Well, Mr. Doerr, would you agree that to encourage carbon-free nuclear energy it ought to be included in the Renewable Energy Production Tax Credit, which provides 3 cents

per kilowatt hour for carbon-free electricity produced by, primarily, wind?

Mr. DOERR. What I would agree with, Senator, and I am not an expert on legislation, I come here as a businessman to build jobs——

Senator ALEXANDER. Well, should it have the same Government support that wind does?

Mr. DOERR. Well, it has considerable Government support. Who pays for the costs of disposing of all of the nuclear waste today? The American taxpayer. If we adopt——

Senator ALEXANDER. The American ratepayer, sir. Let me, if I may ask the questions, my questions are, if it is carbon-free, as you have said it is, should it have the same kind of Government support that other carbon-free energy does?

Since 1992, 75 percent of the Production Tax Credit went to support wind. It did not go to solar. So, I would ask you, should nuclear also be supported by the Production Tax Credit, by the Investment Tax Credit, such as supports solar, and should it also be included in the renewable fuel definition so that we encourage all carbon-free energies and, in fact, have a clean energy policy rather than just a windmill policy or a solar policy or a geothermal policy or whatever we might be invested in or think is important to us?

Mr. DOERR. So, I would say no, and here is why, Senator. I think the most important thing for us to do is to get the big policy right. A cap on carbon emissions, and a price for those, as the legislation sets forth, will favor nuclear energy based on its competitiveness, or wind, or solar, and at the highest levels, I do not believe the Government should be in the business of picking the winners and losers. Now let me continue please——

Senator ALEXANDER. But Mr. Doerr, I only have 4 minutes left. The Government has enacted a Production Tax Credit so narrowly defined it is mainly a windmill tax credit. Those of you who are interested in solar energy got the Government to enact support for an Investment Tax Credit, which also includes solar, and which I support.

Mr. DOERR. I do, too.

Senator ALEXANDER. So, now we have Government picking wind, Government picking solar, and wind and solar together produce 6 percent of our carbon-free electricity. And nuclear produces 70 percent. Why should it not be treated the same?

And then our renewable energy mandates, if we included nuclear power, if it were a carbon-free mandate instead of a narrowly defined mandate, we would, I mean, Tennessee would be 40 percent.

Let me ask you this. What if I proposed a 20 percent nuclear power mandate for California because nuclear is 100 percent carbon-free. Would you support that?

Mr. DOERR. Senator, you know how much I respect you. I deeply do. And I was not able to finish my response to your earlier question.

We have got to get a big policy right. It should not pick winners and losers. But that will not be enough. We have a multi-billion dollar incentive right now to get American battery manufacturing in Michigan, which I wholeheartedly support, and we must have it to electrify the American automobile fleet, unless we to trade our

dependence on oil from the Middle East for a dependence on batteries from Asia.

So, my point is the following: in addition to getting the big thing right, the cap-and-trade, it is totally appropriate and necessary for us to target, on a temporary basis, for a period of time, declining over time, wind and solar.

Senator ALEXANDER. What is the period of time? We have been subsidizing wind since 1992.

Mr. DOERR. My guess is it is about another 10 years. Denmark has been subsidizing wind since 1970, and now they are No. 1 in the world. And watch my words, it is for a declining amount over time. Let me get through——

Senator ALEXANDER. You and I agree that wind and solar are not base load energy, that they are a supplement to the base load energy that we need, and that nuclear is really the only source of electricity that we have that is cheap, clean and reliable.

I mean, in order to build the polysilicon plants in Tennessee, you have to have the nuclear plant or the coal plant. You could not operate it based on the solar plant or the windmill.

Mr. DOERR. I would agree with you that nuclear is a base load technology, and it is very low carbon.

Senator ALEXANDER. It is zero-carbon.

Mr. DOERR. It is zero-carbon. I will also tell you, with innovations in the labs, not out in the marketplace, we are seeing breakthrough battery technologies that can make wind, in fact, together with the batteries, dispatch able. And that is the kind of American innovation we want to encourage.

If I can return, not to be a broken record, but return to the most important refrain——

Senator ALEXANDER. Leave me about 30 seconds of my time, if you would.

Mr. DOERR. We have got to put a price on carbon and a cap on carbon emissions across the whole economy without picking winners or losers if we really want America to compete and to get these innovations into the market quickly. I have nothing against nuclear except that it takes 20 years to deploy a new facility.

Senator ALEXANDER. The Tennessee Valley Authority just restarted Browns Ferry. They built it in 3 years. They thought it would take 10 years to recapture the $1.8 billion construction costs. It took 3. And now all those profits are going to have low cost energy so we can build polysilicon plants in Tennessee, keep jobs in Tennessee for auto companies instead of putting them overseas.

See, my concern is that you are exclusively focusing on winners and losers with a renewable energy standard, and you are not having an across-the-board clean energy standard. And you are focusing just on green jobs, and you are not remembering that cheap, clean energy is what will provide the largest number of American jobs. Green jobs are a very small part, a very good part, but very small.

Mr. DOERR. I agree with you that green jobs is a misnomer. And green jobs is limiting. I am talking about jobs that are engineering jobs, they are manufacturing jobs, they are construction jobs, they are blue collar jobs, and they are white collar jobs. But those jobs

are going to come from America committing to a low carbon energy future.

Senator ALEXANDER. And the way to create the largest number of those green kinds of jobs, or those kinds of jobs, would be to build 100 new nuclear plants in 100 years. The welders, the construction jobs, the manufacturers would be many more than these others that you are describing.

Thank you, Madam Chairman, you have been generous with the time.

Senator BOXER. Well, Senator, I know I have been. And I am going to, therefore, put a few things in the record. One of them is that the Waxman-Markey bill modeling shows that more nuclear plants would be built under the Waxman-Markey bill than you are proposing, and the cost would be offset with tax credits, and the ratepayers would not have to pay. That is No. 1.

No. 2, the record needs to show that since the 1950s, we have had the Price-Anderson Act, and the Price-Anderson Act is the taxpayers backing up a nuclear accident. So, to say that there is not taxpayer involvement is not correct.

Also, in recent energy bills, one of them gave long guarantees for nuclear plants, and a Production Tax Credit was in the latest act. So, I just think that when it comes to nuclear, I understand your position, but I really hope you would take a look at Waxman-Markey because, if nuclear is your passion, you are going to have more plants built under that than you would and the consumers pay less. I do not know why we continue to have these arguments.

Senator ALEXANDER. Could I make a correction, Madam Chairwoman?

Senator BOXER. Yes, you can.

Senator ALEXANDER. Under the Price-Anderson Act, the taxpayers never paid a penny for a nuclear accident, and under the way it operates today they would not because, the way it operates, is that every one of the 104 nuclear power plants are liable for up to $100 million in the event of an accident. So, the money would come from the ratepayers and the nuclear plants.

The loan financing that you spoke of is available to all clean energy, which is what I think all of these policies ought to do, and I do not know why nuclear is not included.

And while we are at it, well, I will leave it alone.

Senator BOXER. Well, Senator, I just have to let the facts speak for themselves. The fact is that there is a limit on the insurance that nuclear power plants have to pay because they cannot get the insurance that is required, and the taxpayers are on the hook if there is a major crisis. That is not debatable. That is the fact.

Senator ALEXANDER. No, $100 million——

Senator BOXER. Let me finish. And then I will call on you.

We know the costs if there is a tragedy. What they would be, $100 million may not be enough. That is why the taxpayers, since the 1950s, have stood behind this. I do not know why we argue about everything. That is the fact. And I think you should be grateful for the Price-Anderson Act and the fact that American taxpayers are on the hook. But to say that there has been no involvement of American taxpayers, that just flies in the face of the law.

I think we should, perhaps, have an exchange of letters on the point. But I do not see——

Senator ALEXANDER. I will come visit with you. We do not have to get formal about it.

Senator BOXER. You can visit with me any day of the week. But I will have, when you visit me, a copy of the law, and I would challenge you to show me where we say to our windmill companies and to our solar companies or to even our coal companies that the taxpayers back them up in case of an accident. So, let us not, you know, paint a one-sided picture.

Every major nuclear company that I am aware of supports the Waxman-Markey bill. I met with Entenergy, and there are many others——

Senator ALEXANDER. Well, absolutely they do, because they make loads of money from it.

Senator BOXER. Well, I do not know. On the one hand, you want——

Senator ALEXANDER. It collects $100 billion every year, and a lot of it goes to businesses, and a lot of it goes to certain power companies.

Senator BOXER. Well, I am glad that you admit that they support it.

Senator ALEXANDER. I will come see you about Price-Anderson——

Senator BOXER. Please. That would be great.

Senator ALEXANDER [continuing]. Because the fact of the matter is, taxpayers have never paid a penny as a result of that——

Senator BOXER. We know. We know that.

Senator ALEXANDER [continuing]. And today, if there were any kind of accident, $100 million would come from every one of 104 nuclear power plants. They are self-insured.

Senator BOXER. Well, if you do not think we need it, then let us cancel it.

Senator ALEXANDER. I did not say that. I am just correcting the record.

Senator BOXER. Well, you are saying that $100 million should cover it. You are implying that.

Senator ALEXANDER. I said $100 million times 104. Every one of the 104 plants is responsible if there should be any problem at any nuclear power plant.

Senator BOXER. Well, let us take another look at this act then. Maybe we do not need it. Maybe the coverage the nuclear plants have is enough and we do not need Price-Anderson.

Senator ALEXANDER. It created a mechanism for self-insuring, which does not cost the taxpayer any money——

Senator BOXER. Unless there is a humongous accident——

Senator ALEXANDER. Which there never has been.

Senator BOXER. Well, that is what insurance is all about. You might have heard of Chernobyl. But I think we will just move on, because the fact is, the reason I am perplexed by your opposition to Waxman-Markey is because the nuclear power industry understands that they would build more plants under that than any command and control system that the Senate could devise. I am going to leave it at that.

Senator ALEXANDER. But, Madam Chairman, I did not say a word about Waxman-Markey. All I was talking about was the renewable fuel standard, the Production Tax Credit and the other Federal policies and mandates and asking whether nuclear should not also be included because it is our principal supplier of low carbon electricity. That is all.

Senator BOXER. And my point is that any bill that comes out of this Senate is going to be a boon to the nuclear industry.

Now, I would like to call on Senator Merkley.

Senator MERKLEY. Thank you, Madam Chair. I think the nuclear industry should feel very good about having this argument over whose plan provides more subsidies for nuclear power.

I guess I would have to say that I would like to see nuclear power compete on the same level playing field. I am concerned that by the time you address the possibility of human error, the possibility of natural catastrophe, the possibility of protection against a terrorist attack, you include the life cycle cost of dismantling the plant, you include the costs of reproducing and storing fuel, and I have not seen numbers yet that show it is cost competitive.

What I do not want is an energy policy that drives up the cost of energy in the United States of America. It is simply an economic argument. But there is also an environmental concern if we do have that catastrophe.

But if we can keep the argument in the context of how we create affordable, reliable energy addressing life cycle costs, I think it probably would be helpful.

I wanted to ask about the impact of staying on the course we are on right now. I look at a situation where we had $4 per gallon gas last summer, just a year ago, the fact that we have 3 percent of the oil reserves, that we burn 25 percent of the world's oil in terms of annual consumption, and it looks like a path to me of catastrophe if we do not proactively change our energy strategy, a catastrophe for our economy.

So, I invite insights in very quick form, if I could.

Mr. WONG. Well, Senator Merkley, I think you hit the button on the nail. The cost of inaction, like I was alluding to in my testimony, the cost of inaction is going to be so much far greater than the cost of action.

NOAA came up with a report that was completed under the Bush administration, and they released it about a month ago, that itemized and in very fine detail described the costs of inaction of climate change, what it would do to our agricultural sectors, what it would to our physical environment. So there is really no point in talking about the costs of complying with a climate legislation or climate law if there is not going to be a physical environment for us to live on.

Senator MERKLEY. Yes, and you have made those points very well. But I am really asking the economic argument over what happens to the price of oil and the cost to our economy and the impacts of that on jobs if we stay on the current course and we are looking 10 years down the road.

Mr. WONG. Right. I think current policies do not embrace energy efficiencies. As Senator Carper said, the cheapest form of energy is the energy that we do not use. If you stay on the current course,

we will not be picking the low hanging fruit that is right before us, we will not be seizing the economic opportunity to save costs. Oil and gas prices, particularly oil prices, are going to fluctuate, but they are on the upward trend, undeniably. We have already seen oil prices rebound, doubling the price since the beginning of this year.

We really need to pass legislation that is really aggressive in saving consumers electricity energy efficiency standards and renewable electricity standards.

Mr. KRENICKI. I would just add, Senator, that, as we model the next 20 or 25 years, the demand for electricity will double worldwide, the needs for clean water will triple, and in the oil and gas space, the world will have to develop another five or six Saudi Arabias to meet demand. So, the challenges are dramatic, and a lot of that is driven by what happens outside of the United States. But those are how we see the macro-environment.

Mr. ALFORD. Senator, I think supply and demand cannot be overlooked. Also, I think offshore drilling. We have enough natural gas supplies and oil reserves within the United States that we probably could exploit far more than what we are to keep us for being so vulnerable to price fluctuations with oil.

Senator MERKLEY. Let me turn to a different question. The goal of the House bill is to reduce carbon dioxide by 17 percent over the 2005 levels. That is an interesting number, because the bill also concludes 2 billion tons of offsets, which is actually 28 percent of the 2005 emissions.

Is anyone worried that with so many offsets it will mean really insufficient investment in building a clean energy economy right here in the United States?

Mr. DOERR. Well, Senator, I think you have identified correctly that the design of offsets is a really key issue. I am convinced that we can design offsets so that they add to environmental certainty, not subtract from it, while maintaining price controls. But that is a separate issue and apart from the issue of competitiveness.

Turning to your question about the 17 percent reduction target, I favor a more aggressive target because I think we are well behind the climate change curve. But I am a pragmatist. The 17 percent target appears to be the one that will allow us to start down the march toward a low carbon economy, and it therefore has my full support.

I am convinced, as I have said before, that carbon abatement would be cheaper and faster than most people suggest because of innovation. And if we start with this 17 percent early, and do it at a profit instead of at a cost, then our whole political discussion is going to change.

By the way, every major company that I know of that has set any kind of carbon targets has beaten them and has made money while they are doing that. So, our experience on this is very, very positive. Let us start with 17 percent, or if the Senate can improve it, please do, and get going.

Senator MERKLEY. If I caught that right, you said you are a pragmatist, so you can deal with 17 percent, but you think that to really drive the transformation, we should have a higher number?

Mr. DOERR. Almost. I said I would personally prefer a higher number. But I think if we set any meaningful price on carbon and a cap, for certainty, with respect to the emissions, we are going to unleash a wave of American innovation that is going to make it profitable to go even faster.

Senator MERKLEY. Well, I would certainly agree with that, as long as the offsets do not end up being the way that we pursue this, because if it only offsets and then we do not have, essentially, a market in allocations, then I think that would severely undermine, am I on the right track there, severely undermine the pace of innovation.

Mr. DOERR. I agree.

Senator MERKLEY. Anyone else want to join in on that point? OK.

The point was put forward about a guaranteed market, if you will, in terms of a renewable energy standard. Oregon established a 25–25 standard. That is 25 percent of renewable energy by 2025. That is on top of the hydropower that Oregon currently has, so it really amounts to a 65 percent standard by 2025.

What would be the ideal standard and what would be the stepping, if we took a near-term approach, what should be the standard at 2012 and 2025, from a policy point of view, not from a political pragmatic point of view?

Mr. KRENICKI. In order to stay on the path we have been on for the last 3 years, 12 percent by 2012 would keep things moving forward on the same path. If a broader concept was considered where nuclear or cleaner coal was included, and it was a clean energy standard versus a renewable energy standard, of course the target would have to be even higher. But 12 percent on an as-established standard, because we will finish 2009 at around 6 percent, and what is in current legislation is 6 percent or lower by 2012. So, there would be no incentive for any incremental investment.

Senator MERKLEY. Any argument? Do the other folks agree that 12 percent might be about right to aim for by 2012? Any other further thought on that? OK, that is great.

I am going to turn to the issue of energy efficiency and how much effort should be, well, right now we have it as kind of a junior partner in this bill. Should it be promoted to being a senior partner, and if so, in what format?

Mr. DOERR. If I may, Senator, I think you are on to a very important issue, the power of efficiency. I do not consider myself qualified to determine what part of the bill ought to be this and what part of the bill ought to be that. But I want to make this point, because it goes to jobs, and jobs right away. The most expensive wasteful energy we have in our country is when millions and millions of American homes use their furnace to heat the cold atmosphere, or use their air conditioner to cool the hot atmosphere.

A McKinsey study has demonstrated that the highest return investment in clean energy is home insulation. We have over 1 million out-of-work construction workers right now. And if this legislation was crafted, just modestly, to do two things, provide our utilities a profit incentive for using their scale to employ these millions of out-of-work construction workers insulating American homes, starting at the end of this year, we know how to do this, they know how to do it, the savings for the American consumer would be real-

ized in less than a year, and those savings would re-circulate in our economy.

Our utilities can be much more powerful allies in driving our country to a clean, more prosperous future. They have a 100 percent market share. They have very low costs of capital. They have vast cash-flows. Modest incentives from our Federal Government can get them to be allies in this most important part of efficiency.

There are standards for appliances that are incredibly important, standards for cars. I think you are on to a very, very important topic, Senator. It should be a senior partner.

Senator MERKLEY. My time is up, but I really appreciate all of your testimony and assistance in the committee pursuing a smart energy policy. Thank you.

Senator BOXER. Thank you, Senator.

Senator Udall.

Senator UDALL. Thank you very much, Madam Chair, and thank you to the panel. You have endured a lot here, and I think it has been a very, very good discussion.

One of the things that I wanted to ask about, in particular Mr. Doerr and, Mr. Wong, to you, the contrast here. We have heard with some of the questions a position that this is just going to cost jobs, and repeating it over and over again, if you do the Waxman-Markey bill, it is going to cost jobs. Then you all have been very strong advocates of the other side.

Why do you see such a disagreement here on this? Please, go ahead.

Mr. DOERR. All of the surveys, sorry, all of the claims that I have seen that this will cost jobs are based on surveys, surveys from academicians. They are not based on experience building jobs or building companies.

I want to say another important thing I said earlier, and stress it. All of these surveys from the academicians take no account for innovation. No account whatsoever for innovation.

It is as if we ran a survey 15 years ago that said what impact computes are going to have on America without taking into account the Internet. Fifteen years ago there was no Web browser. How many of us could do our work today without this idea? Point, click, innovation. It has transformed the way we live, work, play, conduct commerce, entertain, inform and educate.

That is what happens when you rely on an economic survey from respected economists in universities and do not take into account innovation. That is my line of business. I have seen the innovations that could be possible. These innovations will occur. They are not going to occur in America if we do not create large American markets, and we need a cap on carbon and a price on the emissions to get there.

Senator UDALL. And I think you are also an advocate of a renewable electricity standard?

Mr. DOERR. Absolutely.

Senator UDALL. And that you believe, too, as I think you responded to a question that if we do Investment Tax Credits for solar and wind and biofuels, those kinds of things, to jump start them for a short period of time. And your argument is that you put all of that together, and you have the Government not picking win-

ners or losers, but moving us in the direction of a clean energy economy.

Mr. DOERR. That is absolutely correct, Senator. There is going to be no silver bullet. The biggest bullet we have got is putting a price on carbon and a cap on emissions. But that alone is not sufficient. That will not get us to electrified clean automobiles fast enough. That will not get us to a competitive world class wind industry with multiple leaders, leaders in addition to the fine work that GE is doing.

So, I believe in targeted incentives. But I believe in getting the No. 1 thing, the big thing, right.

Senator UDALL. Now, the other side of this is, and this has been asked several times in several ways, inaction. We have not taken decisive action in this area. We have debated a lot. The House, in the last couple of years, passed a Renewable Electricity Standard. The Senate passed one. We never came together. We have not been able to. The Chairwoman has been the only one to be able to bring a bill to the floor that was a climate change global warming bill.

So, what are the costs to inaction, as the way you see it? Have those been studied? And where do you think we are headed when we talk about costs of inaction?

Mr. DOERR. I think the real costs of inaction I find terrifying. I think we underestimate how long it is going to take to turn this around. We have no accounting for the true costs to our health, to our competitiveness.

We are dumping 70 million tons of CO_2 in the atmosphere every day as if our skies were some kind of free, cheap, open sewer. We have done no accounting for this.

We have done no accounting for what the science tells us will already happen in the rise of temperatures, the hundreds of millions of people around this earth that are going to starve because of climate change. The people who are the least responsible for these problems, who are least capable to cope with them, are going to be visited with the most severe consequences.

But I am not an expert on those matters. I come here as a businessman who helps people build jobs and build industries. And I know we have barely got a dog in that fight. We are not in the game right now.

Senator UDALL. Mr. Doerr, if we did all of the things that we just talked about there, an RES, a price on carbon, cap emissions, Investment Tax Credits into the renewable area, is it your opinion that there is venture capital waiting out there? I have heard amounts thrown out, billions of dollars of venture capital if you send the right signals, wiling to go into these areas and innovate and experiment and do things in terms of creating jobs.

What are your thoughts on the amounts of capital we could attract by taking this?

Mr. DOERR. Senator, that is an excellent question. Last year, there was about $3 billion of U.S. venture capital in North America devoted to clean technologies. It was No. 3, I must tell you, behind the Internet and behind the life sciences area. I must tell you also that my overwhelming conclusion is that it is not enough. It is not enough by a lot.

But, this is the beauty of Waxman-Markey. This is the beauty of a price and cap. When we send a long-term steady signal to the marketplace that we are going to put a price on carbon and favor the innovative energy that does not rely on it, we unleash enormous, you will unleash enormous market forces. More money flows through the world's financial markets in a day than through all the governments of the planet in a year.

So, with this modest 17 percent cap, with this price that the market determines, we should be investing $50 billion a year of venture capital in North America in clean tech energy innovation. At the height of the Internet boom, we invested $100 billion a year in some very great valuable companies and in a bunch of otherwise inconsequential, anonymous, socially networked chatting Web sites that do not make any difference.

This is vital. This is America's economic future. It is the health of our planet. It is the health of our kids. It is whether or not we are going to lead in the next great global industry.

Senator UDALL. Mr. Wong, please.

Mr. WONG. Thank you. To answer your first question, I think the reason why a lot of these studies that paint this doom and gloom picture, that say that clean energy policies are going to lead to a loss of jobs and increased costs, is that they do not have the vision. They do not have the vision that we have an opportunity to create new sectors that unleashes an incredible amount of innovation and create an incredible new era of job creation.

Some of these studies, they predict that renewable energy costs will remain the same, remain high and never decrease. They underestimate the learning curve that we can work on to reduce these costs as we scale up these new technologies.

I think we can take a page from what China is doing. They have made energy efficiency the pillar of their, not just environmental policy, but economic policy. They recognize that the five most, and this is from Todd Stern who delivered a speech a couple of months ago, they recognize that the five most polluting industries, heavy industries which account for 50 percent of carbon emissions, only provide the employment of 14 million people. That is a lose-lose strategy, which is why they are aggressively working to restructure the economy to move toward the high tech, to move toward clean energy.

They recognize that clean energy jobs create three times as many jobs as their fossil fuel counterparts. That is the kind of strategy that we should be learning from other countries.

Senator UDALL. Thank you. I know, Mr. Krenicki, that you, and it is a little bit off of this committee, but you had advocated for a stronger RES standard, the Renewable Electricity Standard. Could you just tell us briefly, as a businessman, how the lack of a strong Federal standard impacts a multi-national firm's investment decisions about to locate a manufacturing facility or create new clean energy jobs?

Mr. KRENICKI. OK. Just in the wind business, we have the same capabilities in China and Europe, and will have in India shortly, that we have in the United States. Our employments and levels of production will fluctuate based on the local market.

One thing about the wind industry is transportation costs are very, very high. Components are large. So, it makes sense to manufacture in the largest markets, and that is how we see the dynamic. So, if the U.S. market, on a relative basis, is big, our employment here will follow that trend and vice versa.

Senator UDALL. Thank you, Madam Chair. It has been an excellent panel.

[The prepared statement of Senator Udall follows:]

STATEMENT OF HON. TOM UDALL,
U.S. SENATOR FROM THE STATE OF NEW MEXICO

The naysayers on climate change say that we could hurt our competitiveness if we act "unilaterally." I believe the naysayers have it exactly backwards. In fact, we have been unilateral in our failure to act. There is mounting evidence that nations like China are moving ahead of us in the race to clean energy.

Chinese fuel economy standards are higher today than ours will be in 2020. China is at 35 miles per gallon for 2008 and going to 42 miles per gallon by 2016. We do not reach 35 MPG until 2020.

China has already set a 15 percent renewable electricity standard (RES) for 2020, and their government recently said they could reach 20 percent. In the United States, the House and Senate have separately approved an RES in recent years but have failed to achieve final passage.

The EU has a 20 percent RES which is projected to create 2.8 million jobs in solar panel and wind turbine manufacturing where they already outrank us.

Germany has a 30 percent RES by 2020 and a 50 percent target by 2030. Germany is a global leader in solar power, despite being at the equivalent latitude as Alaska.

In fact, at least 66 nations by our count have a national target for renewable energy, including China and India, meaning that the U.S. is isolated for its lack of an RES.

Brazil is the world's largest producer and consumer of renewable transportation fuels, and 45 percent of Brazil's energy comes from renewable energy.

China and Germany are vying for the world's leader in renewable energy investment, with each over $12 billion per year.

South Korea will invest $84 billion in renewable and efficiency over 5 years.

Including energy efficiency, China is investing over $220 billion between now and 2010 to green their economy as part of their fiscal stimulus package, over $12 million each hour.

In 2009, China became the world's largest clean energy investor and plans to spend nearly a half-trillion dollars over 10 years.

China is the leading manufacturer of wind turbines and looking to expand to the U.S., and they have 65 percent of the solar thermal water heating market.

China generates a higher percentage of its power from wind power than we do in the U.S.; in fact the U.S. ranks only 10th worldwide.

In the early 1990s, the U.S. invested solar photo-voltaic technology, but now China is the largest producer, and we rank 5th, behind Japan and Germany.

India has launched its National Solar Mission, which plans to install 20 gigawatts of solar by 2020 to bring the cost down to fossil fuel levels.

Investors across America, from Silicon Valley, to Wall Street, to Main Street, to the innovation hubs of New Mexico want to join in, but they need leadership from Washington, DC.

Senator BOXER. Thank you.

Senator Klobuchar.

Senator KLOBUCHAR. Thank you very much, Madam Chair. Thank you for holding this hearing. I have been going back and forth to another hearing where there are a lot of cameras and lights, so it is nice and cool in here. Thank you.

I wanted to focus a little bit about our competitiveness in this clean energy new world. I was thinking that we had, in the 1960s we had a space race, in the 1980s we had an arms race, and now we are in the middle of an energy race.

I am one to think that we have to look at all kinds of energy sources, including nuclear, and I am glad that we are discussing that and that it will be, I believe, part of a solution.

Last week, a fellow Minnesotan, Tom Friedman, published an article where he talked about how China's views on energy have changed over the years and that they have set some very aggressive standards. I think it is $462 billion in renewable energy by 2020.

In each of the last few years, China has increased wind power by 100 percent. They are increasing solar power, and in fact, he quotes someone in this article, a guy named Hal Harvey, the Chief Executive of Climate Works. This guy says China is moving, they want to be leaders in green technology.

China has already adopted the most aggressive energy efficiency program in the world. It is committed to reducing the energy intensity of its economy, energy used per dollar of goods produced, by 20 percent in 5 years. They are doing this by implementing fuel efficiency standards for cars that far exceed our own, and by going after their top thousand industries with very aggressive energy efficiency targets. And they have the most aggressive renewable energy deployment in the world for wind, solar and nuclear and are already beating their targets.

I was just recently there with Senator McCain and Senator Graham and sort of scraped the surface on some of the energy issues there, but also visited some of the surrounding countries like Japan, which has been doing more with nuclear and we visited a nuclear reprocessing plant there, as well as in Vietnam where the Prime Minister of Vietnam said his No. 1 issue is climate change for their country. So, you see concern growing in Asia, but you also see some of the solutions coming from Asia.

I get very concerned that, while we may have won the space race and got all of the benefits out of it from the technology that came out of it from GPS monitors to pacemakers to CAT scans to those little chocolate space tics that my family used to take on camping trips in the 1970s, that if we do not really jump start the standards for energy efficiency and for new energy that we are going to fall behind, and we are going to lose this energy race.

That is really where I am coming from in terms of looking at jobs in my own State where, as some of you may know, we have a very aggressive renewable portfolio standard, 25 percent by 2025 and 30 percent for excel energy. And out of that has come a higher percentage of these energy jobs, the renewable energy jobs, in our State than other States.

I think I saw a report recently that while jobs overall had increased something like 2 percent, we were at 11 percent for those clean energy jobs, and the rest of the country was at 9 percent. I am sure that it has something to do with the fact that we worked on a bi-partisan basis with the Republican Governor and a Democratic legislature to get these aggressive standards through.

So, I guess I would start with you, Mr. Doerr. You made a powerful statement your testimony that China is winning the race to lead the world in producing clean energy. What will it take to tip the scales back for U.S. entrepreneurs?

Mr. DOERR. Thank you, Senator. I agree with all of the observations that you made. They are just right.

Here is what I think it takes. Fifty years ago our country got a signal. The signal was Sputnik. It was a long-term signal. And it told us that America had fallen behind the Soviet Union in the race for innovative technologies. And because of that signal, in less than 10 years and, indeed, 40 years ago last week, we put a man on the Moon. A coordinated effort throughout our country. No one would have thought it possible.

We do not have, in our country, such a signal for clean energy or for innovation. And what it is going to take is for your committee, our Congress, to put in place a simple, clear, long-term signal that clean carbon energy is valuable and energy with carbon is more costly.

Just enact a cap on carbon emissions, a price on carbon, and your action will be the signal, it will be the Sputnik for decades of innovation in our country, for our country and for the world.

Senator KLOBUCHAR. Mr. Krenicki.

Mr. KRENICKI. I have nothing to add other than I agree.

I think you mentioned nuclear in Vietnam. We have four nuclear plants under construction, all in Asia, none in the United States. This is 4 years after the 2005 Energy Policy Act. So, nuclear needs help as well. And we are building a big manufacturing site in Hai Phong, Vietnam, precisely because it has a big market.

Senator KLOBUCHAR. I was there.

Mr. KRENICKI. It has a big market. We think Vietnam is going to be a big market where we will sell product into for the next 50 years. So, we agree.

Senator KLOBUCHAR. General Electric has been a leader in nuclear for many decades. What do you think we could do here? I know that the bill that the House passed has some incentives, I think the Chairman mentioned, for 200. What more do you think we could do in the Senate bill?

Mr. KRENICKI. I would say two things. One is this concept of allowing nuclear to be part of a cleaner energy standard could be very powerful, opening up the envelope and setting a higher target. So, giving companies more room to maneuver in a low carbon environment is one possible solution.

The other is, the nuclear industry is heavily impacted by the financial crisis, so the level of loan guarantees if insufficient to restart the industry. You know, $18.5 billion, that could build maybe three nuclear plants. Three nuclear plants do not create a U.S. nuclear industry. It creates an incremental export opportunity for non-U.S. nuclear suppliers.

Senator KLOBUCHAR. I mentioned that our State has this aggressive renewable standard, and it has created more jobs in our State. I have been disappointed by the House renewable standard. I just really do not think it is going to get us to where we want to go.

Senator Snow and I have a bi-partisan bill which we put forward with a standard similar to what Minnesota has with expansive definitions of what would be counted. Could you comment on that? Why do you think it is important to increase the near-term target, and what are your thoughts on a longer term target?

Mr. KRENICKI. I think the reason it is important to increase the near-term target is that the industry is going to react to 2012 much more so than to 2025. In order to continue to grow this industry, and keep jobs increasing versus being cut in half, a 12 percent target by 2012 would keep that going.

If I look at other countries as a proxy for where the United States could be, a country like Spain operates at well over 20 percent today. And they do not have a greater renewable energy resource than the United States. If you look at the U.S., it is blessed with tremendous renewable resource.

Senator KLOBUCHAR. So you are talking about non-nuclear, you are talking about solar, wind and these things——

Mr. KRENICKI. And biomass.

Senator KLOBUCHAR. And biomass. Geothermal, I do not know——

Mr. KRENICKI. Geothermal.

Senator KLOBUCHAR. So that is, we have waste energy, we include that in our bill. So, these other countries are much higher and have seen——

Mr. KRENICKI. Absolutely.

Senator KLOBUCHAR. And do you have job figures on them? What they have seen out of this?

Mr. KRENICKI. We could certainly provide that, but right now we believe roughly about 85,000 jobs have been created through 2008 and that is a trend that we think we would see continue over the next three or 4 years at 12 percent. If what was proposed today in the House bill or the Senate bill, we think at least half of those jobs would go away.

Senator KLOBUCHAR. OK.

Mr. Wong, do you want to add anything?

Mr. WONG. We definitely support a rigorous renewable energy standard because I think it demonstrates the farsightedness in that such signals will create new clean energy sectors and create jobs and unleash the innovation that we need. China has already embraced this.

The U.S. has been stuck on a path of business as usual, especially for the past 8 years. Now we have the opportunity to turn the corner.

In China, it is no longer business as usual. Since 2006, in the Eleventh Five Year Plan, they have thrown down the gauntlet. They have made energy efficiency a priority. They have made new energy development a priority. And as we know, the Eleventh Five Year Plan is like the 10 Commandments to the Chinese.

And so, I think that we have to ask ourselves the question: do we want to be a buyer of clean technologies in the future, or the sellers? We really endorse the climate legislation that is before us, and we really urge the Senate to seize the economic opportunity.

Senator KLOBUCHAR. Mr. Alford, beyond the legislation, I know you do not agree with it, do you see the potential here for jobs with this new energy potential?

Mr. ALFORD. I am on the record for saying I see a loss in jobs. I think the key is self-sufficiency, Senator. I do not think China is concerned about being the leader. They are trying to be self-sufficient. So should we.

So, I think self-sufficiency is the key from a national security point of view, and I think we need to look at all of the aspects. Certainly, nuclear has got to be a key player in this. My Paris Chapter raves about nuclear energy. It is the salvation of their country. And Denmark is happy, and Spain is happy.

We could be happy, too, if we just had a policy. And self-sufficiency is the key.

Senator KLOBUCHAR. Homegrown energy. Mr. Krenicki, with Spain, it was not just nuclear, it is also renewables, is that right?

Mr. KRENICKI. Spain has been heavily renewables but also has some nuclear plants. It also has invested a lot of money in high efficiency gas turbines. So, state-of-the-art technology there is pushing 60 percent efficiency. They have been very active.

Senator KLOBUCHAR. OK. I have gone beyond my time. Thank you so much to all of you. It is helpful.

Senator BOXER. Thank you, Senator. I am just going to ask a couple of questions, and then we are going to close this hearing.

I thought that Senator Barrasso was interesting when he quoted Einstein and he said that you cannot predict the weather let alone try to predict the outcome of legislation. Well, that was his point. But here is the beauty of this. History; history does not lie.

In the 1990 Clean Air Act Amendments, there was Edison Electric Institute, who is now supporting our efforts on cap-and-trade, thank you, this is what they said in fighting the cap-and-trade bill back then. They said, we estimate that the acid rain provisions alone could cost electric utility rate payers $5.5 billion annually between enactment and the year 2000, and increasing to $7.1 billion from 2000 to 2010. Therefore, the total costs to consumers from enactment by 2010 could reach $120 billion.

On the record, what happened? The exact opposite. Electric rates declined by an average of 19 percent from 1990 to 2006. Adjusted for inflation, they were still 5 percent lower than when the Clean Air Act Amendments were passed, and coal State residents saw rate decreases averaging 35 percent.

Here is my point in repeating these historical facts. I think we need to learn that every time we move forward to clean up pollution there are all these dire predictions, loss of jobs, economy slowing down, gloom and doom. Honestly, every single time they have been proven wrong.

And as I said, the Congressional Record is littered with the gloomers and doomers. You know, one thing I remember, I have served with four Presidents. And I remember that the thing about Ronald Reagan that everyone loved, you could not help but love, was this optimism that we are America, and we can do it.

I have to say, Mr. Doerr, all of our panelists have been extremely effective in their rhetoric, their words, their vision, whether they are for or against, but you just said a few things in this that just spoke from the heart that I found to be extraordinary and would like to extract them from the record and really quote you as often as I can.

This challenge presents this amazing opportunity. Even if the scientists were wrong, doing what we are doing is going to make us energy independent, as Mr. Alford has stated is important for us. It is part and parcel with what will result if we do this right.

So, I wanted to put again into the record the rhetoric and the reality with the Clean Air Act Amendments.

I also wanted to talk with Mr. Alford about his statement in the record that he read to us where he said, climate change is a vital issue that must be addressed. I assume that you believe that we should address climate change?

Mr. ALFORD. Absolutely. That is a no-brainer. Something is going on out there, and we should address it. I think it is a no-brainer, climate change, the issue. How we go about doing it, that is the debate.

Senator BOXER. Well, Mr. Alford, I want you to know that there are some people in the Senate that do not believe that it is really happening. I am happy to know, on the record, that you think something is going on and it has to be addressed. You said that quite clearly.

You also said it will take time and cost money to mitigate humanity's influence on our climate. I do not think there is any disagreement.

And then you said, the thing that concerns me and many of the 95,000 business members of the National Black Chamber, is that any legislation Congress enacts must consider the impacts that costs will have on small and minority-owned businesses, their ability to create jobs, and the impact on the communities they serve. Regretfully, the current legislation out of the House will negatively impact the vulnerable of our society.

Now, I do not think you will find any disagreement that we believe that we do have to look at the impacts, not only on the small businesses in your organization, but all small businesses, whether they are minority-owned, majority-owned, whoever owns them.

I am assuming that you think that we should spend our time looking at that impact, or some of our time. Is that correct?

Mr. ALFORD. Certainly. You should spend much time looking at that impact.

Senator BOXER. Good. I would like you to know that the bill we are putting together, the biggest priority is softening the blow on our trade sensitive industries and our consumers. I just want you to know that. That is the goal.

Now, at the end of the day, your organization may not think we have not achieved it. But I also want you to know that with Waxman-Markey, and their analysis comes out with a different opinion than yours, shows that, the analysis by the Congressional Budget Office shows that the lowest quintile, the people you say are the most vulnerable, actually come out ahead by $40 due to the automatic refunds that people will be getting on their utility bills.

The only thing I am asking from you, because we went at it pretty hard, is that I hope you will take a look at that analysis. And ask CRA to take a look at it as well. Would you do that and get back to me as to whether there is any change in your opinions?

Mr. ALFORD. Madam Chair, I will do that.

I have been around the block a few times. People are not going to get that refund. It is not going to hit them. People are going to be unemployed, and they are not going to have any recourse whatsoever. The Government will have failed them again.

Also, I want to take you up on, I want our board to hold a board meeting in San Francisco, and the topic will be the green jobs of California, and we want to get on a bus and go see them.

Senator BOXER. Absolutely.

Mr. ALFORD. Yes, Madam.

Senator BOXER. I have already called ahead to the Apollo Alliance, and I asked them if we can do something like this. We will decide where we want to go, both of us, together, and I definitely would like you to see Richmond Build and Solar Richmond because it is amazing.

I also wanted to say that, when you raised the fact that you are a veteran, for which we are all deeply grateful, it reminded me of the days when my husband volunteered for the Army. He went in for active duty, and then for 6 years he was in the reserves. It brings back memories of those years of not knowing whether or not he would be called. It was the Berlin crisis, and we did not know. And the job insecurity. He was in law school. Would he have to leave, and if he came back?

So, I want you to know that one of the other things I would like to do with you when we are out in California is to look at the reach out to the veteran's organizations that these groups are doing, because it is very heartening to see what they are doing. I am very excited at the fact that you have taken me up on my invitation.

I also have another question. I think I have the answer, but I want to make sure that I understand you. I am sure you agree that, within each community, regardless of whom they are, there is diversity of opinion on this issue. Is that correct?

Mr. ALFORD. Yes, Senator.

Senator BOXER. OK. Because I did get a call from my friends at the House, and they said please put in the record the statement from the Chairwoman of the Black Caucus over there, just because they want to know there are differing opinions. They wanted it included in the record. So, I am going to do that.

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

Senator BOXER. The heat that we felt in this debate is very strong. The reason is we all care so much about this country and its future. And there is such a divide on this issue. The reason I so want to do these hearings, even though they are not easy on any of us, you, me, my colleagues, is because we have to hear everybody's views. We have to see where people are coming from. We have to judge what is best.

There is not book written on this. We are writing it. We are writing one of the chapters today. This is about the 55th hearing we have had on global warming, and we have more to come. So, you really are part of history, everyone here today. And I am ever so grateful.

With that, I certainly feel that I have spoken enough, and I think all of you have had your opportunity. Does anybody on the panel want to say a final word in closing?

If not, I want to thank you from the bottom of my heart for your patience, for your intelligence, for your eloquence, and we stand adjourned.

[Whereupon, at 12:25 p.m. the full committee was adjourned.]

STATEMENT OF THE PORTLAND CEMENT ASSOCIATION ("PCA")

Before The

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Hearing on Ensuring and Enhancing U.S. Competitiveness
While Moving Toward a Clean Energy Economy
July 16, 2009

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I. INTRODUCTION

The Portland Cement Association ("PCA") is a trade association representing cement companies in the United States and Canada. PCA represents 30 U.S. cement companies operating 115 manufacturing plants in 36 states, with distribution centers in all 50 states servicing nearly every Congressional district. PCA members account for more than 98 percent of domestic cement-making capacity.

Portland cement is the essential ingredient in concrete. Concrete, a ubiquitous building material, is the second most consumed material after water globally. Concrete is the foundation of our nation's infrastructure, including roads, homes, bridges, buildings, dams, and levees and newer applications such as platforms for wind energy facilities. It is an eco-efficient material. For example, energy savings from concrete buildings more than offset the greenhouse gas ("GHG") emissions associated with cement manufacturing.

The U.S. cement industry takes its environmental performance seriously. During the last decade, PCA and its members have addressed rising demand for portland cement while at the same time developing and implementing environmentally and socially responsible business practices. The industry has actively invested in technology to reduce air emissions, minimize waste production, recycle and recover inputs, enhance energy efficiency, and conserve natural resources – all the while producing a reliable and affordable supply of building materials to support our economy. As a result, the industry has steadily and consistently improved its GHG emissions intensity over the past two decades.

PCA and its members will continue our efforts to develop innovative solutions to the industry's challenges in adapting to a carbon-constrained world, and we appreciate this Committee's recognition of the need to address U.S. competiveness in the context of federal

climate change legislation. Foremost among the challenges faced by the U.S. cement industry is the risk of "emissions leakage" – that is, a policy-induced increase in GHG emissions outside the regulated jurisdiction that offsets emissions reductions within the regulated jurisdiction.

As producers of a fungible, energy-intensive product that operate in a highly competitive international market, U.S. cement manufacturers are a textbook example of an industry at risk of emissions leakage and jobs leakage. Absent effective measures to address leakage, climate change legislation may have the negative unintended consequence of shifting U.S. cement consumption to imports with a higher GHG footprint, resulting in an increase in global GHG emissions and a decrease in jobs and production capacity in the United States.

PCA projects that by 2020 the nation will need to produce 30 percent more cement than it did in 2007 to meet anticipated demand created by economic recovery and population gains. An even greater supply of cement will be needed to satisfy demand from projects necessary for climate change mitigation ("green" buildings, wind farms, mass transit) and adaptation (flood control, irrigation). U.S. dependence on foreign sources of cement has been as high as almost 40 percent in recent years. If the risk of emissions leakage is not adequately addressed, climate change legislation has the potential to create an inadequate domestic supply of one of the fundamental construction components of our growing infrastructure. If not carefully drafted, climate change legislation could make it prohibitive for cement plants to make the modernization investments necessary to meet this demand and lead to forced closure of domestic plants that will create job losses and hardship in areas throughout the country.

PCA is encouraged by Congress' current efforts to address this critical issue, as well as the Committee's efforts to pursue policies that contribute to a strong, competitive U.S. cement industry, while also meeting climate change objectives. We look forward to working with the

Committee to achieve legislation that meets sound climate change goals without sacrificing the nation's need for increasing cement production and consumption.

II. CEMENT AND THE CEMENT MANUFACTURING PROCESS

Cement is the fine mineral powder that, when added to water and aggregates (*e.g.*, sand, gravel, and other materials), forms concrete. Cement is the binding agent or "glue" in concrete, an indispensable building block of modern economies that is, quite literally, the foundation of cities, suburbs, and factories, as well as the transportation systems and infrastructure that support growing populations and thriving societies. Concrete is second only to water as the most consumed substance on Earth, with almost one ton of it being used for each human every year.[1]

Cement production begins with the extraction of material from shale and limestone quarries. The extracted materials are crushed, ground, and blended to achieve the necessary chemical composition for the raw material feedstock. The raw materials are then fed into a kiln, where they are heated to 2,700° F. The product of the heating process is called "clinker." The clinker is blended with a small percentage of gypsum and other materials and is fed into a grinding mill. The fine powder resulting from the grinding process is cement.

Cement manufacturing results in GHG emissions through three activities: (1) the calcination of limestone (*i.e.*, process emissions), (2) the burning of fossil fuels (*i.e.*, direct combustion emissions), and (3) the use of electricity (*i.e.*, indirect emissions). The heating of the raw materials in the kiln to make clinker results in a chemical process that converts the limestone (calcium carbonate, $CaCO_3$) to calcium oxide (CaO), releasing CO_2. Thus, unlike most industries, cement production results in significant "process emissions" that are an unavoidable and irreducible result of manufacturing the product. In fact, process emissions in the production

[1] www.wbcsdcement.org/concrete_misc.asp.

of clinker account for over half of the cement industry's GHG emissions. Additional CO_2 is emitted directly through the burning of fossil fuels to heat the cement kiln and indirectly through the use of electricity in various stages of the production process. Although cement is the industry's final product, the appropriate metric for regulating the industry's GHG emissions should be based on clinker output, not cement output.

The control of CO_2 emissions based on an equivalent cost of carbon per ton has a far greater cost impact on the cement industry than other energy-intensive industries. For example, although the steel industry emits greater amounts of CO_2 per ton of product, the price per ton of cement is far lower than the price per ton of steel. Thus, the CO_2 emission per value of output is far higher for cement than for steel.[2]

III. FUNDAMENTAL CHARACTERISTICS OF THE CEMENT INDUSTRY MAKE IT EXTREMELY VULNERABLE TO EMISSIONS LEAKAGE

Ideally, the cost increases associated with a climate change policy, whether they are associated with an explicit price of carbon or the implied costs of satisfying certain standards, will be transmitted downstream through product prices – simultaneously providing a clear price signal that encourages more carbon-efficient behavior and shifts the cost of the policy onto end users.

The characteristics of certain industries, however, prevent the pass-through of such costs. Under this less than ideal scenario of limited cost pass-through, companies bear a portion of the cost burden of the policy – placing them at a competitive disadvantage relative to competitors in unregulated jurisdictions. Emitting companies that are faced with a significant and persistent competitive disadvantage are likely to lose market share and/or relocate to unregulated

[2] IEA, Issues Behind Competitiveness & Carbon Leakage: Focus on Heavy Industry, pg. 68.

jurisdictions to avoid the additional cost imposed by the policy – potentially resulting in offsetting increases in global GHG emissions (*i.e.*, leakage). This potential for carbon leakage is exacerbated by the significant GHG emissions associated with shipping cement long distances from foreign countries to supply the U.S. market.

Because of the cement industry's unique characteristics, a poorly designed climate change policy will increase costs for cement manufacturers, resulting in a shift in consumption to imports from unregulated or less regulated suppliers and resulting in substantial emissions leakage:

- Given that suppliers of a homogeneous commodity, such as cement, compete almost exclusively on the basis of price, small cost increases for cement may result in large shifts in market shares – limiting the extent to which cement manufacturers in an internationally competitive market can pass through the costs associated with a climate change policy and increasing the potential for emissions leakage.

- Because cement manufacturing is capital-intensive[3], relatively small losses in market share can result in large reductions in profitability and severe disincentives to investment. As a result, the cement industry is highly sensitive to emissions leakage.

- The United States is an internationally competitive cement market.[4] Thus, a policy that increases costs for U.S. cement manufacturers relative to foreign cement manufacturers will place domestically-produced cement at a persistent and artificial competitive disadvantage and shift market share toward imported cement.

[3] The cement industry ranks high among all manufacturing industries in terms of capital intensity. For example, capital expenditures per dollar of output in the cement industry registered an impressive 8.9 percent in 2006. *See* U.S. Census Bureau, Annual Survey of Manufacturers 2006, Statistics for Industry Groups and Industries. To put this value into perspective, capital expenditures per dollar of output in other key energy intensive and trade exposed industries such as iron and steel (2 percent), aluminum (2.1 percent), and paper and newsprint mills (4.4 percent) were significantly less. *Id.*

[4] During 2004-2006, the industry's trade intensity, as defined under the Waxman-Markey framework, was approximately 19 percent.

- Given the significant emissions associated with transporting cement and clinker long distances, the average carbon intensity of domestically-produced cement is likely to be lower than that of imported cement. Thus, shifts in market share toward imports are likely to increase the GHG emissions associated with U.S. cement consumption.

Environmental regulators in California have already made findings that underscore the severe risk of leakage in the cement sector. In August 2006, California passed Assembly Bill 32: The Global Warming Solutions Act, more commonly referred to as simply "AB 32." This landmark legislation requires that the California Air Resources Board ("CARB") establish a state-wide cap that reduces GHG emissions to 1990 levels by 2020. Importantly, California has recognized the unique nature of the cement industry and the critical need to address leakage in order to achieve the climate change objectives of AB 32:

- "For some energy-intensive industrial sources such as cement, stringent requirements in California . . . have the potential to create a disadvantage for California facilities relative to out-of-state competitors unless those locations have similar requirements. . . . (e.g., through the {Western Climate Initiative 'WCI'}). If production shifts outside of California in order to operate without being subject to these requirements, emissions could remain unchanged or even increase. . . . Minimizing leakage will be a key consideration when developing the cap-and-trade regulation and the other AB 32 program measures."[5]

- "To apply the cap-and-trade program effectively and comply with the requirements of AB 32, the potential for emissions 'leakage' must be considered. While important for all sectors, the assessment of the risk of leakage for industrial facilities must particularly consider the potential for production to shift to outside of California or outside of WCI." [6]

- "If GHG requirements were applied to California cement manufacturing facilities only, the cost of cement from those facilities would rise relative to imports, and imports could displace California productivity. Generally, California's cement manufacturing plants are more efficient than those that produce imported cement. California plants would decrease their GHGs produced, but increased imports

[5] CARB, Proposed Scoping Plan, October 2008, at 31.

[6] CARB, Proposed Scoping Plan, October 2008, Appendix C, at C-151.

> would likely result in a net worldwide increase in GHG emissions. To minimize leakage, in-state and imported products need to be subject to the same standards.[7]

The findings of CARB are equally applicable to the national cement industry. Absent effective measures to address leakage, federal climate change legislation may have the negative unintended consequence of shifting U.S. cement consumption to imports with a higher GHG footprint, resulting in an increase in global GHG emissions.

IV. CEMENT HAS A CRITICAL ROLE IN MITIGATING CLIMATE CHANGE

As a carbon-intensive industry, an engine of economic growth, and an enabler of climate change strategies, the cement industry has the potential to play a multifaceted and constructive role in building a sustainable future. The cement industry constitutes an integral part of the solution in mitigating climate change. For example, virtually all cement is used to make concrete and concrete products. Concrete has a variety of "green qualities" that can be leveraged through innovative product applications to reduce carbon footprints. Moreover, cement is critical to a variety of strategies to mitigate and adapt to the impact of global climate change, including the construction of energy efficient buildings and roads, wind turbines, flood control systems, and irrigation projects.

As stated in its Work Plan for U.S. Cement Industry's Climate Change Program, the PCA has identified product application as providing the greatest promise for CO_2 reductions, including:

- Energy Efficient Structures: Commercial and residential structures built with concrete exterior walls have enhanced energy efficiency.
- Urban Heat Island Mitigation: Light-colored concrete absorbs less and radiates more light energy than dark

[7] CARB, Draft Scoping Plan, June 2008, Appendix C, at C-105.

materials -- whether on pavement, roofs, or other surfaces -- thereby reducing radiated heat energy and thus ambient temperatures.

- Vehicle Fuel Efficiency: Because of its rigidity, concrete pavement enhances fuel efficiency of vehicles when compared to more flexible pavements.

- Lifecycle Analysis: Because of the three applications above, and other benefits, cement-based concrete compares favorably to competing products in terms of GHG emissions reductions and these results should be taken into account in product-selection guidance.[8]

Federal and state agencies have confirmed the importance of concrete (and, thus, cement) in addressing climate change issues. For example, in recommending alternatives to address the "heat island effect" in urban areas, the U.S. EPA refers to "cool coatings" containing cement particles as well as to concrete tile.[9] Under California's Building Energy Efficiency Standards, the California Energy Commission similarly recommends concrete tiles as one type of "cool roofing" product.[10] Other organizations have also promoted the use of concrete for climate change benefits, including in the context of the "Cool Communities" partnership[11] and as a

[8] Portland Cement Association, *Work Plan For U.S. Cement Industry's Climate Change Program* (available at http://www.climatevision.gov/sectors/cement/work_plans.html), at 3. *See also* American Concrete Pavement Association, *Why Is Concrete Such A Great Pavement Choice?* (available at www.pavement.com).

[9] U.S. Environmental Protection Agency, Heat Island Effect, *Frequent Questions* (available at www.epa.gov/heatisland/resources/faq.html).

[10] Consumer Energy Center, California Energy Commission, *Frequently Asked Questions About Cool Roofs* (available at www.consumerenergycenter.org/coolroof/faq.html).

[11] Environmental Council of Concrete Organizations, *Shining A Light On "Cool Communities,"*(available at www.ecco.org).

means for earning certification under the Leadership in Energy and Environmental Design ("LEED") program.[12]

With respect to concrete pavements, the Cool Pavement Report prepared for the U.S. EPA confirms that concrete exhibits much more favorable "cooling" characteristics than any other materials examined, most notably asphalt.[13] Studies have also demonstrated that concrete roads actually increase truck fuel efficiency.[14] In addition, concrete roads have an average life span of 30 years (compared to 10-12 years for asphalt) and require less repair and maintenance. The significantly greater life expectancy and greater long-term resiliency of concrete roads means that road re-surfacing, re-building, and maintenance are conducted less often, using fewer materials and less GHG-emitting construction equipment. All of these savings contribute to reductions in GHG emissions that are in addition to the benefits attributable to "cooler" pavement and enhanced fuel efficiency. In fact, in its "Proposed Early Actions to Mitigate Climate Change in California," the California Air Resources Board identified both "cool roofs" and "light-colored paving" as options for GHG reductions.[15] As the key ingredient in concrete, the availability of cement is necessary to take advantage of these and other climate change benefits attributable to concrete. Thus, preservation of U.S. cement capacity is critical for

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[12] Environmental Council of Concrete Organizations, *LEED Green Building Rating System And Concrete* (available at www.ecco.org).

[13] Cambridge Systematics, Inc., *Cool Pavement Report*, EPA Cool Pavements Study - Task 5 (June 2005), at 14 (Figure 4.2).

[14] *See* Centre for Surface Transportation Technology, National Research Council of Canada, *Test Report: Effects Of Pavement Structure On Vehicle Fuel Consumption - Phase III* (Jan. 27, 2006); Environmental Council of Concrete Organizations, *A Bright Idea: Specify Concrete* (available at www.ecco.org).

[15] Air Resources Board, California Environmental Protection Agency, *Proposed Early Actions To Mitigate Climate Change In California* (Apr. 20, 2007), at 7 (Table 2).

lowering GHG emissions and contributing to the United States' overall climate change objectives.

V. PCA'S CLIMATE CHANGE PRINCIPLES

PCA and its members are studying the carbon leakage provisions in H.R. 2454, the American Clean Energy and Security Act of 2009, and we look forward to discussing those and alternative carbon leakage provisions with this Committee in anticipation of and upon the release of the Committee's discussion draft. While generally supportive of the emission allowance rebate program provided for in H.R. 2454, PCA has serious concerns that the program will not be adequate to avoid leakage in the cement sector, given PCA's projections of increasing cement demand in the United States. For now, however, we will address a flaw in that bill that requires correction and also ask the Committee to consider the PCA's overall climate change principles.

The issue that requires correction in H.R. 2454 is the provision that "[t]he output of the cement industry is hydraulic cement, and not clinker."[16] For purposes of the allowance rebate allocations under H.R. 2454, as well as any alternative leakage provisions under consideration, PCA endorses a clinker-based standard over this cement-based standard included in Title IV of the legislation. The clinker-based standard has a number of indisputable benefits, whereas the cement-based standard included in H.R. 2454 presents significant difficulties. In addition to the advantages of a clinker-based standard described below, it is important to note that the European Cement industry (CEMBUREAU), which has also deliberated over this issue, has taken the position that a clinker-based standard is the most equitable and practical approach for allowance rebate allocations within the industry.

H.R. 2454 uses a production-based GHG allowance rebate approach on direct emissions

[16] Section 762 (7).

(combustion plus process) to minimize leakage. H.R. 2454 also provides allowance rebates for indirect emissions as a means of offsetting higher power costs to minimize leakage. The rebates for a given plant are determined by multiplying the plant's cement production times an industry average carbon intensity level (tons of direct GHG emissions/ton of cement production). The purpose of the allowance rebates for direct emissions is to put the plant at the industry average carbon intensity level in a cost neutral position (GHG rebates would equal the GHG allowance obligation). This can only be achieved through a clinker-based standard. Under the cement-based standard included in H.R. 2454, blending in additional supplementary cementitious materials ("SCMs") such as fly ash and blast furnace slag provides more GHG rebates relative to GHG allowance obligations than would be the case under a clinker-based standard, for those cement plants that are able to produce cement with a lower carbon footprint. Under H.R. 2454, plants with industry average fuel efficiency would receive more rebates than their allowance obligation if they blended in more SCMs than the industry average. Furthermore, the industry average carbon intensity level for rebates is recalculated every four years using an average of the four most recent years of the best available data. Consequently, those cement plants that have access to and can blend in more SCMs have an advantage under the cement-based standard.

This is not an equitable approach. While SCMs contribute to the challenge of reducing GHG emissions within the cement-ready mix concrete supply chain, SCMs are not within any plant's control, and access varies based on the changing locations of coal-fired power plants, blast furnace steel plants, and limestone quarries. It is more equitable to distribute rebates through a clinker-based standard, since clinker is by definition a better metric for combustion and process emissions (converting clinker into cement and blending in SCMs has no impact on direct emissions), and fuel efficiency is within the plant's control.

With a cement-based standard, cement plants could have a competitive advantage over ready-mixed concrete plants for SCM blending. This would then create a competitive distortion of current market conditions without any additional environmental benefit, resulting in a shift of blending from concrete plants to cement plants. It is important to note that adopting a clinker-based standard for purposes of allowance rebate allocations would in no way disincentivize cement or concrete producers from using SCMs. In addition to considering changing from a cement-based to a clinker-based standard, PCA would appreciate the Committee's consideration of the following climate change principles endorsed by the PCA:

- Infrastructure is the backbone of the U.S. economy.
- Cement is an essential component of infrastructure.
- Cement is key to creating energy efficient buildings and pavements.
- Cement is a strategic commodity; domestic production of it is therefore essential.
- Cement production in the United States must increase over the coming decades to meet anticipated increases in cement demand.
- Market and other flexible mechanisms employed to reduce greenhouse gas emissions should be encouraged; distinctions should be made for growing industries and those competing with imports.
- Loss of domestic cement production should be prevented, to avoid increases in emissions in exporting countries and those emissions associated with shipping cement to the United States.
- Measures to prevent leakage must be part of any market mechanism designed to reduce GHG emissions from domestic cement production; the measures must be in effect at the same time the market mechanism is implemented; the industry should be exempt from mandatory reduction legislation if these measures do not withstand World Trade Organization ("WTO") scrutiny. A provisional exemption should be included in any market mechanism proposal.
- Cement industry climate change objectives should be efficiency-based. The efficiency metric should be based on units of combustion emissions per unit of clinker produced. The focus of compliance should be on companies, rather than on individual facilities.

- Emissions associated with calcination should not be subjected to reductions.
- A mandatory GHG measurement and reporting program is necessary to implement market mechanisms; cement emissions should be calculated consistently using the GHG Protocol developed by World Resources Institute and the World Business Council for Sustainable Development (or its successors).
- Cost mitigation strategies, such as emission offsets (*e.g.*, treating alternative fuels as carbon neutral), credit banking and borrowing, investment tax credits, and "safety valves" (carbon price caps) should be employed, as appropriate.
- National legislation should pre-empt all state laws imposing mandatory GHG reductions.
- Demand-side reductions in electricity use should be encouraged.
- Approaches allowing for credit for early action should be considered.
- Building and paving codes should be revised to reward and encourage the use of lower emission cement-based products.

VI. CONCLUSION

The U.S. cement industry faces several formidable challenges in adapting to a carbon-constrained world. Foremost among these challenges is the risk of emissions and jobs leakage. As producers of an energy-intensive and fungible commodity that operate in an internationally competitive market, cement manufacturers will be placed at a severe competitive disadvantage under any climate change regime that does not place equal obligations on all U.S. cement consumption.

Emissions leakage represents a fundamental policy failure that results in lower economic growth and higher global GHG emissions. The complexity of both the global economic system and the issue of global climate change virtually assures that there are no simple fixes or effective "one-size-fits-all" solutions. Consequently, federal policymakers must remain sensitive to the risk of emissions leakage in particular sectors and remain vigilant in their efforts to develop

policy instruments that are calibrated to the unique circumstances, characteristics, and challenges of each industry.

PCA and its members appreciate the Committee's attention to these critical issues and look forward to working with the Committee as it addresses comprehensive climate change legislation.

Public Information and Policy Research **2003**

As a science-based company, ExxonMobil is committed to supporting organizations that research significant domestic and foreign policy issues and promote informed discussion on issues of direct relevance to business and the company's ongoing operations. In 2003, worldwide contributions for Public Information and Policy Research totaled $6.8 million.

We support programs that foster international understanding and engagement and help shape U.S. foreign policy. For example, we fund the Council on Foreign Relations to support constructive public and private discussions and to publish *Foreign Affairs,* a journal on global issues. Our involvement with the Asia Society, the Corporate Council on Africa, the Arab American Institute, Mosaic and other similar organizations, facilitates American understanding about societies and cultures of the world.

Organizations dedicated to researching free market solutions to public policy problems also receive support from ExxonMobil. For example, the American Enterprise Institute for Public Policy Research and the Competitive Enterprise Institute, both dedicated to strengthening the foundations of freedom and to the principles of free enterprise, receive our support. Additionally, through various memberships and affiliations, we support the promotion of business views and solutions on a wide range of global economic and business policy issues.

2003 SLC Texas Host State", Austin	
2003 Southern Legislative Conference	*5,000*
Acton Institute for the Study of Religion and Liberty, Grand Rapids, Michigan	
Challenge Grant for International Work	50,000
Advancement of Sound Science Center Inc., Potomac, Maryland	10,000
Advertising Council, Inc., New York, N.Y.	20,000
AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C.	30,000
Africa Society, Washington, D.C.	25,000
American Council for Capital Formation Center for Policy Research, Washington, D.C.	
General Operating Support	95,000
Project Support	50,000
American Council on Germany, Inc., New York, N.Y.	
John J. McCloy Award Dinner*	25,000
General Operating Support	10,000
American Council on Science and Health, New York, N.Y.	25.000
American Enterprise Institute for Public Policy Research, Washington, D.C.	
Annual Dinner*	5,000
General Operating Support	225,000
American Inns of Court Foundation, Alexandria, Virginia	
Circuit Professionalism Awards	*5,000*
Others, each under $5,000	2,000
American Institute of Chemical Engineers*, New York, N.Y.	
Center for Chemical Process Safety	30,000

American Legislative Exchange Council, Washington, D.C.	
Annual Conference*	78,000
Energy and Climate Change	50,000
General Operating Support	100,000
Global Climate Change	140,000
Subtotal	**290,000**
Americas Society, Inc.*, New York, N.Y.	
Annual Spring Party	5,000
Annapolis Center for Environmental Quality, Inc.*, Maryland	
General Operating Support/Annual Dinner	27,500
Project Support	*75,000*
Arab American Institute Foundation*, Washington, D.C.	
Kahlil Gibran Awards	10,000
Asia Society"	
Tiger Ball 2003 – Houston, Texas	25,000
Annual Conference/Dinner – Washington, D.C.	71,000
Aspen Institute, Inc.*, Washington, D.C.	10,000
Atlantic Council of the United States, Washington, D.C.	10,000
Atlas Economic Research Foundation Atlas, Fairfax, Virginia	190,000
Baker Institute For Public Policy – Rice University*, Houston, Texas	
Energy Forum Membership	50,000
Gala Celebration Dinner	50,000
Baylor University School of Law, Waco, Texas	5,000
Brookings Institution, Washington, D.C.	125,000
Business Council for International Understanding*, New York, N.Y.	
Project Support	5,500
Training in Commercial Diplomacy	25,000
Capital Research Center, Washington, D.C.	
Green Watch Project	25,000
Carnegie Mellon University, Pittsburgh, Pennsylvania	
Center for the Study and Improvement of Regulation	225,000
Cato Institute, Washington, D.C.	25,000
Center for American and International Law, Dallas, Texas	
General Operating Support	5,000
Institute for Energy Law – Membership*	5,000
International and Comparative Law – Membership*	5,000
Institute for Energy Law - General Operating	7,000
ITA - General Operating Support	6,500
Others", each under $5,000	4,150
Others, each under $5,000	100
Subtotal	**32,750**
Center for New Europe-USA, Washington, D.C.	
Global Climate Change Program	40,000
Center for Strategic and International Studies, Inc., Washington, D.C.	150,000
Center for the Defense of Free Enterprise, Bellevue, Washington	
Global Climate Change Issues	40,000

Center for the Study of Carbon Dioxide and Global Change, Tempe, Arizona	
Climate Change Activities	40,000
Central and East European Law Initiative Institute, Washington, D.C.	
Judge and Lawyer Training Program ($100k:2002-2005)	25,000
Chemical Education Foundation, Arlington, Virginia	
Product Stewardship Bulletins	25,000
China Business Forum, Washington, D.C.	25,000
Columbia University, Middle East Institute, New York, N.Y.	
Middle East Studies	20,000
Committee for a Constructive Tomorrow, Washington, D.C.	
Climate Change Issues	25,000
General Operating Support	47,000
Common Good, New York, N.Y.	50,000
Communications Institute*, Pasadena, California	25,000
Competitive Enterprise Institute, Washington, D.C.	
Annual Dinner*	25,000
General Operating Support	440,000
Conference Board, Inc.*, New York, N.Y.	
2003 Energy & Business Conference	30,000
Congress of Racial Equality, New York, N.Y.	25,000
Congressional Black Caucus Foundation, Inc.*, Washington, D.C.	
Annual Legislative Conference Dinner	15,000
Consumer Alert, Inc., Washington, D.C.	15,000
Corporate Council on Africa", Washington, D.C.	
Biannual Summit	100,000
Council of State Governments*, Lexington, Kentucky	5,000
Council on Foreign Relations, Inc.*, New York, N.Y.	
Africa Policy Studies	50,000
Annual Subscription to Corporate Program	55,000
CPR Institute for Dispute Resolution, Inc.*, New York, N.Y.	6,000
Duke University, Durham, North Carolina	
Center for Environmental Solutions	45,000
European Institute Inc.*, Washington, D.C.	
Membership	15,000
Federalist Society for Law and Public Policy Studies, Washington, D.C.	15,000
Financial Accounting Foundation*, Norwalk, Connecticut	
Membership	52,000
Financial Executives Research Foundation*, Florham Park, New Jersey	
Research Program	9,000
Others, each under $5,000	1,000
Florida International University, Miami	
Center for Energy & Technology of the Americas*	10,000
General Operating Support	15,000
Foreign Policy Association*, New York, N.Y.	
Annual Dinner	25,000
Foundation for American Communications*, Pasadena, California	
Science Journalism Program	150,000
Special Project	10,000

Foundation for Public Affairs*, Washington, D.C.	5,000
Foundation for Research on Economics and the Environment, Bozeman, Montana	30,000
Fraser Institute*, Vancouver BC, Canada	
Climate Change	60,000
Free Enterprise Action Institute, Potomac, Maryland	
Research Support	50,000
Frontiers of Freedom Institute, Fairfax, Virginia	
Global Climate Change Outreach	95,000
Project Support-Sound Science Center	50,000
Frontiers of Freedom, Fairfax, Virginia	
Global Climate Change Activities	50,000
George Bush School of Government and Public Service*, College Station, Texas	
Conference Series	10,000
George C Marshall Research Foundation*, Lexington, Virginia	
2003 George C. Marshall Foundation Award Dinner	15,000
George C. Marshall Institute, Washington, D.C.	
Global Climate Change Program	95,000
George Mason University Foundation, Inc., Fairfax, Virginia	
Law & Economics Center	20,000
George Washington University, D.C.	
Global Grassroots Education Program	25,000
Georgetown University, Center Contemporary	30,000
Arabic Studies, Washington, D.C.	
Heartland Institute, Chicago, Illinois	
19th Anniversary Benefit Dinner*	7,500
General Operating Support	85,000
Henry L. Stimson Center, Washington, D.C.	10,000
Heritage Foundation, Washington, D.C.	95,000
Hoover Institution, Stanford, California	
Global Climate Change Projects	30,000
Houston Forum*, Texas	
2004 Annual Luncheon	5,000
General Operating Support	6,500
Houston International Protocol Alliance, Texas	
Emergency Preparedness Exchange Program between Houston and Baku, Azerbaijan	5,000
Houston Junior Chamber of Commerce Foundation, Inc.*, Texas	
52nd Consular Ball	10,000
Independent Institute, Inc., Oakland, California	10,000
Independent Women's Forum, Washington, D.C.	15,000
Institute for Civil Justice*, Santa Monica, California	85,000
Institute for East West Studies, New York, N.Y.	10,000
Institute for Energy Research, Houston, Texas	37,000
Institute for Policy Innovation, Lewisville, Texas	7,500
Institute for Research on the Economics of Taxation*, Washington, D.C.	
Membership	5,000
Institute for the Study of Earth and Man*, Dallas, Texas	10,000
Institute of Internal Auditors Research Foundation*, Altamonte Springs, Florida	
Research Program	5,000

Institute of International Education, Southern Region, Houston, Texas	
International Visitor's Program	20,000
Institute of the Americas*, La Jolla, California	
Mexico Energy Roundtable	5,000
International Association of Defense Counsel Foundation, Chicago, Illinois	
National Jury Trial Innovations Project	10,000
International Foundation for Election Systems, Washington, D.C.	5.000
International Policy Network - North America, Washington, D.C.	
Climate Change Outreach	50,000
International Republican Institute, Washington, D.C.	10,000
John F. Kennedy School of Government, Harvard University",	
Cambridge, Massachusetts	
Caspian Studies Program/Azerbaijan Initiative	50,000
Johns Hopkins University, Washington, D.C.	
School for Advanced International Studies	75,000
Joint Center for Political and Economic Studies, Washington, D.C.	15,000
Keystone Center*, Colorado	
Dialogue	35,000
Landmark Legal Foundation, Kansas City, Missouri	10,000
Legal Aid Society of the District of Columbia*, Washington, D.C.	
Servant of Justice Dinner	10,000
Manhattan Institute for Policy Research, New York, N.Y.	25,000
Massachusetts Institute of Technology, Cambridge	
Energy Policy Studies	90,000
Media Institute, Arlington, Virginia	20,000
Media Research Center, Arlington, Virginia	
Global Climate Change Activities	50,000
Mentor Group, Boston, Massachusetts	
Court Forum	30,000
Mercatus Center", Arlington, Virginia	40,000
Mexican Cultural Institute, Washington, D.C.	5,000
Mexican Institute of Greater Houston, Inc.*, Texas	
Mexican Independence Gala	5,000
Middle East Institute, Washington, D.C.	
Conference*	10,000
General Operating Support	60,000
Middle East Policy Council, Washington, D.C.	17,500
Mosaic Foundation*, McLean, Virginia	
Annual Fundraising Gala	100,000
National Academy of Sciences, Washington, D.C.	
STL Panel	50,000
National Association of Neighborhoods, Washington, D.C.	15,000
National Black Caucus of State Legislators*, Washington, D.C.	
General Operating/Conference Support	9,000
National Black Chamber of Commerce, Washington, D.C.	40,000
National Bureau of Economic Research*, Cambridge, Massachusetts	50,000
National Center for Policy Analysis, Dallas, Texas	75,000

National Center for Public Policy Research, Washington, D.C.	
General Operating Support	25,000
Global Climate Change/EnviroTruth Website	30,000
National Center for State Courts, Williamsburg, Virginia	20.000
National Council on US-Arab Relations*, Washington, D.C.	
Conference Support	20,000
National Democratic Institute for International Affairs, Washington, D.C.	10,000
National Foreign Trade Council, Inc.*, Washington, D.C.	
World Trade Dinner	20,000
National Judicial College, Reno, Nevada	45,000
National Legal Center for the Public Interest, Washington, D.C.	
Gauer Lecture*	*8,500*
General Operating Support	*25,000*
National Policy Association*, Washington, D.C.	
Membership	15,000
New York Chapter of Core, Inc.	
Climate Change Outreach Efforts	15,000
Pacific Legal Foundation, Sacramento, California	15,000
Pacific Research Institute for Public Policy, San Francisco, California	45,000
Paykids Foundation, Lansing, Michigan	*5,000*
Property and Environment Research Center, Bozeman, Montana	*15,000*
Public Affairs Research Council of Louisiana, Inc.*, Baton Rouge	
Membership	*25,000*
Reason Foundation, Los Angeles, California	10,000
Sociedad De Amigos De La Cultura Mexicana, Dallas, Texas	*5,000*
Southern Legislative Conference*, Austin, Texas	
Conference	20,000
Southern Methodist University Law School Foundation, Dallas, Texas	10,000
Stanford University, California	
Center for Research on Economic & Policy Reform*	10,000
Energy Policy Studies	90,000
General Operating Support	10,000
Subtotal	**110,000**
Tax Council Policy Institute, Washington, D.C.	20,000
Tax Foundation*, Washington, D.C.	
Annual Conference Dinner	5,000
Annual Sponsorship	20,500
Tax Research Association of Houston and Harris County", Texas	12,000
Tech Central Science Foundation, Washington, D.C.	
Climate Change Support	95,000
Texas Women's Alliance", Austin	
2003 Encampment	*5,000*
Transparency International US, Washington, D.C.	*50,000*
U.S. National Committee for Pacific Economic Cooperation, Washington, D.C.	15,000
U.S.-Mexico Cultural and Educational Foundation*, Washington, D.C.	
Good Neighbor Awards Gala	*25,000*
United States-Indonesia Society*, Washington, D.C.	*50,000*

University of California Berkeley	
Lawrence Berkley Laboratory	25.000
University of Houston Law Center, Texas	
Annual Gala*	10,000
Institute for Energy, Law and Enterprise	5,000
General Operating Support ($1 00k: 2000-2003)	25.000
Subtotal	**40,000**
University of Texas Law School Foundation, Austin	10,000
Washington Legal Foundation, D.C.	30,000
Washington University, St. Louis, Missouri	
Weidenbaum Center	50,000
Women In Government*, Washington, D.C.	
10th Annual National Legislative Conference	5,000
General Operating Support	5,000
World Affairs Council of Greater Dallas", Texas	
H. Neil Mallon Award Dinner	25,000
World Affairs Councils of America, Washington, D. C.	
National Board	6,000
World Press Institute, St. Paul, Minnesota	20,000
Wyoming Heritage Foundation, Casper	10,000
Exxon Mobil Corporation*	
Other contributions, each under $5,000	17,800
ExxonMobil Foundation	
Other contributions, each under $5,000	21,000
Total Public Policy Contributions made through the United States	**$6,612,550**
Contributions Benefiting Communities in the United States	**6,357,550**
Contributions Benefiting Countries Outside the United States #	**476,300**
Total Worldwide Public Policy Contributions #	**$6,833,850**
Exxon Mobil Corporation*	**2,152,250**
ExxonMobil Foundation	**4,681,600**
Total Public Information and Policy Research #	**$6,833,850**

Grants made by ExxonMobil Foundation except where indicated by:
* Exxon Mobil Corporation

May include contributions to nonprofit and NGO organizations, direct spending on community serving projects, "social bonus" projects required under agreenients with host governments by Exxon Mobil Corporation, its divisions and affiliates, and ExxonMobil's share of co'mmunity expenditures paid by joint ventures operated by other companies.

United Appeals and Workplace Giving Campaigns

ExxonMobil, together with its active and retired employees, donated $19.2 million to local United Way agencies and affiliated organizations across the United States and Canada in 2003. In the United States, the $1 1.4 million pledged by employees and retirees, together with the company's gift of $5.7 million, represents a 5% increase over 2002 workplace giving campaigns. This increase demonstrates the company's continued commitment to investing in the local communities where our employees live and work.

Our commitment to the United Way extends well beyond financial support. For the past several years, ExxonMobil has participated in United Way "Day of Caring" volunteer events in many of the communities in which we operate. As a result of becoming involved with these organizations, many ExxonMobil employees now provide year-round volunteer support to United Way agencies. In addition, ExxonMobil employees serve on committees to help formulate strategies for community programs and provide time and expertise to help manage fundraising campaigns.

Local United Way Campaigns	
Anchorage*, Alaska	15,000
Baytown*, Texas	200,000
Beaumont & North Jefferson County*, Texas	493,000
Capital Area*, Baton Rouge, Louisiana	320,000
Central Coast*, Santa Maria, California	6,000
Central Jersey*, Milltown, New Jersey	10,000
Chester County*, West Chester, Pennsylvania	15,000
Coastal Bend*, Corpus Christi, Texas	16,500
Eastern Fairfield County*, Bridgeport, Connecticut	10,000
Escambia County*, Pensacola, Florida	17,350
Gloucester County*, Thorofare, New Jersey	91,000
Greater Lehigh Valley*, Bethlehem, Pennsylvania	5,000
Greater New Orleans Area*, Louisiana	265,000
Greater Rochester*, New York	86,000
Greater St. Louis*, Alton, Illinois	18,000
Hudson County*, Jersey City, New Jersey	10,000
Hunterdon County*, Annandale, New Jersey	150,000
Los Angeles*, California	160,000
Metropolitan Dallas*, Texas	450,000
Metropolitan Tarrant County*, Fort Worth, Texas	50,000
Miami-Dade County*, Florida	35,000
Midland*, Texas	12,000
Pottawatomie County*, Shawnee, Oklahoma	18,000
San Antonio & Bexar County*, Texas	5,800
Santa Barbara County*, California	5,000
Southwest Alabama*, Mobile	16,000
Summit County*, Akron, Ohio	50,000
Sweetwater County*, Rock Springs, Wyoming	20,000
Texas Gulf Coast*, Houston	2,277,000
Union County*, Elizabeth, New Jersey	10,000
West Georgia*, LaGrange	25.000

United Appeals and Workplace Giving Campaigns

Will County*, Joliet, Illinois	115,000
Yellowstone County*, Billings, Montana	25,000
Others*, each under $5,000	53,900
Subtotal Local United Way Campaigns	$5,055,550
Other Workplace Giving Campaigns	
Greater Washington, D.C. Area*	392,040
Greater Washington, D.C. Area	2,960
United Way International*	*25,000*
Miscellaneous Support Programs	
Baton Rouge, Louisiana	26,600
Beaumont, Texas*	7,000
Houston, Texas*	
Capital Campaign ($500k: 2002-2004)	100,000
Day of Caring Event Support	80,000
Help Close the Gap Campaign	20,000
Young Leaders Program	5,000
Subtotal	205,000
Vienna, Virginia*	10,000
Others*, each under $5,000	3,000
Subtotal Miscellaneous Support Programs	$251,600
Total United Appeals made through the United States	$5,727,150
Contributions Benefiting Communities in the United States	5,702,150
Contributions Benefiting Countries Outside the U.S. #	819,800
Total Worldwide United Appeals Contributions #	$6,521,950
Exxon Mobil Corporation*	6,492,390
ExxonMobil Foundation	29,560
Total United Appeals and Workplace Giving Campaigns #	$6,521,950

Grants made by ExxonMobil Foundation except where indicated by:
* Exxon Mobil Corporation

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2004

Exxon Mobil Corporation
2004 Worldwide Contributions and Community Investments

Public Information and Policy Research

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Acton Institute for the Study of Religion and Liberty, Grand Rapids, Michigan	50,000
Advancement of Sound Science Center Inc., Potomac, Maryland	
Climate Change	10,000
Advertising Council, Inc., New York, N.Y.	20,000
AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C.	
General Support (Climate Change)	25,000
Africa Fighting Malaria", Washington, D.C.	
Climate Change Outreach	30,000
Africa Grantmakers' Affinity Group", New York, N.Y.	
Membership	7,500
Africa Society, Washington, D.C.	25,000
Africare*, Washington, D.C.	25,000
American Council for Capital Formation Center for Policy Research, Washington, D.C.	
Climate Change	180,000
General Operating Support	75,000
American Council on Germany, Inc., New York, N.Y.	
John J. McCloy Awards Dinner*	7,500
General Support	10,000
American Council on Science and Health, New York, N.Y.	
Climate Change Issues	15,000

American Enterprise Institute for Public Policy Research, Washington, D.C.	
Annual Dinner*	*5,000*
General Support	225,000
American Friends of the Institute of Economic Affairs, Fairfax, Virginia	
Climate Change Issues	50,000
American Legislative Exchange Council, Washington, D.C.	
Annual Conference*	55,000
Energy and Climate Change	62,000
Energy Sustainability Project (Climate Change)	75,000
General Operating Support	30,000
Subtotal	**222,000**
American Tort Reform Foundation*, Washington, D.C.	
Justice Systems Improvement	100,000
Annapolis Center for Science-Based Public Policy Inc., Maryland	75,000
Arab American Institute Foundation*, Washington, D.C.	
Kahlil Gibran Awards	10,000
Arizona State University Foundation*, Tempe	
2004 US Presidential Debate #3	8,000
Asia Society*, Washington, D.C.	
Annual Dinner	25,000
Congressional Forum Series	20,000
DC Metro and *NY*	20,000
Tiger Ball 2004 – Houston, Texas	15,000
Subtotal	**80,000**
Asian American Journalists Association", San Francisco, California	
Mayor's Circle Corporate Banquet Table Sponsorship	*5,000*
Aspen Institute, Inc.*, Queenstown, Maryland	10,000
Atlantic Council of the United States, Washington, D.C.	10,000
Atlas Economic Research Foundation Atlas, Fairfax, Virginia	*75,000*
Baker Institute For Public Policy – Rice University", Houston, Texas	
Energy Forum Membership	50,000
Brookings Institution, Washington, D.C.	
General Operating Support	50,000
Judicial Education Program*	30,000
Project Support	75,000
Subtotal	**155,000**
Business Council for International Understanding*, New York, N.Y.	
Business Reception	*5,000*
Training in Commercial Diplomacy	25,000
Capital Research Center, Washington, D.C.	
Green Watch Project	25,000
Carnegie Mellon University, Pittsburgh, Pennsylvania	
Center for the Study and Improvement of Regulation	200,000
Cato Institute, Washington, D.C.	
Environmental Education and Outreach	15,000

Center for American and International Law, Plano, Texas	
Institute for Energy Law – General Operating	7,000
Institute for Transnational Arbitration – General Operating	6,500
International and Comparative Law – General Operating	5,000
Others*, each under $5,000	4,500
Others, each under $5,000	100
Subtotal	**23,100**
Center for Public Policy Priorities", Austin, Texas	
Sponsorship -Legacy Luncheon	5,000
Center for Strategic and International Studies Inc., Washington, D.C.	
General Operating Support	150,000
Gulf of Guinea Security Forum	25,000
Center for the Defense of Free Enterprise, Bellevue, Washington	
Global Climate Change Issues	130,000
Central and East European Law Initiative Institute, Washington, D.C.	
Judge and Lawyer Training Program ($100k: 2002-2005)	25,000
Centre for New Europe-USA, Washington, D.C.	
Global Climate Change Education Efforts	80,000
Centro Adelante Campesino, Inc.*, Surprise, Arizona	5,000
Chemical Education Foundation*, Arlington, Virginia	
Product Stewardship Bulletins	25,000
China Business Forum, Inc., Washington, D.C.	25,000
Columbia University, Middle East Institute, New York, N.Y.	
Middle East Studies	20,000
Committee for a Constructive Tomorrow, Washington, D.C.	
Climate Change Issues	35,000
General Operating Support	40,000
Grassroots Efforts on Climate Change Issues	50,000
Subtotal	**125,000**
Communications Institute*, Pasadena, California	
Public Policy Education and Outreach	50,000
Competitive Enterprise Institute, Washington, D.C.	
General Operating Support	90,000
Global Climate Change	90,000
Global Climate Change Outreach	90,000
Subtotal	**270,000**
Congress of Racial Equality, New York, N.Y.	
Climate Change Regulation/Legislation	75,000
Global Climate Change Issues	60,000
Congressional Black Caucus Foundation, Inc.*, Washington, D.C.	
Annual Legislative Conference Dinner	15,000
Consumer Alert, Inc., Washington, D.C.	
Climate Change Issues (Opinion Leader and Public Education Efforts)	15,000
Climate Change Issues (Outreach to Opinion Leaders)	10,000
Corporate Council on Africa*, Washington, D.C.	
Annual Dinner	10,000
General Operating Support	5,000

Council of State Governments*, Lexington, Kentucky	5,000
Council on Foreign Relations, Inc.*, New York, N.Y.	
Africa Initiative	50,000
Annual Subscription to Corporate Program	55,000
CPR Institute for Dispute Resolution, Inc.*, New York, N.Y.	10,000
East-West Center*, Washington, D.C.	
Membership: US Asia Pacific Council	15,000
EastWest Institute, New York, N.Y.	5,000
European Institute Inc.*, Washington, D.C.	
Membership	15,000
Federalist Society for Law and Public Policy Studies, Washington, D.C.	15,000
Financial Executives Research Foundation, Inc.*, Florham Park, New Jersey	
Research Program	9,000
Foreign Policy Association*, New York, N.Y.	
Corporate Sponsorship-US. Saudi Arabian Relations Program	30,000
Foundation for Public Affairs*, Washington, D.C.	5,000
Foundation for Research on Economics and the Environment, Bozeman, Montana	
Climate Seminar*	20,000
Federal Judicial Seminars	20,000
General Operating Support	30,000
Subtotal	70,000
Foundation of the International Association of the Defense Counsel, Chicago, Illinois	10,000
Fraser Institute*, Vancouver BC, Canada	
Climate Change	60,000
Free Enterprise Education Institute, Potomac, Maryland	
Research Support	10,000
Frontiers of Freedom Institute, Fairfax, Virginia	
Climate Change Efforts	50,000
Global Climate Change Outreach	90,000
Project Support - Climate Change	40,000
Project Support- Science Center & Climate Change	70,000
Subtotal	**250,000**
Fund for Peace*, Washington, D.C.	
Human Rights and Business Roundtable Membership	11,250
George C. Marshall Institute, Washington, D.C.	
Awards Dinner - Climate Change Activities*	25,000
Climate Change	145,000
George Mason University Foundation, Inc., Fairfax, Virginia	
Law & Economics Center	40,000
George Washington University, Graduate School of Political Management, D.C.	
Global Grassroots Education Program	25,000
Georgetown University, Center Contemporary Arab Studies, Washington, D.C.	30,000
Heartland Institute, Chicago, Illinois	
Climate Change Activities*	10,000
Climate Change Efforts	15,000
General Operating Support	75,000
Subtotal	**100,000**

Houston Forum*, Texas	6,500
Houston World Affairs Council", Texas	
Conversations with History	15,000
Institute for Civil Justice", Santa Monica, California	85,000
Institute for Energy Research*, Houston, Texas	
Climate Change and Energy Policy Issues	45,000
Institute for Research on the Economics of Taxation", Washington, D.C.	
Membership	*5,000*
Institute for the Study of Earth and Man", Dallas, Texas	
General Operating Support	10,000
Others, each under $5,000	1,500
Institute of Internal Auditors Research Foundation", Altamonte Springs, Florida	
Research Program	5,000
International Foundation for Election Systems, Washington, D.C.	10,000
International Policy Network - North America", Washington, D.C.	
Climate Change	115,000
International Republican Institute, Washington, D.C.	10,000
Johns Hopkins University, School for Advanced International Studies, Washington, D.C.	
60th Anniversary Academic Convocation – Foreign Policy Challenges*	*5,000*
SAIS – International Programs	*75,000*
Joint Center for Political and Economic Studies", Washington, D.C.	
2004 Annual Dinner	15,000
Kuwait-America Foundation, Washington, D.C.	
"A Tribute to Friendship" Benefit Dinner for Iraqi Refugees	50,000
Landmark Legal Foundation, Kansas City, Missouri	
Environmental Accountability Insurance	10,000
Lindenwood University, St. Charles, Missouri	
Climate Change Outreach	*5,000*
Massachusetts Institute of Technology, Cambridge	
Energy Policy Studies	90,000
Joint Program on the Science and Policy of Global Change	200,000
Media Institute, Arlington, Virginia	20,000
Media Research Center, Arlington, Virginia	
Climate Change & Environmental Issues	50,000
Mentor Group, Boston, Massachusetts	
Court Forum	30,000
Mercatus Center", George Mason University, Arlington, Virginia	
Regulatory Improvement (Climate Change)	40,000
Mexican Cultural Institute", Washington, D.C.	*5,000*
Mexico Institute", Dallas, Texas	
Invitation to A Night in Zacatecas	*5,000*
Middle East Institute, Washington, D.C.	
Annual Conference Dinner	10,000
Corporate Membership	40,000
Middle East Policy Council, Washington, D.C.	20,000

Mosaic Foundation*, McLean, Virginia	
General Operating Support-Annual Gala	100,000
National Association of Neighborhoods, Washington, D.C.	
Climate Change Issues	25,000
General Operating Support	25,000
National Black Caucus of State Legislators*, Washington, D.C.	
Corporate Roundtable and Convention Sponsorship	14,000
National Black Chamber of Commerce, Washington, D.C.	50,000
National Bureau of Asian Research*, Seattle, Washington	
NBR Chairman's Council	15,000
National Bureau of Economic Research*, Cambridge, Massachusetts	50,000
National Center for Policy Analysis, Dallas, Texas	75,000
National Center for Public Policy Research Inc., Washington, D.C.	55,000
National Center for State Courts, Williamsburg, Virginia	20,000
National Conference of State Legislatures Foundation*, Denver, Colorado	
Alliance Sponsorship	5,000
Foundation for Legislatures	13,500
National Council on US-Arab Relations", Washington, D.C.	
Conference Support	20,000
National Democratic Institute for International Affairs, Washington, D.C.	
20th Anniversary Dinner*	*5,000*
General Support	10,000
National Foreign Trade Council Foundation, Inc.*, Washington, D.C.	
World Trade Dinner	10,000
National Judicial College, Reno, Nevada	45,000
National Legal Center for the Public Interest, Washington, D.C.	
Gauer Lecture*	10,000
General Support	25,000
Pacific Legal Foundation, Sacramento, California	15,000
Pacific Research Institute for Public Policy, San Francisco, California	
Climate Change and Environmental Quality Research	*50,000*
General Operating Support	50,000
Property and Environment Research Center (PERC), Bozeman, Montana	
Property and Environment Research Center	15,000
Public Affairs Research Council of Louisiana, Inc.*, Baton Rouge	
Membership	30,000
Regents of the University of California, Berkeley	
Lawrence Berkley Laboratory	25,000
Southern Methodist University Law School Foundation, Dallas, Texas	10,000
Southern Methodist University, Dallas, Texas	
McGuire Center	10,000
Stanford University, California	
Center for International Development*	10,000
Institute for Economic Policy Research	90,000
Tax Council Policy Institute, Washington, D.C.	20,000

Tax Foundation*, Washington, D.C.	
Annual Conference & Dinner	5,500
Annual Sponsorship	20,500
Tax Research Association of Houston and Harris County", Texas	
Membership	5,000
Temple University, Philadelphia, Pennsylvania	
Judicial Training Program (JTP)	75,000
Texas Conference for Women*, Austin	10,000
Texas Public Policy Foundation*, Austin	
15th Anniversary Fundraiser	10,000
Texas Women's Alliance", Austin	
Honoring Our Heroes and Winter Warm-Up Luncheon	5,000
Transparency International US, Washington, D.C.	50,000
United States-Indonesia Society*, Washington, D.C.	
10th Anniversary Sponsorship	5,000
General Operating Support	50,000
University of Houston Law Foundation, Texas	
Annual Gala & Auction*	15,000
Institute for Energy, Law and Enterprise	5,000
Institute for Intellectual Property and Information Law	25,000
Subtotal	**45,000**
University of Oklahoma Foundation, Inc., Norman	
Climate Change Issues	8,000
University of Texas Law School Foundation*, Austin	10,000
University of Texas at Austin	
Project Support (Climate Change Efforts)	50,000
Washington Legal Foundation, D.C.	30,000
Washington University, St. Louis, Missouri	
Weidenbaum Center	50,000
Women In Government*, Washington, D.C.	25,000
Woodrow Wilson International Center for Scholars*, Washington, D.C.	
2004 Kennan Institute Annual Dinner	5,000
Annual Dinner	25,000
Mexico Institute	15,000
Subtotal	**45,000**
World Affairs Council of Greater Dallas", Texas	
H. Neil Mallon Award Dinner (Lee R. Raymond – Honoree)	25,000
World Affairs Council of Washington DC*, D.C.	10,000
World Press Institute, St. Paul, Minnesota	20,000
Wyoming Heritage Foundation, Casper	10,000
Youth E-Vote Inc., Washington, D.C.	*5,000*

Exxon Mobil Corporation"	
Other contributions, each under $5,000	3,000
ExxonMobil Foundation	
Other contributions, each under $5,000	17,500
Total Public Policy Contributions made through the United States	**$6,433,350**
Contributions Benefiting Communities in the United States	**6,108,350**
Contributions Benefiting Countries Outside the United States #	**431,200**
Total Worldwide Public Policy Contributions #	**$6,539,550**
Exxon Mobil Corporation"	**1,883,450**
ExxonMobil Foundation	**4,656,100**
Total Public Information and Policy Research #	**$6,539,550**

Grants made by ExxonMobil Foundation except where indicated by:
* Exxon Mobil Corporation

May include contributions to nonprofit and NGO organizations, direct spending on community serving projects, "social bonus" projects required under agreements with host governments by Exxon Mobil Corporation, its divisions and affiliates, and ExxonMobil's share of community expenditures paid by joint ventures operated by other companies.

Acton Institute for the Study of Religion and Liberty, Grand Rapids, Michigan	$ 50,000
Advertising Council, Inc., New York, New York	20,000
AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C.	25,000
Africa Grantmakers Affinity Group*, New York, New York	
Membership	7,500
Africa Society*, Washington, D.C.	25,000
Africare*, Washington, D.C.	10,000
American Conservative Union Foundation, Alexandria, Virginia	50,000
American Council for Capital Formation Center for Policy Research, Washington, D.C.	360,000
American Council on Germany, Inc.*, New York, New York	
John J. McCloy Award Dinner	10,000
American Council on Science and Health, New York, New York	25,000
American Enterprise Institute for Public Policy Research, Washington, D.C.	
Annual Dinner*	5,000
General Operating Support	235,000
American Friends of Lubavitch*, Washington, D.C.	
Annual Benefit Event	5,000
American Legislative Exchange Council, Washington, D.C.	
Annual Conference*	90,000
Energy Sustainability Project	80,000
General Operating Support	71,500
Subtotal	**$ 241,500**
American Spectator Foundation*, Arlington, Virginia	15,000
Americas Society, Inc.*, New York, New York	
Sponsorship Dinner	10,000
Annapolis Center for Science-Based Public Policy Inc., Maryland	30,000
Arab American Institute Foundation*, Washington, D.C.	
Kahlil Gibran Awards	10,000
Asia Society*, Washington, D.C.	
Annual Dinner	25,000
General Operating (including DC Metro and NY)	45,000
Silver Anniversary Tiger Ball 2005 – Houston, Texas	25,000
Subtotal	$ **95,000**
Asian American Journalists Association*, San Francisco, California	
Annual National Convention	5,000
Aspen Institute, Inc.*, Queenstown, Maryland	10,000
Atlas Economic Research Foundation, Arlington, Virginia	100,000
Baker Institute For Public Policy – Rice University*, Houston, Texas	
Energy Forum Membership	50,000
National Oil Companies Study	10,000
Brookings Institution, Washington, D.C.	
General Operating Support*	95,000
Project Support	75,000
Business Council for International Understanding*, New York, New York	
Commercial Diplomacy Program	50,000
Capital Research Center, Washington, D.C.	50,000
Center for American and International Law, Plano, Texas	
CAIL Rogers Award Dinner (February 2006)'	6,000
Institute for Energy Law	8,000
Institute for Transnational Arbitration	6,500
International and Comparative Law	5,000
Other contributions*, each under $5,000	2,500
Other contributions, each under $5,000	100
Subtotal	$ **28,100**

Center for Strategic and International Studies Inc., Washington, D.C.	
Conference Support*	25,000
General Operating Support	150,000
Other contributions*, each under $5,000	2,500
Subtotal	$ **177,500**
Center for the Defense of Free Enterprise, Bellevue, Washington	60,000
Center for the Study of Carbon Dioxide and Global Change, Tempe, Arizona	25,000
Central and East European Law Initiative institute, Washington, D.C.	
General Operating Support	50,000
Judge and Lawyer Training Program ($100,000: 2002–2005)	25,000
Centre for New Europe – USA, Washington, D.C.	50,000
City of Irving*, Texas	
8th Annual Texas Transportation Summit	5,000
Committee for a Constructive Tomorrow, Washington, D.C.	90,000
Communications Institute*, Pasadena, California	75,000
Competitive Enterprise Institute, Washington, D.C.	
General Operating Support	90,000
General Operating Support*	180,000
Congress of Racial Equality, New York, New York	75,000
Congressional Black Caucus Foundation, **Inc.***, Washington, D.C.	
Annual Legislative Dinner	15,000
Corporate Council on Africa*, Washington, D.C.	
General Operating Support	10,000
US-Africa Business Summit	100,000
Council of State Governments*, Lexington, Kentucky	6,000
Council on Foreign Relations, **Inc.***, New York, New York	
Africa Initiative	*50,000*
Annual Corporate Membership	*60,000*
Annual Subscription to Corporate Program	60,000
Roundtable Dinner – Washington, D.C.	*3,000*
Subtotal	$ **173,000**
CPR institute for Dispute Resolution, **Inc.***, New York, New York	10,000
East-West Center*, Washington, D.C.	
Membership – US Asia Pacific Council	15,000
Eisenhower Exchange Fellowships Inc., Philadelphia, Pennsylvania	
2005 Arab Middle East Program	40,000
Environmental Law Institute*, Washington, D.C.	
Star Sponsor – October 19,2005 Award Dinner	10,000
Environmental Literacy Council, Washington, D.C.	50,000
Federal Focus*, Washington, D.C.	
Data Quality Rapid Response Fund	125,000
Federalist Society for Law and Public Policy Studies, Washington, D.C.	15,000
Financial Executives Research Foundation, **Inc.***, Florham Park, New Jersey	10,000
Florida International University*, Miami	5,000
Foreign Policy Association*, New York, New York	15,000
Foundation for American Communications*, Pasadena, California	50,000
Foundation for Public Affairs*, Washington, D.C.	5,000
Foundation for Research on Economics and the Environment, Bozeman, Montana	*30,000*
Foundation for the Center for Energy, Marine Transportation and Public Policy at Columbia University*, New York, New York	*75,000*
Foundation of the International Association of the Defense Counsel, Chicago, Illinois	10,000
Free Enterprise Education Institute, Inc., Potomac, Maryland	*70,000*
Frontiers of Freedom Institute, Chantilly, Virginia	
Annual Gala and General Operating Support*	*50,000*
General Operating Support	90,000
Fund for Peace*, Washington, D.C.	15,000

George C. Marshall Institute, Washington, D.C.	
Awards Dinner and General Operating Support*	*25,000*
General Operating Support	90,000
George Mason University Foundation, Inc., Fairfax, Virginia	
Law & Economics Center	*30,000*
Georgetown University, Center Contemporary Arabic Studies, Washington, D.C.	*30,000*
Heartland Institute, Chicago, Illinois	
General Operating Support*	90,000
General Operating Support	29,000
Henry L. Stimson Center, Washington, D.C.	10,000
Heritage Foundation, Washington, D.C.	30,000
Hoover Institution, Stanford, California	20.000
Houston Bar Foundation Records Preservation*, Texas	
Historic Court Records Preservation	10,000
Houston Forum*, Texas	6,500
Hudson Institute Inc., Washington, D.C.	10,000
Independent Institute, Inc., Oakland, California	30,000
Independent Women's Forum, Washington, D.C.	15,000
Institute for Energy Research*, Houston, Texas	65,000
Institute for Research on the Economics of Taxation*, Washington, D.C.	5,000
Institute for Senior Studies, Arlington, Virginia	30,000
Institute for the Study of Earth and Man*, Dallas, Texas	
Hollis D. Hedberg Award	10.000
Institute for Trade, Standards, and Sustainable Development, Inc.*,	
Princeton, New Jersey	15,000
Institute of Internal Auditors Research Foundation*, Altamonte Springs, Florida	
Research Program	*5,000*
international Foundation for Election Systems, Washington, D.C.	
Democracy Dinner*	10,000
General Operating Support	10,000
International Policy Network – North America*, Washington, D.C.	130,000
International Republican Institute, Washington, D.C.	10,000
Johns Hopkins University, School for Advanced International Studies,	
Washington, D.C.	*75,000*
Joint Center for Political and Economic Studies*, Washington, D.C.	
2005 Annual Dinner	15,000
Kuwait-America Foundation*, Washington, D.C.	
Benefit Dinner	100,000
Landmark Legal Foundation, Kansas City, Missouri	
Environmental Accountability insurance	10,000
Lindenwood University, St. Charles, Missouri	5,000
Massachusetts Institute of Technology, Cambridge	
Energy Policy Studies	*75,000*
Media Institute, Arlington, Virginia	20,000
Media Research Center, Arlington, Virginia	*50.000*
Mentor Group, Boston, Massachusetts	
Court Forum	30,000
Mexican Cultural Institute*, Washington, D.C.	5,000
Mexico Institute*, Dallas, Texas	5,000
Middle East Institute, Washington, D.C.	
Annual Conference and Banquet*	10,000
General Operating Support	40,000
Middle East Policy Council, Washington, D.C.	20,000
Mosaic Foundation*, McLean, Virginia	
Annual Gala	100,000
National Association of Neighborhoods, Washington, D.C.	25,000
National Association of Women Judges*, Bellaire, Texas	
Annual Conference	10,000

National Black Caucus of State Legislators*, Washington, D.C.	14,000
National Black Chamber of Commerce, Washington, D.C.	60,000
National Bureau of Asian Research*, Seattle, Washington	
NBR Chairman's Council	15,000
Program Support	38,000
National Bureau of Economic Research*, Cambridge, Massachusetts	25,000
National Center for Policy Analysis, Dallas, Texas	75,000
National Center for Public Policy Research Inc., Washington, D.C.	
General Support and Educational Activities	*55,000*
National Center for State Courts, Williamsburg, Virginia	*25,000*
National Conference of State Legislatures Foundation for State Legislatures*, Denver, Colorado	
Foundation for Legislatures	15,000
General Operating Support	5,000
National Council on U.S.-Arab Relations*, Washington, D.C.	
Conference Support	20,000
National Democratic Institute for International Affairs, Washington, D.C.	20,000
National Foreign Trade Council Foundation, Inc.*, Washington, D.C.	
World Trade Dinner	10,000
National Governors Association Center for Best Practices*, Washington, D.C.	15,000
National Judicial College, Reno, Nevada	45,000
National Legal Center for the Public Interest, Washington, D.C.	25,000
National Taxpayers Union Foundation, Alexandria, Virginia.	70,000
Pacific Legal Foundation, Sacramento, California	15,000
Pacific Research Institute for Public Policy, San Francisco, California	95,000
Property and Environment Research Center (PERC), Bozeman, Montana	20,000
Public Affairs Research Council of Louisiana, Inc.*, Baton Rouge	30,000
Rand Institute for Civil Justice*, Santa Monica, California	
Distinguished Scholar Program	15,000
General Operating Support	85,000
Reason Foundation, Los Angeles, California	20,000
Regents of the University of California, Berkeley	
Lawrence Berkeley Laboratory	25,000
Regulatory Checkbook*, Mt. Vernon, Virginia	45,000
Smithsonian Astrophysical Observatory*, Cambridge, Massachusetts	105,000
Southern Legislative Conference*, Montgomery, Alabama	
Conference	10,000
Southern Methodist University Law School Foundation, Dallas, Texas	10,000
Stanford University, California	
Center for International Development*	*25,000*
Stanford Institute for Economic Policy Research	*80,000*
Tax Council Policy Institute, Washington, D.C.	*20,000*
Tax Foundation*, Washington, D.C.	
Annual Conference and Dinner	*5,500*
Annual Sponsorship	25,500
Texas A&M University*, College Station	
U.S.-China Relations Conference	100,000
Texas Civil Rights Project*, Austin	
14th Annual Bill of Rights Dinner	6,500
Texas Cultural Trust Councils*, Austin	
Texas Medal of Arts Award Leadership Dinner	20,000
Texas Women's Alliance*, Austin	
Fall Encampment	5,000
Transparency International USA, Washington, D.C.	*50,000*
University of Houston Law Foundation, Texas	
Annual Gala*	15,000
General Operating Support	*25,000*
Institute for Energy, Law, and Enterprise	*5,000*

Subtotal	**$ 45,000**
University of North Carolina at Chapel Hill	
Air Quality Research Support	80,000
University of Texas at Austin*	*50,000*
University of Texas Law School Foundation*, Austin	10,000
Washington Legal Foundation, D.C.	30,000
Western Governors' Association*, Denver, Colorado	15,000
Women in Government*, Washington, D.C.	
Women in Government Business Council	20,000
Woodrow Wilson International Center for Scholars*, Washington, D.C.	
Annual Dinner – Dallas, Texas	25,000
Awards Dinner – Houston, Texas	25,000
General Operating Support	25,000
Subtotal	$ 75,000
World Affairs Council*	
Conversations with History – Houston, Texas	15,000
General Operating Support – Dallas, Texas	20,000
General Operating Support – Washington, D.C.	10,000
Global Education Dinner – Washington, D.C.	5,000
Subtotal	**$ 50,000**
World Press institute, St. Paul, Minnesota	20,000
Wyoming Heritage Foundation*, Casper	
Leadership Development	10,000
Exxon Mobil Corporation*	
Other contributions, each under $5,000	9,500
ExxonMobil Foundation	
Other contributions, each under $5,000	14,000
Total Public Policy Contributions Made Through the United States	$6,682,100
Contributions Benefiting Communities in the United States	$6,592,100
Contributions Benefiting Countries Outside the United States'	$ 185,900
Total Worldwide Public Policy Contributions'	$6,778,000
Exxon Mobil Corporation*	$3,088,900
ExxonMobil Foundation	$3,689,100
Total Public Information and Policy Research'	$6,778,000

Grants made by ExxonMobil Foundation except where indicated by:
* Exxon Mobil Corporation

May include contributions to nonprofit and NGO organizations; direct spending on community-serving projects; social bonus projects required under agreements with host governments by Exxon Mobil Corporation, its divisions and affiliates' and, ExxonMobil's share of community expenditures paid by joint ventures operated by other companies.

2006

Exxon Mobil Corporation"'
2006 Contributions and Community Investments"!
($ Millions)

	United States	*Canada*	*Africa & Middle East*	*Asia Pacific*	*Europe, Russia, & Caspian*	*Latin America*	*Totals*
Arts and Culture	3.3	.9	.1	.4	.5	–	5.2
Civic and Community	16.6	1.9	6.2	3.6	11.7	.9	40.9
Environment	1.9	.5	.6	1.6	1.6	.3	6.5
Health	3.9	.7	11.0	.4	2.7	.3	19.0
Education: Higher Education	32.0	.8	.5	.6	.9	.3	35.1
Pre-College[3]	10.1	1.2	2.9	.5	3.6	.6	18.9
Total Education	42.1	2.0	3.4	1.1	4.5	.9	54.0
Policy Research	6.1	–	.2	.1	.1	–	6.5
United Appeals	5.4	1.0	–	–	.1	–	6.5
Total	79.3	7.0	21.5	7.2	21.2	2.4	138.6

(1) Includes donations from Exxon Mobil Corporation its divisions and affiliates and ExxonMobil Foundation

(23 Includes contributions to nonprofit and NGO urganizabons. direct spending on community serving projects. social bonus projects required under agreements with host governments by Exxon Mobil Corporation, its divisions and affiliates. and ExxonMobil s share of community expenditures paid by joint venture: operated by other companies

(3j Includes in-kind donation in the United States of $225,000

Acton Institute for the Study of Religion and Liberty*, Grand Rapids, Michigan	$ 50,000
AEI-Brookings Joint Center for Regulatory Studies*, Washington, D.C.	25,000
Africa Society*, Washington, D.C.	10,000
American Council for Capital Formation Center for Policy Research*, Washington, D.C.	15,000
American Enterprise Institute for Public Policy Research*, Washington, D.C.	
Annual Dinner	5,000
General Operating Support	235,000
American Friends of **Lubavitch***, Washington, D.C.	
Annual Benefit Event	5,000
American Legislative Exchange Council*, Washington, D.C.	
Annual Meeting Host Committee Sponsorship	15,000
Annual Meetings Sponsorship	31,000
General Support	10,000
Subtotal	**$ 56,000**
American Legislative Exchange Council, Washington, D.C.	30,000
American Spectator Foundation*, Arlington, Virginia	25,000
Americas Society, **Inc.***, New York, New York	
Annual Spring Party	10,000
Annapolis Center for **Science-Based** Public Policy Inc., Maryland	
General Operating Support"	30,000
General Operating Support	75,000
Arab American Institute Foundation*, Washington, D.C.	
Kahlil Gibran Awards	10,000
Asia Society'"	
Annual Conference – Washington, D.C.	20,000
Annual Dinner – Washington, D.C.	25,000
Tiger Ball 2006 – Houston. Texas	25,000
Washington, D.C. Metro and New York, New York	20,000
Other contributions, each under $5,000	2,000
Subtotal	**$ 92,000**
Aspen Institute, **Inc.***, Queenstown, Maryland	10,000
Atlas Economic Research Foundation, Arlington, Virginia	00,000
Baker Institute For Public Policy – Rice **University***, Houston, Texas	
Energy Forum Membership	50,000
Brookings Institution, Washington, D.C.	
AEI-Brookings Judicial Education Program*	30,000
Corporate Council	75,000
General Operating Support	30,000
Subtotal	**$135,000**
Bush House*, Bakersfield, **California**	
Bill Thomas Event	10,000
Business Council for International Understanding*, New York, New York	
Commercial Diplomacy Program	25,000
Capital Research **Center***, Washington, D.C.	25,000
Carnegie Endowment for International Peace, Washington, D.C.	
Russian and Eurasian Program Support	25,000
Cato Institute*, Washington, D.C.	20,000

Public Information and Policy Research

Center for American and International Law, Plano, Texas	
CAIL Rogers Award Dinner 2007*	$ 6,000
Institute for Energy Law	8,000
Institute for Transnational Arbitration	6,500
International and Comparative Law	5,000
Other contributions', each under $5,000	5,500
Subtotal	**$ 31,000**
Center for Strategic and International Studies Inc., Washington, D.C.	
General Operating Support	225,000
Support of the Middle East & Energy Programs'	17,000
US-Saudi Energy Dialogue'	40,000
Subtotal	**$282,000**
Center for the Study of Carbon Dioxide and Global Change*, Tempe, Arizona	10,000
Central and East European Law Initiative Institute*, Washington, D.C.	25,000
Chemical Educational Foundation*, Arlington, Virginia	
Product Stewardship Bulletins	25,000
Committee for a Constructive Tomorrow, Washington, D.C.	70,000
Committee for Economic Development*, Washington, D.C.	10,000
Committee to Encourage Corporate Philanthropy*, New York, New York	
Membership	10,000
Common Good Institute, Inc., New York, New York	25,000
Communications Institute*, Pasadena, California	75,000
Congress of Racial Equality*, New York, New York	25,000
Congressional Black Caucus Foundation, Inc.*, Washington, D.C.	
Annual Legislative Dinner	7,500
Corporate Council on Africa*, Washington, D.C.	
Africa Chiefs of Mission Gathering 2006	5,000
General Operating Support	10,000
Membership	10,000
Subtotal	**$ 25,000**
Council of State Governments*, Lexington, Kentucky	5,000
Council on Foreign Relations, Inc.*, New York, New York	
Africa Initiative	50,000
Annual Corporate Membership	60,000
Eisenhower Exchange Fellowships, Inc., Philadelphia, Pennsylvania	
Northeast Asia Program	40,000
Environmental Law Institute*, Washington, D.C.	
Award Dinner	10,000
Corporate Program Membership	10,000
Federalist Society for Law and Public Policy Studies, Washington, D.C.	15,000
Financial Executives Research Foundation, Inc.*, Florham Park, New Jersey	
Research Program	15,000
Foundation for American Communications*, Pasadena, California	50,000
Foundation for Public Affairs*, Washington, D.C.	5,000
Foundation for Research on Economics and the Environment, Bozeman, Montana	30,000
Foundation for the Center for Energy, Marine Transportation and Public Policy at Columbia University*, New York, New York	100,000
Foundation of the International Association of the Defense Counsel, Chicago, Illinois	10,000
Frontiers of Freedom Institute, Oakton, Virginia	
General Operating Support"	90,000
Science & Policy Center	90,000

Fundfor Peace*, Washington, D.C.	
Human Rights & Business Roundtable	$ 15,000
George C. Marshall Institute*, Washington, D.C.	
General Support and Annual Dinner	85,000
George Mason University Foundation, Inc., Fairfax, Virginia	
Law & Economics Center	30,000
George Washington University, D.C.	
Research & Education	25,000
Georgetown University, Center Contemporary Arabic Studies, Washington, D.C.	30,000
Heartland Institute, Chicago, Illinois	
Anniversary Benefit Dinner*	10,000
General Operating Support*	15,000
General Operating Support	90,000
Subtotal	**$115,000**
Henry L. Stimson Center, Washington, D.C.	20,000
Heritage Foundation*, Washington, D.C.	30,000
Independent Women's Forum*, Washington, D.C.	
Annual Dinner Sponsorship	15,000
Institutefor Energy Research*, Houston, Texas	65,000
Institutefor International Economics, Washington, D.C.	
US-Indonesia FTA Project	15,000
Institutefor Research on the Economics of Taxation*, Washington, D.C.	
Membership	10,000
Institute of Internal Auditors Research Foundation*, Altamonte Springs, Florida	
Research Program	5,000
International Conservation Caucus Foundation*, Alexandria, Virginia	
Inaugural Gala	25,000
International Foundation for Election Systems, Washington, D.C.	10,000
International Institute for Conflict Prevention & Resolution*, New York, New York	
Membership Support	10,000
International Policy Network - North America*, Washington, D.C.	95,000
International QSAR Foundation To Reduce Animal Testing*,	
Two Harbors, Minnesota	
McKim Conference	5,000
Johns Hopkins University, School for Advanced International Studies,	
Washington, D.C.	
20th Anniversary Celebration*	15,000
Energy Club Trip	13,000
SAIS - International Programs	90,000
Subtotal	**$118,000**
Joint Center for Political and Economic Studies*, Washington, D.C.	
2006 Annual Dinner	15,000
Landmark Legal Foundation, Kansas City, Missouri	
Environmental Accountability Insurance	10,000
Leadership America Inc*, Dallas, Texas	
Sponsorship of Leadership America Reception	5,000
Lindenwood University, St. Charles, Missouri	10,000
Manhattan Institute for Policy Research*, New York, New York	30,000
Media Research Center, Arlington, Virginia	52,500
Mentor Group, Boston, Massachusetts	
Court Forum	30,000
Mercatus Center*, Arlington, Virginia	40,000

Middle East Institute, Washington, D.C.	
General Operating Support'	$ 10,000
General Operating Support	40,000
Middle East Policy Council, Washington, D.C.	20,000
Mosaic Foundation*, McLean, Virginia	
Annual Gala	100,000
National Association of Neighborhoods, Washington, D.C.	25,000
National Black Caucus of State Legislators*, Washington, D.C.	15,000
National Black Chamber of Commerce, Washington, D.C.	50,000
National Bureau of Asian Research*, Seattle, Washington	
2005 China Energy Conference	10,000
NBR Chairman's Council	15,000
Program Support	50,000
Subtotal	**$ 75,000**
National Bureau of Economic Research*, Cambridge, Massachusetts	25,000
National Center for Policy Analysis*, Dallas, Texas	75,000
National Center for Public Policy Research Inc.*, Washington, D.C.	55,000
National Center for State Courts, Williamsburg, Virginia	25,000
National Conference of State Legislatures Foundation for State Legislatures*, Denver, Colorado	
Foundation for Legislatures	5,000
National Council on US-Arab Relations*, Washington, D.C.	
Conference Support	20,000
National Foreign Trade Council Foundation, Inc.*, Washington, D.C.	
World Trade Dinner	10,000
National Governors Association Center for Best Practices*, Washington, D.C.	15,000
National Judicial College, Reno, Nevada	45,000
National Legal Center for the Public Interest, Washington, D.C.	25,000
National Taxpayers Union Foundation*, Alexandria, Virginia	70,000
Nixon Center*, Washington, D.C.	
Service Award Dinner	10,000
Pacific Legal Foundation, Sacramento, California	15,000
Pacific Research Institute for Public Policy*, San Francisco, California	75,000
Property and Environment Research Center (PERC)*, Bozeman, Montana	20,000
Public Affairs Research Council of Louisiana, Inc.*, Baton Rouge	
Membership	30,000
Rand Institute for Civil Justice*, Santa Monica, California	85,000
Regents of the University of California*, Berkeley	
Lawrence Berkley Laboratory	25,000
Regulatory Checkbook*, Mt. Vernon, Virginia	50,000
Seeds of Peace, Washington, D.C.	
Conflict Management Program	100,000
Smithsonian Astrophysical Observatory*, Cambridge, Massachusetts	
Project Support	105,000
General Operating Support	50,000
Social Investment Forum Foundation*, Washington, D.C.	
Global Leadership Forum Honorarium	10,000
Southern Methodist University Law School Foundation, Dallas, Texas	10,000
Stanford University/Center for International Development*, California	25,000
State Legislative Leaders Foundation*, Centerville, Massachusetts	
Annual National Speaker's Conference	15,000
Tax Council Policy Institute, Washington, D.C.	20,000

Tax Foundation*, Washington, D.C.	
Annual Conference & Dinner	$ 5,000
Annual Sponsorship	25,500
Project Support	50,000
Subtotal	**$ 80,500**
Temple University, Philadelphia, Pennsylvania	
Judical Training Program (China)	75,000
Texas Appleseed*, Austin	
Good Apple Dinner	25,000
Texas Conference for Women*, Austin	
Conference	15,000
Texas Public Policy Foundation*, Austin	
2006 Policy Orientation	10,000
General Operating Support	5,000
Tides Center/Africa Grantmakers' Affinity Group*, New York, New York	
Membership	7,500
Transparency International USA, Washington, D.C.	50,000
University of Houston Law Foundation, Texas	
Annual Gala*	20,000
General Operating Support	25,000
University of North Carolina at Chapel Hill	
Air Quality Research Support	50,000
University of Texas at Austin, Sugar Land	
institute for Energy, Law and Enterprise	5,000
University of Texas Law School Foundation*, Austin	10,000
Washington, D.C. Martin Luther King, Jr., National Memorial Project	
Foundation, Inc.	1,000,000
Washington Legal Foundation, D.C.	30,000
Western Governors' Association*, Denver, Colorado	15,000
Women In Government*, Washington, D.C.	20,000
Woodrow Wilson International Center for Scholars*	
Annual Awards – New York, New York	10,000
Kennan Institute Dinner – Washington, D.C.	10,000
World Affairs Council*	
2006 Global Education Dinner – Washington, D.C.	$ 15,000
Ambassador Luncheons – Dallas, Texas	10,750
"Bono Speaks Live" Event – Dallas, Texas	50,000
Conversations with History – Houston, Texas	15,000
General Operating Support – Dallas, Texas	20,000
General Operating Support –Washington, D.C.	10,000
Subtotal	**$ 120,750**
World Press Institute, St. Paul, Minnesota	20,000
Wyoming Heritage Foundation*, Casper	5,000
Exxon Mobil Corporation*	
Other contributions, each under $5,000	12,750
ExxonMobil Foundation	
Other contributions, each under $5,000	10,500
Total Public Policy Contributions made through the United States	**$6,171,000**

Public Information and Policy Research

Contributions Benefiting Communities in the United States	**$6,026,000**
Contributions Benefiting Countries Outside the United States'	**$ 478,900**
Total Worldwide Public Policy Contributions'	**$6,504,900**
Exxon Mobil Corporation*	**$3,579,400**
ExxonMobil Foundation	**$2,925,500**
Total Public Information and Policy Research'	**$6,504,900**

'Grants made by ExxonMobil Foundation except where indicated by Exxon Mobil Corporation, its divisions and affiliates

May include contributions to nonprofit and NGO organizations direct spending on community serving projects social bonus projects required under agreements with host governments by Exxon Mobil Corporation its divisions and affiliates and ExxonMobil's share of community expenditures paid by joint ventures operated by other companies

Exxon Mobil Corporation
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Public Information and Policy Research

Acton Institute*, Grand Rapids, Michigan	$ 50,000
Africa Society*, Washington, D.C.	25,000
Africa-America Institute*, New York, New York	10,000
Alliance To Save Energy*, Washington, D.C.	
General Operating Support	60,000
Global Forum and Exposition	10,000
American Conservative Union Foundation*, Alexandria, Virginia	20,000
American Council for Capital Formation Center for Policy Research*, Washington, D.C.	15,000
American Council on Science and Health*, New York, New York	
Project Support	25,000
American Enterprise Institute for Public Policy Research*, Washington, D.C.	
General Operating Support & Annual Dinner	240,000
American Friends of Lubavitch*, Washington, D.C.	
Annual Benefit Event	10,000
American Judicature Society*, Des Moines, Iowa	
Justice Award Dinner	5,000
American Legislative Exchange Council, Washington, D.C.	31,000
American Spectator Foundation*, Arlington, Virginia	25,000
Americas Society, Inc.*, New York, New York	
Spring Party	10,000
Annapolis Center for Science-Based Public Policy Inc.*, Maryland	105,000
Asia Society Texas*, Houston	
Tiger Ball	25,000
Asia Society*, Washington, D.C.	
Annual Conference	20,000
Annual Dinner	25,000
DC Metro and NY	25,000
Subtotal	**$ 70,000**
Aspen Institute, Inc.*, Queenstown, Maryland	
Forum on Global Energy	90,000
General Operating Support	7,000
Atlas Economic Research Foundation*, Arlington, Virginia	100,000
Baker Institute for Public Policy – Rice University*, Houston, Texas	
Energy Forum	50,000
British American Business Council*, Houston, Texas	
Women's Global Leadership Conference	23,500
Brookings Institution*, Washington, D.C.	
AEI-Brookings Judicial Education Program	30,000
Corporate Council	200,000
Business Civic Leadership Center*, Washington, D.C.	
Project Support	25,000
Business Council for International Understanding*, New York, New York	
Training in Commercial Diplomacy	25,000
California Legislative Black Caucus Foundation Inc.*, Los Angeles	5,000
Capital Research Center*, Washington, D.C.	50,000
Caribbean-Central American Action*, Washington, D.C.	
31st Annual Miami Conference	15,000
Carnegie Endowment for International Peace*, Washington, D.C.	
Program Support	20,000

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Public Information and Policy Research

Center for American and International Law, Plano, Texas	
Institute for Energy Law	$ 8,000
Institute for Transnational Arbitration	6,500
International and Comparative Law	5,000
Other Contributions*, each under $5,000	3,000
Other Contributions, each under $5,000	2,500
Subtotal	**$ 25,000**
Center for Clean Air Policy*, Washington, D.C.	25,000
Center for Corporate Citizenship at Boston College*, Chestnut Hill, Massachusetts	
Membership	10,000
Center for Strategic and International Studies Inc.*, Washington, D.C.	
2009 Africa Policy Review and Recommendations	40,000
General Operating Support	225,000
Leadership Dinner & Dialogue	25,000
Support of the CSIS Africa Program	25,000
Subtotal	**$315,000**
Central and East European Law Initiative Institute*, Washington, D.C.	
Judge and Lawyer Training	25,000
Chemical Educational Foundation*, Arlington, Virginia	
Product Stewardship Bulletins	25,000
China Business Forum, Inc., Washington, D.C.	
U.S.-China Legal Cooperation Fund	25,000
Committee Encouraging Corporate Philanthropy*, New York, New York	
Membership	10,000
Committee for a Constructive Tomorrow*, Washington, D.C.	40,000
Committee for Economic Development*, Washington, D.C.	
Annual Awards Dinner	10,000
General Operating Support	10,000
Communications Institute*, Pasadena, California	
Energy Literacy	75,000
Congressional Black Caucus Foundation, Inc.*, Washington, D.C.	
Annual Legislative Dinner	15,000
Corporate Council on Africa*, Washington, D.C.	
Forum and Reception	5,000
Membership	25,000
US Africa Business Summit	150,000
Subtotal	**$180,000**
Council for the United States and Italy*, Washington, D.C.	
Membership	5,000
Council on Competitiveness*, Washington, D.C.	15,000
Council on Foreign Relations, Inc.*, New York, New York	
Africa Initiative	50,000
Membership	60,000
Council on Foundations, Inc.*, Arlington, Virginia	
Membership	15,000
Environmental Law Institute*, Washington, D.C.	
Membership	11,000
Faith & Politics Institute*, Washington, D.C.	25,000
Federalist Society for Law and Public Policy Studies*, Washington, D.C.	15,000

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Public Information and Policy Research

Financial Executives Research Foundation, Inc.*, Florham Park, New Jersey	
Project Support	$ 35,000
Research Program	15,000
Foreign Policy Association*, New York, New York	
Annual Dinner	30,000
Foundation for Public Affairs*, Washington, D.C.	5,000
Foundation for Research on Economics and the Environment*, Bozeman, Montana	30,000
Foundation for the Center for Energy, Marine Transportation and Public Policy at Columbia University*, New York, New York	100,000
Foundation of the International Association of the Defense Counsel*, Chicago, Illinois	
Project Support	10,000
Frontiers of Freedom Institute*, Oakton, Virginia	
Energy Literacy	90,000
Fund for Peace*, Washington, D.C.	
Human Rights & Business Roundtable	15,000
George C. Marshall Institute*, Washington, D.C.	
Energy Literacy	50,000
General Operating Support	65,000
George C. Marshall Research Foundation*, Lexington, Virginia	
Award Dinner	10,000
George Mason University Foundation, Inc., Fairfax, Virginia	
Law & Economics Center	30,000
Law & Economics Center*	10,000
George Washington University*, D.C.	
Middle East Policy Forum	25,000
Georgetown University, Center for Contemporary Arabic Studies, Washington, D.C.	30,000
Georgetown University*, Washington, D.C.	50,000
Headwaters Resource Conservation and Development Area Inc.*, Butte, Montana	
Montana Economic Development Summit	10,000
Henry L. Stimson Center*, Washington, D.C.	25,000
Heritage Foundation*, Washington, D.C.	40,000
Independent Institute, Inc.*, Oakland, California	15,000
Institute for Energy Research*, Houston, Texas	
Energy Literacy	45,000
General Operating Support	50,000
Institute for Research on the Economics of Taxation*, Washington, D.C.	
Membership	10,000
Institute of Internal Auditors Research Foundation*, Altamonte Springs, Florida	
Research Program	5,000
International Accounting Standards Committee Foundation*, New York, New York	150,000
International Conservation Caucus Foundation*, Washington, D.C.	25,000
International Foundation for Election Systems, Washington, D.C.	
Program Support	10,000
International Institute for Conflict Prevention & Resolution*, New York, New York	
Membership Support	10,000
John P. Ellbogen Foundation*, Casper, Wyoming	5,000

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Public Information and Policy Research

Johns Hopkins University, School for Advanced International Studies, Washington, D.C.	
Africa Program (Nigeria)*	$ 5,000
SAIS – Latin America	75,000
Kuwait-America Foundation*, Washington, D.C.	
Benefit Dinner - Healing for Peace	150,000
Landmark Legal Foundation, Kansas City, Missouri	10,000
Lindenwood University*, St. Charles, Missouri	10,000
Manhattan Institute for Policy Research*, New York, New York	30,000
Massachusetts Institute of Technology, Cambridge	
Energy Policy Studies	75,000
Energy Policy Studies*	75,000
Media Research Center*, Alexandria, Virginia	55,000
Mentor Group*, Boston, Massachusetts	
Court Forum	30,000
Mercatus Center*, Arlington, Virginia	40,000
Mexican Cultural Institute*, Washington, D.C.	5,000
Mexico Institute*, Dallas, Texas	5,000
Middle East Institute*, Washington, D.C.	50,000
Middle East Policy Council*, Washington, D.C.	20,000
Mountain States Legal Foundation, Lakewood, Colorado	5,000
National Association of Neighborhoods*, Washington, D.C.	25,000
National Black Caucus of State Legislators*, Washington, D.C.	15,000
National Black Chamber of Commerce*, Washington, D.C.	75,000
National Bureau of Asian Research*, Seattle, Washington	
Energy Program Sponsorship	10,000
Energy Program Support	10,000
NBR Chairman's Council	15,000
Subtotal	**$ 35,000**
National Bureau of Economic Research*, Cambridge, Massachusetts	25,000
National Center for Policy Analysis*, Dallas, Texas	75,000
National Center for Public Policy Research Inc.*, Washington, D.C.	55,000
National Center for State Courts*, Williamsburg, Virginia	25,000
National Conference of State Legislatures Foundation for State Legislatures*, Denver, Colorado	10,000
National Conference of State Legislatures Foundation*, Denver, Colorado	
Women's Legislative Network	5,000
National Council on US-Arab Relations*, Washington, D.C.	25,000
National Foreign Trade Council Foundation, Inc.*, Washington, D.C.	
World Trade Dinner	15,000
National Foundation for Judicial Excellence*, Chicago, Illinois	10,000
National Governors Association Center for Best Practices*, Washington, D.C.	15,000
National Judicial College, Reno, Nevada	
General Operating Support	45,000
Other Contributions*, each under $5,000	2,000
National Taxpayers Union Foundation*, Alexandria, Virginia	125,000
National Woman's Party*, Washington, D.C.	
2007 Alice Award Honoring Senator Kay Bailey Hutchison	10,000
Nixon Center*, Washington, D.C.	10,000
Pacific Legal Foundation*, Sacramento, California	15,000
Pacific Research Institute for Public Policy*, San Francisco, California	85,000

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Public Information and Policy Research

Partnership for Public Service*, Washington, D.C.	
Leadership Awards Dinner	$ 10,000
Peterson Institute for International Economics*, Washington, D.C.	
U.S.–Indonesia FTA Project	15,000
Property and Environment Research Center (PERC)*, Bozeman, Montana	20,000
Public Affairs Research Council of Louisiana, Inc.*, Baton Rouge	
Membership	30,000
RAND Corporation*, Santa Monica, California	
Business Leaders Forum Membership	25,000
Rand Institute for Civil Justice*, Santa Monica, California	100,000
Regents of the University of California*, Berkeley	
Lawrence Berkeley Laboratory	25,000
Rene Moawad Foundation*, Washington, D.C.	
Gala	5,000
Seeds of Peace, Washington, D.C.	
General Operating Support	100,000
Spring Gala*	10,000
World Leaders Summit*	15,000
Subtotal	**$125,000**
Senate Hispanic Research Council, Inc.*, Austin, Texas	
Luna Minority Student Internships	10,000
Smithsonian Astrophysical Observatory*, Cambridge, Massachusetts	55,000
Southern Methodist University Law School Foundation*, Dallas, Texas	10,000
Stanford University/Center for International Development*, California	25,000
Stanford University/Stanford Institute for Economic Policy Research, California	
Energy Policy Studies	50,000
General Operating Support*	50,000
State Agency Council*, Austin, Texas	
Governor's Commission for Women 40th Anniversary Luncheon	10,000
Tax Council Policy Institute*, Washington, D.C.	20,000
Tax Foundation*, Washington, D.C.	
Annual Conference & Dinner	5,000
Annual Sponsorship	25,500
WPT Project Support	25,000
Subtotal	**$ 55,500**
Temple University*, Philadelphia, Pennsylvania	
Judicial Training Program	75,000
Texas A&M University*, College Station	
U.S. China Relations Conference	100,000
Texas Appleseed*, Austin	
Good Apple Dinner	10,000
Texas Center for Legal Ethics and Professionalism*, Austin	5,000
Texas Conference for Women*, Austin	
Conference	15,000
Texas Equal Access to Justice Foundation*, Austin	10,000
Texas Public Policy Foundation*, Austin	
Fundraiser	10,000
Texas Southern University*, Houston	
Texas Legislative Internship Program	10,000
Tides Center/Africa Grantmakers' Affinity Group*, New York, New York	
Membership	7,500

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Public Information and Policy Research

Transparency International USA, Washington, D.C.	$ 50,000
United States-Indonesia Society*, Washington, D.C.	
2007 Annual Fund	75,000
Dinner Honoring Republic of Indonesia Minister of Finance	25,000
University of Houston Law Foundation, Texas	
General Operating Support ($100,000: 2004-2007)	25,000
University of North Carolina at Chapel Hill*	
Air Quality Research Program	50,000
Project Support	25,000
University of Texas at Austin*, Houston	
Center for Energy Economics Research	5,000
University of Texas at Dallas*, Richardson	
Corporate Governance Conference	5,000
University of Texas Law School Foundation*, Austin	10,000
US-ASEAN Council for Business and Technology Inc.*, Washington, D.C.	10,000
Washington Legal Foundation, D.C.	30,000
Washington University*, St. Louis, Missouri	
International Symposium on Energy & Environment	25,000
Western Governors' Association*, Denver, Colorado	15,000
Wisconsin Chamber of Commerce Foundation Inc.*, Madison	
Project Support	10,000
Women in Government*, Washington, D.C.	
Membership	20,000
Woodrow Wilson International Center for Scholars*, Washington, D.C.	
Awards Dinner	10,000
General Operating Support	15,000
Kennan Institute	5,000
Subtotal	**$ 30,000**
World Affairs Council*	
Conversations with Living Legends – Houston, Texas	15,000
General Operating Support – Dallas, Texas	35,000
General Operating Support – Houston, Texas	6,500
General Operating Support – Washington, D.C.	10,000
Subtotal	**$ 66,500**
World Press Institute, St. Paul, Minnesota	25,000
Wyoming Governor's Residence Foundation*, Cheyenne	
2007 Inauguration Fundraiser	6,000
Wyoming Heritage Foundation*, Casper	5,000
Exxon Mobil Corporation	
Other Contributions*, each under $5,000	31,792
ExxonMobil Foundation	
Other Contributions, each under $5,000	2,000
Total Public Policy Contributions made through the United States	**$6,133,792**

Exxon Mobil Corporation
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Public Information and Policy Research

Contributions Benefiting Communities in the United States#	**$6,133,792**
Contributions Benefiting Countries Outside the United States#	**$ 106,700**
Total Worldwide Public Policy Contributions#	**$6,240,492**
Exxon Mobil Corporation*	**$5,600,492**
ExxonMobil Foundation	**$ 640,000**
Total Public Information and Policy Research#	**$6,240,492**

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\# May include cash and in-kind contributions to nonprofit and NGO organizations; direct spending on community-serving projects; social bonus projects required under agreements with host governments by Exxon Mobil Corporation, its divisions and affiliates; and, ExxonMobil's share of community expenditures paid by joint ventures operated by other companies.