

**GREEN JOBS CREATED BY GLOBAL  
WARMING INITIATIVES**

---

---

**HEARING**  
BEFORE THE  
**COMMITTEE ON**  
**ENVIRONMENT AND PUBLIC WORKS**  
**UNITED STATES SENATE**  
ONE HUNDRED TENTH CONGRESS  
FIRST SESSION

SEPTEMBER 25, 2007

Printed for the use of the Committee on Environment and Public Works



Available via the World Wide Web: <http://www.access.gpo.gov/congress.senate>

U.S. GOVERNMENT PRINTING OFFICE

73-571 PDF

WASHINGTON : 2013

---

For sale by the Superintendent of Documents, U.S. Government Printing Office  
Internet: [bookstore.gpo.gov](http://bookstore.gpo.gov) Phone: toll free (866) 512-1800; DC area (202) 512-1800  
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED TENTH CONGRESS  
FIRST SESSION

BARBARA BOXER, California, *Chairman*

MAX BAUCUS, Montana	JAMES M. INHOFE, Oklahoma
JOSEPH I. LIEBERMAN, Connecticut	JOHN W. WARNER, Virginia
THOMAS R. CARPER, Delaware	GEORGE V. VOINOVICH, Ohio
HILLARY RODHAM CLINTON, New York	JOHNNY ISAKSON, Georgia
FRANK R. LAUTENBERG, New Jersey	DAVID VITTER, Louisiana
BENJAMIN L. CARDIN, Maryland	JOHN BARRASSO, Wyoming <sup>1</sup>
BERNARD SANDERS, Vermont	LARRY E. CRAIG, Idaho
AMY KLOBUCHAR, Minnesota	LAMAR ALEXANDER, Tennessee
SHELDON WHITEHOUSE, Rhode Island	CHRISTOPHER S. BOND, Missouri

BETTINA POIRIER, *Majority Staff Director and Chief Counsel*  
ANDREW WHEELER, *Minority Staff Director*

---

<sup>1</sup>Note: During the 110th Congress, Senator Craig Thomas, of Wyoming, passed away on June 4, 2007. Senator John Barrasso, of Wyoming, joined the committee on July 10, 2007.

# C O N T E N T S

Page

**September 25, 2007**

## OPENING STATEMENTS

Boxer, Hon. Barbara, U.S. Senator from the State of California .....	1
Inhofe, Hon. James M., U.S. Senator from the State of Oklahoma .....	2
Sanders, Hon. Bernard, U.S. Senator from the State of Vermont .....	30
Cardin, Hon. Benjamin L., U.S. Senator from the State of Maryland .....	209

## WITNESSES:

Sigmar, Gabriel, Federal Minister for Environment, Nature Conservation and Nuclear Safety, Federal Republic of Germany .....	32
Prepared statement .....	34
Responses to additional questions from Senator Boxer .....	35
Armev, Richard K., Chairman, Freedomworks .....	87
Prepared statement .....	88
Khosla, Vinod, Founder, Khosla Ventures .....	91
Prepared statement .....	93
Response to an additional Question from Senator Boxer .....	106
Ringo, Jerome, President, Apollo Alliance .....	108
Prepared statement .....	110
Winegarden, Wayne, Partner, Arduin, Laffer and Moore Econometrics .....	114
Prepared statement .....	116
Responses to additional questions from Senator Boxer .....	118
Berrigan, Carol, Director of Industry Infrastructure, Nuclear Energy Institute .....	143
Prepared statement .....	144
Responses to additional questions from:	
Senator Boxer .....	147
Senator Inhofe .....	148
Klobuchar, Hon. Amy, U.S. Senator from the State of Minnesota .....	154
Kammen, Daniel, Professor of Energy and Society, Professor of Public Policy in the Goldman School, Professor of Nuclear Engineering, and Director of the Renewable and Appropriate Energy Laboratory, University of California, Berkeley .....	156
Prepared statement .....	158
Green, Kenneth, Visiting Fellow, American Enterprise Institute for Public Policy Research .....	166
Prepared statement .....	168
Responses to additional questions from Senator Inhofe .....	170
Blittersdorf, David, CEO, Earth Turbines; Founder, NRG Systems .....	185
Prepared statement .....	186
Responses to additional questions from Senator Boxer .....	189
Culpepper, Mark, Vice President of Strategic Marketing, SunEdison .....	190
Prepared statement .....	192
Responses to additional questions from Senator Boxer .....	195
Gilligan, Donald, President, National Association of Energy Service Companies .....	196
Prepared statement .....	197
Response to an additional question from Senator Boxer .....	202

IV

	Page
ADDITIONAL MATERIAL	
Letter from The Center for American Progress .....	214
Statements from:	
Apollo Alliance Urban Habitat .....	218
The Nature Conservancy .....	241

## **GREEN JOBS CREATED BY GLOBAL WARMING INITIATIVES**

**TUESDAY, SEPTEMBER 25, 2007**

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

The full committee met, pursuant to notice, at 2 p.m. in room 406, Dirksen Senate Office Building, the Hon. Barbara Boxer (chairman of the committee) presiding.

Present: Senators Boxer, Inhofe, Lautenberg, Sanders, Alexander, Klobuchar, Barrasso

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

Senator BOXER. The hearing will come to order. I want to welcome all of our distinguished panelists. Lovely to see you here.

When Senator Inhofe came in, he jokingly said our honeymoon is over because yesterday we worked so closely together on the water infrastructure of the Country, and global warming, we view it a little differently. But speaking just for myself, I believe global warming is one of the greatest challenges our generation faces and I believe that the scientists have determined that we must take action because if global warming goes unheeded, we will face impacts such as drought, loss of snow pack, and water supplies, significant extinction of species, and extreme weather events. We have already seen some of this happening.

In July, I traveled to Greenland with 10 colleagues to view the rapid melting of the enormous Greenland ice sheet. If the sheet were to melt, the sea level would rise by 23 feet and it would be disastrous for our coastlines. I don't think I will ever forget that trip. It was very powerful. But I approach this whole issue with hope, not fear. There is a great opportunity in addressing global warming. By taking action to solve it, we will help our economy and create many jobs.

Today, we had a briefing from the Europeans. They are very clear. They have the numbers to show how jobs are increasing, while they cut back on carbon emissions. In Britain since 1990, they have reduced their greenhouse gas emissions by about 15 percent, but their economy has grown by over 40 percent. I think we can use American know-how and innovation to experience the same success by producing domestically renewable energy, biofuels and energy-conserving products.

In fact, a study completed this August by the University of California at Berkeley projected that meeting the caps from AB32—

that is California's landmark global warming legislation—could boost gross State product in my State in 2020 by up to \$74 billion and create 89,000 new jobs. This is just my State of California.

In fighting global warming, we can increase energy efficiency, increase our energy independence, improve our national security, and increase our global competitiveness. The reports from the Pentagon State that they believe in future years if we do nothing, that global warming will be the major cause of wars.

So I am going to place the rest of my statement in the record and do a couple of housekeeping things. First, I want to say that when Tom Friedman said "Green is the new red, white and blue," I thought he captured my sentiments exactly. But what I want to do, because of my schedule and because of his extreme interest in this hearing, is to turn the gavel over to my colleague, Senator Sanders. He will run the hearing after we hear from Senator Inhofe.

So Senator Inhofe, please go forward.

[The prepared statement of Senator Boxer follows:]

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

Global warming is one of the greatest challenges of our generation.

According to a recent Intergovernmental Panel on Climate Change report, if global warming goes unchecked, we will face impacts such as drought, loss of snow pack and water supplies, significant extinction of species, and extreme weather events.

In July, I traveled to Greenland to view the rapid melting of the enormous Greenland Ice Sheet. If the Greenland Ice sheet were to melt, the sea level would rise by 23 feet. This would have disastrous consequences for our coastlines.

But I approach this issue with hope, not fear. There is great opportunity in addressing this issue.

By taking action to solve global warming, we will help our economy and create many new jobs.

I believe that if we cap carbon emissions and fight global warming, we will be better off for it in every way, including economically.

Take a look at Britain. Since 1990 they have reduced their greenhouse gas emissions by about 15 percent, while its economy has grown by over 40 percent.

Today, Britain's environmental industries are the fastest growing sector of the country's economy, growing from about 135,000 jobs to over 500,000 jobs in just the last 5 years.

We can use American know-how and innovation to experience the same success by producing domestically renewable energy, biofuels, and energy-conserving products domestically.

In fact, a study completed this August by the University of California, Berkeley projected that meeting the caps from AB32, California's landmark global warming legislation, could boost Gross State Product in 2020 by up to \$74 billion. It would create 89,000 new jobs in California. And this is only in California.

In fighting global warming we can increase energy efficiency, increase our energy independence, improve our national security, and increase our global competitiveness.

As 60 California Economists have said: "The most expensive thing we can do is nothing."

When we create and build clean energy sources and energy efficient technologies, we will export these technologies to the rest of the world. America will rebuild our manufacturing sector and create new, skilled "green collar" jobs.

Green jobs are our future. I agree with Tom Friedman who says, "green is the new red, white and blue."

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

Senator INHOFE. Thank you, Madam Chairman.

I am just amazed every time I hear people talk about the science is settled and all that. Fortunately, this is not a hearing where we

are going to be talking about the science, but you are going to hear some recent things that have happened. Without question, the preponderance of the science that is coming along is primarily those individuals who are on the other side of the issue coming over and becoming skeptics.

While I do think holding this hearing is important, I have no doubt in my mind what would happen to our jobs should we start having a cap and trade system or a tax system. So I think it is very important to have this. I welcome all of the witnesses, particularly my good friend Dick Armey, with whom I served in the House, and who is from Texas and saw fit to get a good education and went to Oklahoma University to get his Ph.D. It is nice to have you here.

I would note with regret that Paul Renfrow of OGE was going to be on this panel. He is not able to because of the death of Steve Moore, who has been their Chairman, Madam Chairman, for probably 15 or 20 years.

We have held numerous hearings in this Committee on the issue of climate change. I have lost count, about 20 or 21, I guess. In contrast, a hearing on job impacts of carbon mandates on the U.S. economy is an important one. I will be blunt. Like several of our witnesses today, I believe carbon mandates are job destroyers. Our witnesses will testify today on how devastating carbon mandates would be to the economy, costing up to \$10,400 for a family of four. It is kind of a grueling number. First all, we had the Wharton Econometrics survey, and then that was followed by an MIT study and the numbers keep going up.

They are staggering numbers, and the burdens will not be shared equally. I think we all understand that the poor are the ones that will be carrying the brunt of the loss. As a strong supporter of nuclear energy, I was gratified that we could expect more nuclear plants to come online and thousands of good jobs in the building of new reactors that will create. Today, we celebrated the first new application in 30 years. I am just very, very excited about that. We have been working on this for quite some time.

In fact, while we are looking at the crisis we have in energy in this Country, it is not just oil and gas and coal and nuclear and renewables, it is all of the above. I would like to submit for the record the testimony of Dr. Gabriel Calzada.

Senator BOXER. Without objection.  
[The referenced testimony follows:]

STATEMENT OF GABRIEL CALZADA, ASSOCIATE PROFESSOR OF ECONOMICS, KING JUAN CARLOS UNIVERSITY, MADRID PRESIDENT, INSTITUTO JUAN DE MARIANA (SPAIN)

Madame Chairman and respected Members on this Committee, my name is Dr. Gabriel Calzada, Associate Professor in Economics at the King Juan Carlos University in Madrid, Spain and President of the Instituto Juan de Mariana, a classical liberal think tank. I appreciate the opportunity to provide comments for the record of this hearing addressing the issue of "green-collar jobs", or specifically the notion that adopting carbon constraints will produce jobs.

In short, while certainly this is literally true as with any regulatory scheme will directly create some jobs out of necessity to deal with or capitalize upon it, it says nothing about the quality or sustainability of the jobs, their actual gross or net benefit or contribution to the economy. More important, the claim notably does not include any consideration of the jobs that such regulations cost an economy, particularly when the scheme in question is one adopted by only a few countries worldwide and involves a basic requirement of most industries: the availability and affordability of energy.

It is on that latter count that I will focus my remarks today, specifically to note how Europe's cap-and-trade scheme has demonstrably chased existing and future jobs away from Europe's Member State economies. I read much about how whatever the United States adopts, if anything, it will of course not indulge in the mistakes of Europe's scheme which it is an understatement to describe as less than successful.

#### AVOIDING EUROPE'S COSTLY MISTAKES: IS IT POSSIBLE?

One rarely reads the specifics of how this avoidance will come about, what of the Emission Trading Scheme's (ETS) pitfalls will the U.S. Congress "engineer out", should it choose this rationing path. In truth, such claims are very curious given that Europe has not learned how to fix its scheme to avoid these massive downsides.

As regards a U.S. plan, one typically reads only general statements about auctioning some amount of overall emission allocations instead of giving them all away as Europe has done (despite the authority to auction some, albeit quite small, portion). It is important to first note that this proves far more difficult in practice than in theory—after all, when industry participants advocate for such a scheme they mean that they support the specific scheme that they have in mind, under which they envision making money, and I need not tell Congress that these constituencies have proven willing to lobby heavily to gain what they seek, and avoid being the ones to pay under whatever design is chosen if any.

Further, simply auctioning some (politically realistic, that is, likely quite small) quantity of emission allocations as opposed to handing out for free the suddenly (if artificially) valuable certificates does not avoid other problems inherent in such schemes as applied to a ubiquitous product of industrial activity. I say "product" as opposed to "byproduct" because CO<sub>2</sub> emissions from any given source increase as one more efficiently combusts hydrocarbon energy.

These other problems inherent to cap-and-trade as applied to carbon dioxide include a) that policymakers can determine an emission cap or the cost, but not the emission cap and the cost; any GHG policies mild enough to make it through the policymakers are of such small effect as to be without remote chance of having a climatic impact; the costs imposed on the activity are typically far beyond the assessed societal cost of the activity; and, most important in this context, cap-and-trade particularly as applied to CO<sub>2</sub> is inherently subject to gaming. There is after all a reason that Enron was the pioneer pushing for exactly this scheme in the U.S.

I regret that I do not have space permitting me to address each of these, today, but am willing to provide responses in writing to any questions seeking more detail. Instead, I specifically wish to focus on Europe's newest export to the U.S.: jobs lost due to having convinced itself of artificially low estimates of the cost of, and artificially high speculation about potential gain from, regulating greenhouse gases.

#### EUROPE'S NEWEST EXPORT: KYOTO JOBS, THANKS TO ITS ETS

The Kyoto Protocol is steeped in mythology, the leading myth being Europe's supposed successful performance under the global warming treaty. Even the European Environment Agency annually admits the truth: since Kyoto (1997), through 2006 (the latter year's figures being unofficial) Europe's greenhouse gas (GHGs) emissions are well up, not down, and rising not falling. Although EEA's most recent statement from June of this year notes a year-over-year reduction, 2005 compared to 2004, enough figures are in the public domain to note that this was a function of the German economy's downturn which, like EU GHG emissions, was reversed in 2006.

Another myth involves the U.S., whose economic (and population) growth has far outpaced Europe's while its emissions have actually increased at a fraction of Europe's rate under any modern baseline (since Kyoto was agreed). A vibrant economy, not name-calling or rationing energy use emissions, has proven the better tool for improving one's GHG performance, by pulling through new technologies. In my opinion that is the preferable "green jobs" pathway.

Now, the U.S. has also begun receiving a "Kyoto windfall" in the form of foreign direct investment from those few countries actually bound by Kyoto. Thus it is all the more mysterious why U.S. policymakers are so driven to shift the U.S. focus from growth to rationing by mimicking the approach of this failed pact, cutting off Europe's newest export of jobs.

Consider the case of Spain, which unlike the U.S.—but like many European countries—was allowed to increase GHGs under Kyoto. "Comply with Kyoto, no matter what," was current Spanish Prime Minister Zapatero's slogan when campaigning for La Moncloa—Spain's White House. Three years later, Kyoto's "cap-and-trade" model is costing Spaniards a fortune even while their chances of complying with the Pro-

to col are at zero, as is typical throughout Europe and most of Kyoto's few covered countries.

Possibly due to the resulting blackouts, Spanish authorities remain in the dark about the costs of their stubborn commitment to Kyoto's cap-and-trade scheme. For example, in the province of Valencia the government fined and temporarily closed a paper mill, a ceramic tile manufacturer and a glass maker for not possessing GHG permits, until the administration could create a way for the companies to acquire permits. Meanwhile the central government has issued over 20 national "Kyoto" plans regulating a myriad of economic activities, futilely distorting the national economy.

Yet despite (because of?) harmful regulations Spain's emissions have increased by nearly 50 percent. When the European market for GHG permits opened, then-Environment Minister Cristina Narbona promised "the maximum companies entering the [Emission Trading Scheme (ETS)] will have to pay will not be over 85 million euros per year." One year later, Spanish companies paid about 300 million (about \$388 million), 3 1/2 times the minister's avowed cost ceiling. And this is just the tip of the iceberg.

The Instituto Juan de Mariana estimated Spain's cap-and-trade cost for the years 2008–2012 as between 4 and 7 billion (between about \$5.5 to \$9.5 billion USD) depending on various factors including the price at the time we conducted this report (appx. 21 for future credits); this was from 10 to 16 times Minister Narbona's prediction. A PriceWaterhouseCoopers study elevated the price of Kyoto for Spain to 15 billion, or 35 times the minister's promise. The government has been forced to admit that costs in the billions of euros will ensue, but downplays it. That is to say, the government announced that the cost for 2008–2012 could be up to more than 3 billion (the exact estimate was 3067 million, coming quite close to our earlier estimates, particularly when one considers they began with an 85 million per year prediction).

Regardless, this drag on the economy accrues no environmental benefit, as even Kyoto's most ardent champions admit: this is the first of 30 such steps, they say.

Some Spanish employers already shut their doors or shifted new investment to countries not requiring GHG rationing. Consider North American Stainless Steel, a subsidiary of Acerinox S.A., the world's second-largest stainless steel producer and the largest Spanish investor in the U.S. Acerinox decided to expand its investments in Kentucky in large part because the ETS is wrecking Spain's competitiveness. Expanding operations in Spain has become prohibitively expensive due to the added cost for every ton of CO<sub>2</sub>. This helps to explain why this large manufacturer plans to invest just a fraction of what it will invest in Kentucky (270 million, or about \$350 million) in its home market (41 million) (exchange rates vary, these cited are as of the time of particular of Mr. Munoz's relevant remarks).

Acerinox's then-CEO (now retired) Victoriano Munoz noted on 24th February 2005, just after announcing one significant USD investment in Kentucky, that his company does not want to invest in Spain because they find difficulties in complying with Kyoto and "I would not like to find myself buying quotas from France or Germany".

Mr. Munoz also said as early as 2004 that, unlike its European counterparts, North American Stainless had significantly improved its comparative advantage by the U.S. staying out of Kyoto. Not coincidentally, just a few months later the company decided to expand its U.S. presence, adding 175 new jobs in Carroll County, KY, while holding back new investments in Spain. In early 2005, when presenting the company's 2004 figures Munoz explained that principal drivers behind Acerinox re-directing investments toward its American factory included the cost of complying with Kyoto and the continuous blackouts in Spain (even a failing European performance under Kyoto has limited its power supply options).

South Africa is exempt from Kyoto and—like 155 countries which continue to reject the rationing approach of Kyoto and "cap-and-trade"—is unlikely to ever enact similar policies. As such, Acerinox's South African branch also benefits from Kyoto's destructive impact on Europe's economy with, as Munoz put it in the 2006 shareholders meeting, "a great strategic value". On one hand it boasts a reliable electricity supply, unlike Kyoto-mired Spain. On the other hand, a tightening of requirements in Europe (which Kyoto demands must continue ever deeper) or the possible eventual adoption of a similar rationing scheme by the U.S. makes that plant an important strategic asset.

That is, were the U.S. to make clear that it was not in fact going to impose some new and improved version of Europe's disastrous example, even more investment would apparently flow to your shores. Following Europe's example, it is reasonable to conclude, would similarly drive existing and future investment away. Regrettably,

many political leaders do find political appeal in, to date at least rhetorically, touting Kyoto-style regulation, leaving investors somewhat wary.

Many energy-intensive companies face the dilemma whether to pay the excessive costs of complying with Kyoto, or to instead redirect investments to other countries. Munoz repeatedly warns of Kyoto creating a “very grave” situation for Spanish industry, “forc[ing] us into a second industrial restructuring.” In his opinion, “Kyoto is one of the biggest problems Spain will have to deal with in the coming years.”

It is also useful to note that Europeans are not being made wealthy by selling windmills and solar panels to each other, as the rhetoric leading up to enactment of its carbon trading scheme would have led one to believe. Instead, it is only utilities and brokers who are clearing massive, indeed “windfall” profits from selling the credits given them by the State or else—if instead used to offset their own production—incorporating their market value into the price of their electricity (after all, once granted by the State it is a valuable asset that could have been sold), directly on the backs of ratepayers.

This causes me to remark on one other aspect of imposing carbon controls on an economy, which is particularly relevant to the claim that such controls create jobs. That is, the manufacture of “renewable” energy sources—which of course are heavily subsidized under such schemes both directly and indirectly—is often cited in an artificial way as proof of some resulting profitability that generates wealth and jobs for everyone. Please consider the current Spanish law on the subject, which is not unique from what one should expect in a world of state-imposed carbon-constraints: the “fixed sell price” (for wind-energy-producers) to distributors of energy is 73.22/MWh, which is between 136 percent and a 209 percent of the market price. This results in great redistribution (the money going from millions of Spaniards to the ones that have license to open a windmill field), in a game leading people to believe that windmills are creating (net) jobs while, in the best case, it destroys jobs in other sectors to create new ones in these privileged sector. Unfortunately, the future is now and Kyoto is already one of Spain’s economic problems due to the lost of competitiveness and outsourcing brought about by rationing GHG emissions. A whole generation of European policymakers still must learn that there is no gain for the environment from rationing energy use. In the meantime and for now, countries like U.S. and South Africa are becoming refuges for international investment.

#### CONCLUSION

In conclusion, I respectfully suggest that the U.S. take a long and serious look at the truth behind Europe’s experience with a carbon “cap-and-trade” scheme, and also the problems inherent in such a scheme. It is not sufficient to State that the Clean Air Act’s “acid rain” program is a useful analog, for not only is that program’s success oversold (e.g., SO<sub>2</sub> emissions had been falling for 20 years, and unrelated interventions such as rail deregulation occurred which are not likely to rescue a CO<sub>2</sub> scheme from reaching the estimated cost to the economy). But also know that Europe expressly enacted its CO<sub>2</sub> program with the benefit of that experience, too.

The practical realities of applying cap-and-trade to CO<sub>2</sub> simply do not match the sunny rhetoric, and it seems clear that the jobs gained from imposing such a burden on the U.S. economy will be far outweighed by the jobs lost due to the reduced competitiveness resulting from imposing this drag on the availability and affordability of energy.

Thank you again for allowing me to comment for the record.

Senator INHOFE. He tells a story of North American Stainless Steel, a subsidiary of Acerinox, the world’s second largest stainless steel producer. The Kyoto Protocol’s emissions trading system is wrecking Spain’s competitiveness and adding to the bottom line cost of production in that country, so the company announced in 2005 that it would expand operations in Carroll County, Kentucky, creating an additional 175 jobs. CEO Victoriano Munoz explained the decision by saying, “I would not like to find myself buying quotas from France and Germany.”

Government projections all show that mandates will worsen the economy. Of course, the hardest burdens will hit on the poor. It is no coincidence, Madam Chairman, that the average American can expect to live 25 years longer than less than a century ago, and the real standard of living has increased six-fold. These leads were

driven by rapid growth that was unleashed in the 20th century. I am concerned that instead of continuing our amazing success story, we will write a very different story for the future generations.

Instead of continuing to prosper, we will write laws that become the engine of the Nation's decline. I urge my colleagues to safeguard the future prosperity of the Nation and reject symbolic climate gestures that threaten that prosperity.

Thank you, Madam Chairman. Indeed, the honeymoon is over.

[The prepared statement of Senator Inhofe follows:]

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

Madame Chairman, thank you for holding this hearing today. I would like to welcome all of our witnesses, but especially that of Dick Armey, who is not only a man of great substance, but great learning. And I would note with regret that Paul Renfrow of OG&E will not be joining us due to the passing of OG&E's CEO, Steve Moore. Steve was a good and decent man and the people of my State will miss him.

We have held numerous hearings in this Committee on the issue of climate change, but few of any substance. In contrast, a hearing on the job impacts of carbon mandates on the U.S. economy is an important one. I will be blunt: like several of our witnesses today, I believe carbon mandates are job destroyers.

Our witnesses will testify today on how devastating carbon mandates would be to the economy, costing up to \$10,800 a year for a family of four. These are staggering numbers. And the burdens will not be shared equally. Some will win, but many more will lose—and some people will lose everything as their jobs are shipped overseas.

As a strong supporter of nuclear energy, it is gratifying that we could expect more nuclear plants to come online, and the thousands of good jobs the building of new reactors will create. But more jobs will be lost elsewhere than are created. I would like to submit for the record the testimony of Dr. Gabriel Calzada of Madrid. He tells the story of North American Stainless Steel, a subsidiary of Acerinox, the world's second-largest stainless steel producer. Kyoto Protocol's emissions trading system is wrecking Spain's competitiveness and adding to the bottom line costs of production in that country, so the company announced in 2005 that it would expand operations in Carroll County, Kentucky, creating an additional 175 jobs. CEO Victoriano Munoz explained the decision by saying "I would not like to find myself buying quotas from France or Germany."

Government projections all show that mandates will worsen the economy. Of course, the hardest burdens will be borne by the poor and working class, as a Congressional Budget Office analysis showed earlier this year. Their energy costs—already five times higher than wealthier Americans as a percentage of their monthly budget—will mushroom.

It is no coincidence, Madame Chairman, that the average American can expect to live 25 years longer than less than a century ago. And the real standard of living has increased 6-fold. These leaps were driven by the rapid growth that was unleashed in the 20th Century. I am concerned that, instead of continuing our amazing success story, we will write a very different story for future generations. That instead of continuing to prosper, we will write laws that become the engine of the Nation's decline. I urge my colleagues to safeguard the future prosperity of the Nation and reject symbolic climate gestures that threaten that prosperity.

Thank you.

Senator BOXER. Yes, I am sad to say it sure is.

I would like to place in the record two things. One is recent climate change news in the last 2 weeks of all the stories that point to what is happening in the real world out there on the ground. The other is a report by the Ella Baker Center for Human Rights talking about what we need to do as we move forward for social justice in this global warming legislation.

[The referenced documents follows:]

### Recent Global Warming News, August 1<sup>st</sup> – September 5<sup>th</sup>

China Considering Trading Market, Quote System, *Greenwire*, August 1, 2007 -

<http://www.eenews.net/Greenwire/2007/08/01/6/#6>

The Chief of China's central bank said in early August that China is considering setting up an emissions quota system and a carbon trading exchange to control the nation's contribution to climate change.

Particulate Pollution in Asia Speeding Glacier Melt – study, *E&E News PM*, August 1, 2007

- <http://www.eenews.net/eenewspm/2007/08/01/9/#9>

According to a study published by *Nature* the haze of particulate pollution that hovers over South Asia is accelerating the melting of Himalayan glaciers. The study assigns as much blame to the "Asian Brown Cloud" as greenhouse gases for climate change observed in the Himalayas over the past 50 years.

China Blames Climate Change for Extreme Weather, *Reuters*, August 1, 2007 -

<http://www.alertnet.org/thenews/newsdesk/PEK358550.htm>

China blamed global warming for this year's weather extremes, which have led to more than 700 deaths from flooding and left more than 7 million with little access to water. Such extreme conditions are likely to get worse and more common in the future according to Song Lianchun, the head of the China Meteorological Administration's Department of Forecasting Services and Disaster Mitigation.

Warming of Glaciers Threatens Millions In China, *San Francisco Chronicle*, August 1, 2007

- <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/08/01/MN2VRAKIH2.DTL&feed=rss.news>

The glaciers in western China are shrinking rapidly, endangering hundreds of millions of people who depend on the waters flowing eastward through the Yellow River. With the rest of the nation being punished this summer by record heat waves, floods and droughts, Beijing is coming to realize that China may be especially at risk.

U.N. Climate Chief Skeptical About Global Carbon Tax, *Reuters*, August 2, 2007 -

<http://in.reuters.com/article/worldNews/idINIndia-28774420070801>

A top U.N. climate change official (Yvo de Boer) voiced doubt about a global carbon tax but said national taxes were possible and laws to cap global warming emissions were better for business.

Climate Deal Talks Gain Global Support, *AP*, August 3, 2007 -

<http://www.msnbc.msn.com/id/20102028/>

Nearly 100 countries speaking at the first UN General Assembly meeting on climate change signaled strong support for negotiations on a new international deal to tackle global warming. There was so much interest among worried nations, many facing drought, floods, and searing heat, that the 2 day meeting was extended for an extra day.

Global Warming Fight May Get Boost From Ozone Plan, *Reuters*, August 3, 2007 -

<http://www.reuters.com/article/environmentNews/idUSL0338932420070803>

Countries can take a big step toward fighting global warming by agreeing to tighten a UN treaty outlawing gases that damage the ozone layer. According to the UN Environment

Programme (UNEP) the Montreal Protocol on ozone may take one of the biggest steps to reduce global warming this year if nations agree to speed up the phase out of HCFCs. HCFCs, used in refrigerants, destroy ozone and are also powerful GHGs.

European Heat Waves Double in Length Since 1880, *Innovations Report*, August 3, 2007 - <http://www.innovations-report.de/html/berichte/geowissenschaften/bericht-88325.html>

Very accurate measures of European daily temperatures indicate that the length of heat waves on the continent has doubled and the frequency of extremely hot days has nearly tripled in the past century.

World Must 'Go Beyond' the Kyoto Protocol, Finance Ministers Say, *Greenwire* August 3, 2007 - <http://www.eenews.net/Greenwire/2007/08/03/12/#12>

World governments need to "go beyond" the goals of the Kyoto Protocol once it expires in 2012 to adequately address climate change, according to 21 finance ministers from member countries of the Asia Pacific Economic Cooperation during a meeting in Australia.

Investment Funds Looking to Companies that Will Profit from Climate Policies, *Greenwire*, August 3, 2007 - <http://www.eenews.net/Greenwire/2007/08/03/9/#9>

Investors are increasingly creating new funds and raising their stake in companies expected to profit from global warming and climate policies. And this is likely just the beginning.

Sidebar: Companies of all Sizes Going Green, *Washington Post*, August 6, 2007 - <http://www.washingtonpost.com/wp-dyn/content/article/2007/08/06/AR2007080600034.html>

IT companies going "green" is becoming common place with new products that are better for the environment. These companies are acting to increase efficiency, cut their own costs and reduce their carbon footprint.

Smart Metering Could Throttle Carbon, *BusinessWeek*, August 6, 2007 - [http://www.businessweek.com/globalbiz/content/aug2007/gb2007086\\_356928.htm?chan=top+news\\_top+news+index\\_global+business](http://www.businessweek.com/globalbiz/content/aug2007/gb2007086_356928.htm?chan=top+news_top+news+index_global+business)

The British government hopes to save energy with utility meters that give automatic real-time readings of consumer use, "smart metering." Smart meters enable the real-time transmission of energy readings to utilities companies so an individual customer's usage can be accurately monitored without the need for manual meter readings. The UK government is expecting these meters to help reduce energy use.

Early 2007 Saw Record-Breaking Extreme Weather: UN, *Scientific American*, August 7, 2007 - <http://www.sciam.com/article.cfm?alias=early-2007-saw-record-bre&chanId=sa003&modsrc=reuters>

The world experienced a series of record-breaking weather events in early 2007, from flooding in Asia to heatwaves in Europe and snowfall in South Africa, according to the UN weather agency. Also, the World Meteorological Organization (WMO) said global land and surface temperatures in January and April were likely the warmest since records began in 1880, at more than 1 degree C higher than average for those months.

Tipping Points Exploring How Agriculture Contributes to Global Change, *ScienceDaily*, August 7, 2007 - <http://www.sciencedaily.com/releases/2007/08/070806090324.htm>

Growing food and fiber entails the use of fertilizer and irrigation systems and results in land clearing. These side effects of agriculture can lead to tipping points which include desertification, salinization, water degradation, and climate changes. As human populations shift to more meat-heavy diets, trade of agricultural products increases, and demand for biofuels grows, the pressure on agricultural systems increase as does the stress on the climate and the planet.

Climate Change Endangers India, UN Says, *New York Times*, August 7, 2007 - <http://www.nytimes.com/2007/08/07/world/middleeast/07cnd-floods.html?ex=1189051200&en=d3db7714a587cf66&ei=5070>

As India is battered with exceptionally heavy rains, UN officials have warned that climate change could destroy vast swaths of farmland in India, ultimately affecting food production and adding to the woes of already desperate peasants who live off the land.

Temps Stressing Sierra Nevada's Old-Growth Forests – USGA, *E&E News PM*, August 7, 2007 - <http://www.eenews.net/eenewspm/2007/08/07#2>

Warming temperatures in California's Sierra Nevada is making life difficult for trees in old-growth forests, according to scientists at the US Geological Survey. The death rate for conifers, firs, and pines in Sequoia has risen over a 22 year period.

Across Globe, Extremes of Heat and Rain, *Washington Post*, August 8, 2007 - <http://www.washingtonpost.com/wp-dyn/content/article/2007/08/07/AR2007080701728.html>

With a monsoon dropping 14 inches of rain in one day in South Africa, Germany having its wettest May on record following an April that was the driest in a century, temperatures in reaching 113 degrees in Bulgaria and 90 degrees in Moscow in late May, shattering old records. There are still several months left in the year, but it has already experienced a range of weather extremes that the UN's World Meteorological Organization (WMO) said is well outside the historical norm and is a precursor of much greater weather variability as global warming transforms the planet.

Ore. Governor Signs Climate Bill, *Greenwire*, August 8, 2007 - <http://www.eenews.net/Greenwire/2007/08/08#12>

Oregon governor Ted Kulongoski (D) signed a measure into law that will put the states at the forefront of states addressing climate change. The law aims to slash the state's GHG emissions to 75% below 1990 levels by mid-century.

Indo-Pacific Populations in Steep Decline – Study, *Greenwire*, August 8, 2007 - <http://www.eenews.net/Greenwire/2007/08/08#16>

Coral reefs in the Indo-Pacific region are disappearing more quickly than experts thought, according to recent research. The study is the first comprehensive look at the coral population in the Indo-Pacific, which is home to about 75% of the world's coral, including Australia's Great Barrier Reef. "We have already lost half of the world's reef-building corals," a researcher said.

Climate Model Predicts Hot Decade, *USA Today*, August 9, 2007 -

[http://www.usatoday.com/weather/climate/globalwarming/2007-08-09-climate-model\\_N.htm](http://www.usatoday.com/weather/climate/globalwarming/2007-08-09-climate-model_N.htm)

According to scientists releasing a 10-year projection of global warming, the next decade will be a hot one. The projection suggests that a natural cooling trend in eastern and southern Pacific Ocean waters has limited warming in recent years. Scientists say it will continue to do so, but not for long. At least half the years after 2009 are predicted to be warmer than 1998, the warmest year currently on record.

BP, Powerspan to Test CO<sub>2</sub>-Capture Technology, *Greenwire*, August 9, 2007 -

<http://www.eenews.net/Greenwire/2007/08/09#8>

BP's alternative energy unit announced a deal yesterday to test a commercialize CO<sub>2</sub> capture technology developed by Powerspan in New Hampshire. BP will provide funding and technical support for commercial scale-up for technology that captures post-combustion CO<sub>2</sub> from conventional coal-fired power plants.

Foundation to help Asia, Africa Combat effects of Warming, *Greenwire*, August 9, 2007 -

<http://www.eenews.net/Greenwire/2007/08/09#11>

The Rockefeller Foundation has announced it will invest \$70 million over the next 5 years to help Asian cities and African farmers to cope with floods, droughts, and other effects of global warming.

Analysts See 'Simply Incredible' Shrinking of Floating Ice in the Arctic, *New York Times*,

August 10, 2007 -

The area of floating ice in the Arctic has shrunk more this summer than in any other summer since satellite tracking began in 1979, and it has reached that record point a month before the annual ice pullback typically peaks. The cause is likely a mix of natural fluctuations, such as unusually sunny conditions in June and May, and long-term warming from heat-trapping GHGs and sooty particles accumulating in the air.

Canadian Premiers Agree to GHG Registry to Inventory Emissions, *Greenwire*, August 13,

2007 - <http://www.eenews.net/Greenwire/2007/08/13#6>

The premiers of Canada's 10 provinces agreed to create a national GHG registry that will inventory the level of emissions from each province but stops short of a program to actively cut them.

Calif. Official Debate Land-Use Regs' Role in Curbing Emissions, *Greenwire*, August 13,

2007 - <http://www.eenews.net/Greenwire/2007/08/13#8>

According to a state energy regulator, California lawmakers should avoid prescribing land use or dictating city planning as part of an effort to cut GHG emissions. A better approach would be to defer to local governments on specifics and order towns and cities to meet GHG reduction quotas on their own terms.

Morgan Stanley Creates Carbon Bank, *Greenwire*, August 14, 2007 -

<http://www.eenews.net/Greenwire/2007/08/14#14>

Morgan Stanley announced that it has created a carbon bank to sell GHG credits to factories, airlines, and offices worldwide so that companies can voluntarily offset their emissions.

Wolfowitz Attempted to Censor World Bank Report on Global Warming, *Greenwire*, August 14, 2007 - <http://www.eenews.net/Greenwire/2007/08/14#11>

Former World Bank President Paul Wolfowitz attempted to shift the organization's focus away from climate change during his tenure, according to documents made public recently. His behavior is indicative of a political climate at the bank that was not receptive to discussing the threat posed by global warming. A Wolfowitz deputy attempted to tone down climate references in one of the bank's main environmental strategy papers.

It Takes Deep Pockets to Fight Global Warming, *New York Times*, August 13, 2007  
<http://www.nytimes.com/2007/08/12/business/yourmoney/12proto.html?ref=science>

Some scientists argue that the ideas being backed in the U.S., like biofuels and carbon-emissions trading, may not hold much potential for actually staving. And that plenty of bigger ideas are out there to address climate change, but that they will require much more substantial funding. Carbon sequestration, solar deflection/"the parasol effect", and outer-space solutions are some of the billion dollar ideas discussed.

After Glacial Retreat, Regrowth May Feed on an Ancient Snack, *New York Times*, August 14, 2007 - <http://www.nytimes.com/2007/08/14/science/14obs2.html>

Some scientists aren't just studying the causes of glacial retreat, but the effects. Specifically, the issue of succession: how is newly exposed ground repopulated by plant and animal life? New research shows that not only do algae and simple plants take over with the newfound sunlight, but that microbes like bacteria and fungi are also early feeders, using ancient carbon as food. "The bacteria and fungi could be munching on extremely old leftovers."

Group Cites Water Law in Bid to Limit CO<sub>2</sub> Emissions, *E&ENews PM*, August 15, 2007  
<http://www.eenews.net/eenewspm/2007/08/15#1>

An environmental group filed petitions today asking seven states to declare their coastal waters "impaired" by carbon dioxide emissions under the Clean Water Act. The Center for Biological Diversity said CO<sub>2</sub> emissions are turning oceans more acidic in a bid to use the water pollution law as an alternative tack on the global warming front. Oceans absorb about half of the CO<sub>2</sub> that is emitted into the atmosphere and the oceans are 25 percent more acidic now than they were in the mid-to-late-19<sup>th</sup> century, at the start of the Industrial Revolution.

U.K. to seek 60% GHG Cuts by 2050, Enviro Say, *Greenwire*, August 16, 2007 -  
<http://www.eenews.net/Greenwire/2007/08/16#19>

The UK government will send legislation to Parliament in three months proposing 60% cuts in GHG emissions from 1990 levels by 2050, according to Friends of the Earth. The draft bill would mandate the emissions cuts with five-year rolling carbon budgets and an independent committee to monitor progress of the work.

Cost of the Saving the Climate Meets Real-World Hurdles, *The Washington Post*, August 16, 2007 - <http://www.washingtonpost.com/wp-dyn/content/article/2007/08/15/AR2007081502432.html?hpid=topnews>

Consumers can "erase" their role in climate change on the Internet with about \$99/year and a click. But what does the "offset" really translate to? This article grapples with the real-world implications of carbon offsets. One may buy an offset and keep guzzling gas at the pumps feeling reassured that her offset is doing the necessary work. That may not be a safe

assumption. For example, if her offset went toward planting trees, the amount of carbon that tree inhales from the atmosphere is not so easily measured and depends on a lot of outside factors—species, microclimate, forest fires, etc. Some argue for setting carbon exchange market standards.

[Boosting Biofuel Use Could Raise Global CO<sub>2</sub> Emissions](http://www.eenews.net/eenewspm/2007/08/17#1) – Study, *E&ENews PM*, August 17, 2007 - <http://www.eenews.net/eenewspm/2007/08/17#1>

A global increase in biofuels could emit nine times more carbon dioxide than conventional gasoline and diesel as forests and grasslands are cleared for ethanol-crop production, according to a study published today in the journal *Science*. Rather than mandating increased biofuel production and use, policymakers should focus on increasing the efficiency of fossil fuels, conserving natural habitats and planting forests and grasslands on farmland that is not needed for food, the report says.

[Priority Changes on Green Policies](http://www.latimes.com/news/politics/la-na-green21aug21.0.2163873.story?coll=la-home-center), *Los Angeles Times*, August 21, 2007

<http://www.latimes.com/news/politics/la-na-green21aug21.0.2163873.story?coll=la-home-center>  
Reflecting a shift in priorities under the Democratic majority, Congress is moving to spend as much as \$6.7 billion next fiscal year to combat global warming, an increase of nearly one-third from the current year. House appropriations bills call for about \$2 billion in spending on initiatives aimed to reduce GHG emissions and oil dependency.

[Warming Will Exacerbate Global Water Conflicts](http://www.washingtonpost.com/wp-dyn/content/article/2007/08/19/AR2007081900967.html), *The Washington Post*, August 21, 2007.

<http://www.washingtonpost.com/wp-dyn/content/article/2007/08/19/AR2007081900967.html>  
As global warming heats the planet, the climate will be wetter in some places and drier in others. Changing weather patterns will leave millions of people without dependable supplies of water for drinking, irrigation, and power. “You are going to intensify the hydrologic cycle ... [intensified] drought ... [intensified] floods.” The potential for conflict is more than theoretical, especially in the Middle East and North Africa. The WHO says, already, 1 billion people across the globe lack access to potable water.

[Emissions Pact Near in San Bernardino County](http://www.latimes.com/news/science/environment/la-me-sanberdo21aug21.1.2200977.story?coll=la-news-environment), *Los Angeles Times*, August 21, 2007

<http://www.latimes.com/news/science/environment/la-me-sanberdo21aug21.1.2200977.story?coll=la-news-environment>  
The county Board of Supervisors will meet in closed session to vote on the settlement of a lawsuit that Atty. Gen. Jerry Brown filed in April to force the county to account for greenhouse gas emissions in its 10-year growth plan.

Related Story:

[Brown Settles San Bernardino Global Warming Lawsuit](http://www.sacbee.com/111/story/336939.html), *The Sacramento Bee*, August 21, 2007 - [www.sacbee.com/111/story/336939.html](http://www.sacbee.com/111/story/336939.html)

Under the terms of deal announced by Brown in a Los Angeles news conference, the fast-growing county in the heart of the Inland Empire of Southern California will amend its general plan within 30 months to include a greenhouse gas reduction policy. Brown: “San Bernardino now sets the pace for how local government can adopt powerful measures to combat oil dependency and climate disruption...”

[Six Western States Plan Emission Cuts](http://www.wsj.com), *Wall Street Journal*, August 22, 2007

The Western Climate Initiative, including Arizona, California, New Mexico, Oregon, Utah, Washington, and the Canadian provinces of British Columbia and Manitoba announced a regional goal to cut emissions by 15% below 2005 levels within 13 years. The cuts would include a market-based cap and trade system styled after California's planned program.

[U.S. Told to Issue Global Warming Plans, \*The Washington Post\*, August 22, 2007](http://www.washingtonpost.com/wp-dyn/content/article/2007/08/22/AR2007082200534.html)  
[www.washingtonpost.com/wp-dyn/content/article/2007/08/22/AR2007082200534.html](http://www.washingtonpost.com/wp-dyn/content/article/2007/08/22/AR2007082200534.html)

A federal judge ordered the Bush administration to issue two scientific reports on global warming, siding with environmentalists who sued the White House for failing to produce the documents. The judge set March and May 2008 deadlines for the reports.

[Unlikely Allies Advance Global Warming Policy, \*The Boston Globe\*, August 22, 2007](http://www.boston.com/news/nation/washington/articles/2007/08/22/unlikely_allies_advance_global_warming_policy/)  
[http://www.boston.com/news/nation/washington/articles/2007/08/22/unlikely\\_allies\\_advance\\_global\\_warming\\_policy/](http://www.boston.com/news/nation/washington/articles/2007/08/22/unlikely_allies_advance_global_warming_policy/)

The United States Climate Action Partnership, a coalition of 25 corporations, including DuPont, General Electric, Detroit's Big Three automakers, three oil companies, and NGOs like Environmental Defense and the NRDC, has a proposal that they hope will encourage Congress and the White House to move faster on climate change legislation. They call for a mandatory cap-and-trade system that would set a target of reducing emissions by 60-80% of today's levels by 2050. The congressional legislation expected to be debated this fall calls for similar reduction targets.

[Supply Shortage Raises Costs in the West, \*Greenwire\*, August 23, 2007 -](http://www.eenews.net/Greenwire/2007/08/23#3)  
<http://www.eenews.net/Greenwire/2007/08/23#3>

Record demand for wind power has caused a three-year supply shortage of wind turbines and is pushing up the costs of ambitious renewable energy projects in the West. The demand is causing developers to secure deals for new wind turbines long before construction begins on projects.

[Calif. Homebuilder to Make Solar Energy Systems Standard on New Construction, \*Greenwire\*, August 23, 2007 -](http://www.eenews.net/Greenwire/2007/08/23#9)  
<http://www.eenews.net/Greenwire/2007/08/23#9>

Lennar Homes, which builds about 1,000 new homes per year, will install solar power systems on all new homes it builds. The San Joaquin Valley based company will install systems that cost \$15,000-20,000 but can reduce energy bills by 50% and give home buyers a one-time tax credit of \$2,000.

[Global Warming Threatens Egypt's Nile Delta, \*USA Today\*, August 24, 2007](http://www.usatoday.com/news/world/2007-08-23-egypt-nile-threat_N.htm)  
[http://www.usatoday.com/news/world/2007-08-23-egypt-nile-threat\\_N.htm](http://www.usatoday.com/news/world/2007-08-23-egypt-nile-threat_N.htm)

The World Bank describes Egypt as particularly vulnerable to the effects of global warming, saying it faces potentially "catastrophic" consequences. A big reason is the particular vulnerability of the Nile Delta, home to more than a third of the country's population.

[Greenhouse gases fueled 2006 U.S. Heat, \*Reuters\*, August 28, 2007](http://www.reuters.com/article/domesticNews/idUSN2827509420070828?feedType=RSS&feedName=domesticNews)  
<http://www.reuters.com/article/domesticNews/idUSN2827509420070828?feedType=RSS&feedName=domesticNews>

Greenhouse gas emissions—not El Nino or other natural phenomena—pushed U.S. temperatures for 2006 close to a record high, government climate scientists report. This is a significant break from recent reports that claim the day-to-day effects of carbon emissions will not be felt for decades and that temperatures are largely affected by otherwise normal weather patterns.

Study Links CO<sub>2</sub> to Demise of Grazing Lands, *Los Angeles Times*, Aug. 28, 2007  
[http://www.latimes.com/news/nationworld/nation/la-sci-prairie28aug28.1.541871\\_story?coll=la-headlines-nation&ctrack=2&cset=true](http://www.latimes.com/news/nationworld/nation/la-sci-prairie28aug28.1.541871_story?coll=la-headlines-nation&ctrack=2&cset=true)

Rising levels of carbon dioxide may be contributing to the conversion of the world's grasslands into a landscape of woody shrubs, much less useful for livestock grazing. The study artificially doubled the atmospheric CO<sub>2</sub> in an enclosed area in Colorado, simulating what some believe will be a reality in 2100 across the globe.

Irish EPA Cites Climate Change in Rapid Rise of Average Temperature, *The Washington Post*, Aug. 30, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/08/29/AR2007082902404.html>  
 Ireland's average temperature has been rising at twice the global rate since the early 1980s and parts of the country are becoming wetter and more prone to flooding due to climate change, a government-funded report said. Ireland has been "making up for lost time ... and warming at roughly twice the rate of the global average."

Global Warming—Not So Hot, *The Washington Post (Op-Ed)*, August 31, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/08/30/AR2007083001440.html>  
 Global Warming ranked twentieth on a list of the top 23 issues the American public would like to see government address, according to a Pew Research Center poll. Why? Unlike Iraq, the public sees this as an issue of the future. Also, the author cites the possibility that most Americans call themselves environmentalists and it is now time for the politicians to take the reigns on an issue the public has been adamant about since the 1970s.

Severe Weather is in NASA Scientists' Forecast, *Los Angeles Times*, August 31, 2007

[http://www.latimes.com/news/nationworld/nation/la-na-climate31aug31.1.1680086\\_story?coll=la-headlines-nation](http://www.latimes.com/news/nationworld/nation/la-na-climate31aug31.1.1680086_story?coll=la-headlines-nation)  
 As the world warms, the U.S. will face more thunderstorms with deadly lightning, bigger and faster-falling hail, and the potential for stronger tornadoes, a study by NASA suggests. A unique geography already makes the U.S. vulnerable to these storms, but warming could create stronger "updrafts" throughout the mid-west and southeast that will increase their intensity. A higher carbon dioxide make-up of the atmosphere also increases the likelihood of lightning strikes in the Western part of the country.

U.S. Draws Map of Rich Arctic Floor Ahead of Big Melt, *Wall Street Journal*, August 31, 2007

In an era of climate change, when by 2040 the Arctic could become ice-free in summer months and the melting ice allows for detailed mapping and, one day, drilling, the frozen assets are up for grabs. 23 scientists aboard the U.S. coast-guard icebreaker *Healy* are gathering data legally required to extend national territories across vast reaches of the

mineral-rich seafloor usually blocked by Arctic ice. Maps of Mars are about 250 times better than maps of the Earth's ocean floor.

New Forecast for Climate Debate, *Wall Street Journal*, Sept. 4, 2007

The coming weeks will include climate negotiations stretching from this week's Asia-Pacific Economic Cooperation forum in Sydney to back-to-back sessions later this month organized by the United Nations in New York and the Bush Administration in Washington to a big U.N. gathering in December in Indonesia. The goal of the meetings is to come up with a Kyoto successor.

GHGs Responsible for Last Year's High Temps, NOAA Says, *Greenwire*, September 4, 2007 - <http://www.eenews.net/Greenwire/2007/09/04#18>

It was GHGs and not natural phenomena that primarily contributed to near-record high temperatures last year, according to government scientists at NOAA. The annual average temperature in the US last year was 2.1 degrees F above the average temperature of the 20<sup>th</sup> century.

Growth in Carbon Emissions Slows—U.S. Analysts, *Reuters*, Sept. 4, 2007

<http://www.reuters.com/article/latestCrisis/idUSL04503766>

Growth in global emissions of the heat-trapping greenhouse gas CO<sub>2</sub> slowed slightly last year, preliminary data from the U.S. Carbon Dioxide Information Analysis Center (CDIAC) suggest. CDIAC is the U.S. DOE's primary source for climate-change data and in the past its preliminary emissions estimates have been subsequently revised upwards. CDIAC's preliminary estimates for 2005 and 2006 are based on fuel consumption data from oil company BP.

'Bringing the Ocean to the World,' in High-Def, *New York Times*, September 5, 2007

<http://www.nytimes.com/2007/09/04/science/04ocea.html?ref=science>

"This is a mission to Planet Ocean," said Prof. Delaney of U of Washington, who is heading up the new Ocean Observatories Initiative. The \$331 million program has been a dream for years and is now financed by the National Science Foundation. The multifaceted effort to study the ocean—in the ocean—through a combination of Internet-linked cables, buoys, robots, and high-definition cameras will focus on how oceans affect life on land, including their role in storing carbon and climate change; the causes of tsunamis; the future of fish populations; and the effect of ocean temperature on growing seasons.

**Recent Global Warming News 9/5/2007-9/14/2007**

Asia-Pacific Businesses Call for Carbon Pricing, *Reuters*, September 5, 2007  
<http://uk.reuters.com/article/environmentNews/idUKSYD901920070905?pageNumber=1>  
 Business leaders in the Asia-Pacific region said on Wednesday they will ask governments to put a price on carbon emissions as soon as possible to combat climate change. At their meeting in Sydney for the Asia Pacific Economic Cooperation (APEC) summit, business heads said governments should provide more incentives for companies to invest in costly research and development of new technologies to reduce their carbon footprints.

GAO Chides Government on Warming, *Washington Post*, September 6, 2007  
<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/05/AR2007090502115.htm>  
 The federal government needs to do a better job addressing how climate change is transforming the hundreds of millions of acres under its watch. The 184-page report requested by Kerry and McCain in 2004 looks at agencies ranging from the U.S. Forest Service to the National Oceanic and Atmospheric Administration (NOAA). One section notes that since 1850, the number of glaciers in Glacier National Park has declined from 150 to 26.

Belgium Building Zero-Emission Antarctic Station, *Reuters*, September 6, 2007  
[http://today.reuters.com/news/articlenews.aspx?type=worldNews&storyid=2007-09-05T131704Z\\_01\\_L05737356\\_RTRUKOC\\_0\\_US-CLIMATE-POLAR.xml](http://today.reuters.com/news/articlenews.aspx?type=worldNews&storyid=2007-09-05T131704Z_01_L05737356_RTRUKOC_0_US-CLIMATE-POLAR.xml)  
 Belgium is building the first ever zero-emission polar station in the Antarctic, powered by solar panels and wind turbines. All waste from the Princess Elizabeth Station, housing 20 researchers, will be recycled. Fossil fuel will be available, but only used for back-up.

Industry Ready for Federal Regs, AEP Executive Tells Congress, *E&ENews*, September 7, 2007  
<http://www.eenews.net/EEDaily/2007/09/07/2/#2>  
 American Electric Power CEO Michael Morris told the House Select Committee on Global Warming that his "is a willing industry." He and other operators of coal-fired power plants told the House panel they are eager to shoulder the burden of capturing and storing their CO2 emissions as long as doing so secured clear federal regulation to encourage investment. Wyoming Gov. Dave Freudenthal (D) said, "Give us a clue of what we need to do."

NOAA Scientists Say Arctic Ice Is Melting Faster Than Expected, *Washington Post*, September 7, 2007  
<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/06/AR2007090602499.html>  
 or  
 40% Shrink in Arctic Ice Predicted by 2050, *Los Angeles Times*, September 7, 2007  
<http://www.latimes.com/news/nationworld/nation/la-na-ice7sep07.1.7108111.story?coll=la-headlines-nation>  
 The Arctic ice cap is now expected to lose 40% of its mass by 2050 in most regions. A much faster rate than last reported, the forecast holds grim consequences for the polar bears, walrus, and other marine animals that live there. The ice will retreat 300-500 miles farther from the coast of Alaska in the summer, opening up vast waters for further fishery

exploitation and oil and gas exploration. One of the lead scientists said that though they have “no clue” as to how it will look, they are sure that the effects of the emissions we have put into the atmosphere over the last twenty years will certainly be felt for at least the next forty—not to mention the gases we continue to emit.

Related Story:

USGS Predicts Two-Thirds Decline in Polar Bear Population by 2050, *E&ENews*, September 7, 2007

<http://www.eenews.net/eenewspm/2007/09/07/1/#1>

Shrinking sea ice could eliminate two-thirds of the world’s polar bears in the next fifty years. All of Alaska’s bears would also disappear. The models predict a 42% loss of optimal polar bear habitat in summers by mid-century

Air Board to Detail Plan on Emissions, *Los Angeles Times*, September 7, 2007

<http://www.latimes.com/news/local/la-me-air7sep07,0,6034955.story?coll=la-home-center>

Beginning with small measures, the California Air Resources Board will make proposals that would cut greenhouse gas emissions by 2.8 million metric tons a year. 174 million metric tons must be slashed by 2020. The proposals include retrofitting trucks, reducing pollution in computer manufacturing, and requiring car owners to keep their tires properly inflated.

2 Recent Storms Show Forests Help Blunt Hurricanes’ Force, *New York Times*, September 7, 2007

[http://www.nytimes.com/2007/09/07/world/americas/07hurricane.html?\\_r=1&oref=slogin](http://www.nytimes.com/2007/09/07/world/americas/07hurricane.html?_r=1&oref=slogin)

“The trees secure the ground and offer a buffer from the storms,” according to a leading Honduran environmental advocate. Forested areas are shrinking, and the environmental degradation is one of the reasons would be run-of-the-mill rainstorms can cause deadly floods and mudstorms. (My note: Some scientists relate climate change and the warming of tropical oceans—where hurricanes form—to the recent high intensity of hurricanes.)

Pacific Rim Nations Adopt Nonbinding Emissions Targets, *New York Times*, September 10, 2007

[http://www.nytimes.com/2007/09/10/world/asia/10apec.html?\\_r=1&ref=world&oref=slogin](http://www.nytimes.com/2007/09/10/world/asia/10apec.html?_r=1&ref=world&oref=slogin)

The Asia-Pacific Economic Cooperation (APEC) meeting closed on Sunday (Sept. 9) with a highly compromised climate change agreement. The agreement sets no timetable for post-Kyoto (2012) emissions reductions. A pervading sense of the lack of urgency characterized the agreement, which proposed a slowdown in the growth of CO<sub>2</sub> emissions, but no concrete targets that would neutralize or reverse the emissions.

‘Feel Good’ vs. ‘Do Good’ on Climate, *New York Times*, September 11, 2007

<http://www.nytimes.com/2007/09/11/science/earth/11tiern.html?ref=science>

*New York Times* reporter John Tierney heads on a far-flung scientific expedition with infamous “skeptical environmentalist” Bjorn Lomborg to research rising sea levels—to the air-conditioned Brooklyn Bridge Café. Lomborg suggests “solving other problems first” and making cities rich enough to deal with sea and temperature rise by creating more shoreline and greening big cities. “If you’re worried about stronger hurricanes

flooding coasts,” for example, “concentrate on limiting coastal development and expanding wetlands now rather than trying to slightly delay [inevitable] warming decades from now.” Bjorn Lomborg testified before this committee for Sen. Inhofe last fall.

Warming May Be Hurting Gray Whales’ Recovery, *Washington Post*, September 11, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/10/AR2007091002143.html>

As many as 118,000 gray whales roamed the Pacific before humans decimated the population through hunting, and human-induced climate change may now be depriving the surviving population of the food they need. The 22,000 remaining whales are key members of the large-scale ocean ecosystem because they feed on the sea-floor and release enormous amounts of food to other marine wildlife. A recent spike in deaths among the gray whales may suggest “this decline was due to shifting climatic conditions on Arctic feeding grounds.”

Effects of Warm-Up ‘Striking’ in U.S. – Federal Report, *E&E News*, September 11, 2007

<http://www.eenews.net/eenewspm/2007/09/11/2/#2>

Larger, more frequent forest fires, earlier spring runoff, and the spread of invasive plants and insects are among the “striking” effects of climate change already being seen in the United States and are likely to intensify over the next half century. The draft analysis by the Climate Change Science Program examines the outlook for U.S. land, water, agriculture, and biodiversity over the next 25 to 50 years.

Climate Change’s Great Divide, *Wall Street Journal*, September 12, 2007

[http://online.wsj.com/article/SB118955082446224332.html?mod=hps\\_us\\_editors\\_picks](http://online.wsj.com/article/SB118955082446224332.html?mod=hps_us_editors_picks)

Even though there may not be much practical difference between a cap-and-trade system and a carbon tax, the divide between economists and politicians on the issue is heating up. Many academics, even conservatives, favor a tax on carbon emissions. And even liberal lawmakers lean toward a cap-and-trade system.

200 Plants, Animals Added to Global Watch List, *E&E News*, September 12, 2007

<http://www.eenews.net/Greenwire/2007/09/12/12/#12>

Galapagos corals, North American reptiles and nearly 200 other species joined the World Conservation Union’s newest list today of worldwide plants and animals threatened with extinction. Corals make their first appearance on the list this year (including 10 Galapagos species). The group attributes their decline to climate change and El Nino weather effects.

Related Story:

188 More Species Listed as Near Extinction, *Washington Post*, September 13, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/12/AR2007091202322.html>

Habitat loss, climate change and infection diseases are pushing a growing number of species toward extinction. “We expect the situation across taxonomic groups to be, quite honest, quite bleak. One needs to know how bleak,” said Jane Smart, head of the World Conservation Union’s species group.

Warming Warning Issued by Security Group, *Reuters*, September 12, 2007

<http://www.msnbc.msn.com/id/20744385/>

Climate change could have global security implications on par with nuclear war unless urgent action is taken, a report from the International Institute for Strategic Studies (IISS) said. The IISS report said global warming would negatively affect crop yields and water availability everywhere, causing great human suffering and leading to regional strife.

Climate Change Brings Grim Forecast, *New York Times*, September 13, 2007

[http://www.nytimes.com/2007/09/13/world/africa/13briefs-africa.html?\\_r=1&ref=world&oref=slogin](http://www.nytimes.com/2007/09/13/world/africa/13briefs-africa.html?_r=1&ref=world&oref=slogin)

Economist William Cline quantifies sharp reductions in agricultural productivity in many of Africa's poorest countries by the 2080s if greenhouse gas emissions continue to increase.

As Arctic Ice Melts, Northwest Passage Beckons Sailors, *Wall Street Journal*, September 13, 2007

[http://online.wsj.com/public/article\\_print/SB118961106656125136.html](http://online.wsj.com/public/article_print/SB118961106656125136.html)

Where adventurers found their boats squeezed out of the sea by encroaching ice floats, or simply stuck, just years ago as they attempted the Northwest Passage, they have recently breezed through. "There was hardly any ice," said Mr. Swanson, a 76-year-old Minnesota pig farmer turned yachtsman. Another said of his treacherous journey, "I feel like a bit of a fraud, really. It's all been quite comfortable."

Cuts Will Limit Climate Research, Experts Say, *Washington Post*, September 14, 2007

[http://www.washingtonpost.com/wp-dyn/content/article/2007/09/13/AR2007091300797.html?nav=rss\\_nation](http://www.washingtonpost.com/wp-dyn/content/article/2007/09/13/AR2007091300797.html?nav=rss_nation)

The government's research on climate change is threatened by spending cuts that will reduce scientists' observations from space and on the ground, according to a report by the National Research Council. The Climate Change Science Program (CCSP) has made progress "unraveling the [human] influences on the observed climate changes" over the last few decades, but the program director lacks both funding and authority.

**Recent Climate Change News 9/15/2007-9/20/2007**  
**Compiled by Jake Levine and Eric Thu**

Arctic Sea Route Opens, *Washington Post*, September 15, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/15/AR2007091500572.html>

The Arctic's Northwest Passage has opened up fully because of melting sea ice. Sea ice has reached its lowest level since satellite measurements began 30 years ago. Now, a long-sought but historically impassable route between Europe and Asia has opened. Countries such as Russia, who recently planted its flag on the seabed beneath the North Pole ice, are hoping for new shipping routes or access to oil and gas.

Images Show Arctic Ice Shrinking to Record Low, *Washington Post*, September 16, 2007

<http://www.washingtonpost.com/wp-dyn/content/article/2007/09/15/AR2007091501618.html>

The European Space Agency said nearly 200 satellite photos this month showed an ice-free passage along northern Canada, Alaska, and Greenland, and ice retreating to its lowest level since images were first taken in 1978. The waters are exposing unexplored resources, and ships could trim thousands of miles from Europe to Asia by bypassing the Panama Canal.

Mammoth Dung, Prehistoric Goo May Speed Warming, *Washington Post*, September 16, 2007

[http://www.washingtonpost.com/wp-dyn/content/article/2007/09/16/AR2007091601374\\_pf.html](http://www.washingtonpost.com/wp-dyn/content/article/2007/09/16/AR2007091601374_pf.html)

For millennia, layers of animal waste and other organic matter left behind by the creatures that inhabited the Arctic tundra have been sealed inside the frozen permafrost. Now climate change is thawing the permafrost, and releasing this "prehistoric ooze." The arctic permafrost is thought to contain more organic carbon than the entire atmosphere. Perhaps more alarmingly, organic waste is rich in methane, which is over 20 times more potent as a greenhouse gas than carbon dioxide.

Alaska Governor Palin Forms Cabinet-Level Climate Change Committee, *Juneau Empire*, September 16, 2007

[http://www.juneauempire.com/stories/091607/sta\\_20070916009.shtml](http://www.juneauempire.com/stories/091607/sta_20070916009.shtml)

Gov. Sarah Palin announced Friday she has created a committee to tackle and prepare for climate change. "We are already seeing the effects," Palin said. "Coastal erosion, thawing permafrost, retreating sea ice and record forest fires ... we must begin to prepare for those changes now."

Climate Change Brings Risk of More Extinctions, *Washington Post*, September 17, 2007

[http://www.washingtonpost.com/wp-dyn/content/article/2007/09/16/AR2007091600607\\_pf.html](http://www.washingtonpost.com/wp-dyn/content/article/2007/09/16/AR2007091600607_pf.html)

If warming continues as predicted, scientists say, 20 percent or more of the planet's plant and animal species could be at increased risk of extinction. In the Chesapeake Bay's Blackwater National Wildlife Refuge, for example, biologists say the effects of rising sea

levels are already being felt. The wetlands have begun to “drown,” and have become a large, salty lake, forcing many creatures out of their natural habitat.

Call for Voluntary Agreement Tops Draft Bush Summit Agenda, *E&E News*, September 17, 2007

<http://www.eenews.net/eenewspm/2007/09/17/1/#1>

Secretary of State Condoleezza Rice will open next week’s global warming summit in Washington, DC. She will be followed by the President and as many as four other Cabinet secretaries, who will combine for more than two hours of opening remarks from the Bush administration, the UN, and representatives from 16 countries. Bush is expected to call for voluntary agreement among the countries to a “long-term global emissions reduction goal.”

Katrina Victims Appeal Case against Energy Companies, *E&E News*, September 17, 2007

<http://www.eenews.net/eenewspm/2007/09/17/2/#5>

Gulf Coast victims of Hurricane Katrina asked a federal appeals court today to reinstate their class-action lawsuit that seeks damages from major U.S. energy companies for the role their heat-trapping emissions played in fueling the 2005 storm. U.S. District Court Judge Guirola, a Bush appointee, noted the case’s importance, but expressed his concern that “it is a debate which simply has no place in the court ...”

From Ozone Success, a Potential Climate Model, *New York Times*, September 18, 2007

<http://www.nytimes.com/2007/09/18/science/18clim.html?ref=science>

In 1987, two years after scientists discovered “hole” in the ozone layer, an initial batch of countries signed the Montreal Protocol. The treaty has since grown and led to bans on 95 percent of the ozone-eating compounds. “The lesson from Montreal is that curbing global warming will not be as hard as it looks,” said David Doniger, an NRDC climate group director.

Suit Blaming Automakers over Gases is Dismissed, *New York Times*, September 18, 2007

<http://www.nytimes.com/2007/09/18/us/18pollute.html?ref=us>

The courts do not have the authority or the expertise to decide injury lawsuits concerning global warming, a federal judge in San Francisco ruled yesterday in dismissing a suit brought by the State of California against six car companies. The suit claimed the emissions were a “public nuisance” and sought billions in damages.

Effort to Get Companies to Disclose Climate Risk, *New York Times*, September 18, 2007

<http://www.nytimes.com/2007/09/18/business/18disclose.html?ref=business>

Two environmental groups and the financial officers of 10 states and New York City are asking the Securities and Exchange Commission (S.E.C.) to require companies to disclose the risks that climate change may pose to their bottom lines. More than half of S&P 500 firms are not currently disclosing their climate risk.

E.U. Fund Will Help Developing Countries Battle Warming, *E&E News*, September 18, 2007

<http://www.eenews.net/eenewspm/print/2007/09/18/5>

The European Commission announced the creation of a fund and a donation of \$69 million today to help developing nations deal with global warming. The EU has slated about E300 million to be spent between 2008 and 2010 to battle climate change.

Aviation Conference Discusses Emissions Limits, *E&E News*, September 19, 2007

<http://www.eenews.net/Greenwire/print/2007/09/19/11>

Draft measures that would mandate emissions cuts for airlines created controversy at the 36<sup>th</sup> International Civil Aviation Organization in Montreal this week. Representatives from 190 nations are debating what actions to take in order to curb CO<sub>2</sub> emissions that contribute to global warming.

Waxman Questions EPA Permitting for New Coal Plants, *E&E News*, September 19, 2007

<http://www.eenews.net/eenewspm/2007/09/19/1/#1>

Waxman called on the Bush administration today to explain why it won't require greenhouse gas controls on a new coal-fired power plant when a Supreme Court opinion earlier this year appeared to give them exactly that authority.

Belching British Bogs Fueled Ancient Global Warming, *National Geographic News*, September 19, 2007

<http://news.nationalgeographic.com/news/pf/57333495.html>

Huge belches of methane from bogs in what is now Britain likely contributed to global warming some 55 million years ago, a new study says (The study was published this week in the peer-reviewed journal *Nature*). The emissions probably amplified an ancient and extreme global warming that heated the Arctic waters to 73 degrees Fahrenheit. Some scientists worry that a similar scenario could trigger a runaway greenhouse effect today.

Lieberman Would Take One-Vote Majority on Cap-and-Trade, *E&E News*, September 20, 2007

<http://www.eenews.net/EEDaily/2007/09/20/2/#2>

"My goal is to get more than a one-vote majority in both [the subcommittee and the full EPW Committee], and I believe that is possible," Sen. Lieberman said while speaking on cap and trade at a Progressive Policy panel. Although he and Warner plan on meeting with every committee member, Lieberman said he would settle for just Warner's vote on the Republican side to move the process along rapidly.

New Zealand to Introduce a Greenhouse Gas Trading Scheme for Industry, *International Herald-Tribune*, September 20, 2007

<http://www.ihf.com/articles/ap/2007/09/20/asia/AS-GEN-New-Zealand-Climate-Change.php>

New Zealand is set to launch a cap-and-trade emissions system next system next year. Under the plan, an agreed level of greenhouse gas emissions will be allocated to each

industry in the country's economy. The system would cause an estimated 4 cents per liter rise in the price of gasoline—to which Climate Change Issues Minister David Parker said, "Four cents to beat climate change, what a deal."

Trading Rise Boosts Climate Exchange, *Financial Times*, September 20, 2007

<http://www.ft.com/cms/s/0/e6df90b0-6712-11dc-a218-0000779fd2ac.html>

Higher trading volumes at the Climate Exchange, which operates exchanges to trade in greenhouse gases on both sides of the Atlantic, helped the company reach its first profit. The company said the increase of 155% in trading volume on its European Climate Exchange and the doubling of its volume on its Chicago Climate Exchange were evidence of rapidly growing interest in trading greenhouse gases.



[ellabakercenter.org](http://ellabakercenter.org)

344 40th street • oakland, ca 94609

v 510.428.3939

f 510.428.3940

JUSTICE + OPPORTUNITY + PEACE

*Van Jones, esq.*  
**Ella Baker Center for Human Rights,**  
President & Founder, Oakland, CA  
**Green For All, President**

Senate Committee on Environment and Public Works  
“Green Jobs Created by Global Warming Initiatives”  
Tuesday, September 25, 2007  
2:00 PM

*Van Jones, esq.*

**Ella Baker Center for Human Rights**, President & Founder, Oakland, CA  
**Green For All**, President

---

Chairwoman Boxer and members of the Committee, thank you for holding this hearing.

As a nation and a planet, we face an ecological crisis. Per capita, the United States is the number one emitter of greenhouse gases. To avert climate chaos globally, the United States must transition rapidly to a low-carbon economy, with an emphasis on renewable energy and conservation measures. This conversion will boost the U.S. economy, generating new opportunities for wealth and work.

The rapidly expanding green economy can do more than create business opportunities and consumer choices for the rich. It can also create job opportunities for the poor. Through investment in Green Jobs, we can simultaneously address poverty and pollution, securing employment for U.S. workers while creating global warming solutions.

**Avoiding a ‘green’ labor shortage**

A highly-trained “green-collar” workforce will be essential to a successful transition. But the United States lacks a comprehensive job training strategy to meet the demand for skilled labor in the emerging green trades (e.g., green building, solar panel installation, energy-saving retrofits of existing buildings, bio-fuel production, etc.).

Progress toward global warming solutions could be slowed by a simple shortage of skilled labor. Such an outcome would be doubly tragic – since so many urban and rural communities are desperate for new sources of work, hope and opportunity.

Organizations like the Ella Baker Center for Human Rights, 1Sky, Workforce Alliance, Energy Action Coalition, the Apollo Alliance and Green For All are advocating for a national commitment to greater job training, employment and entrepreneurial opportunities in the emerging green economy - especially for people from disadvantaged communities.

As the United States moves to a clean energy economy, both common decency and smart politics dictate that we should minimize the pain and

maximize the gain for poor people.

Creating greater access to “green-collar” jobs can be a key part of that effort.

Some progress is already being made. As Title I of this year’s energy package, the U.S. House of Representatives passed the Green Jobs Act of 2007, which dedicates \$125 million to green-collar job training (enough to train more than 30,000 workers). Companion legislation passed in the U.S. Senate. And at the local level, the Ella Baker Center and the Oakland Apollo Alliance also succeeded in getting the City of Oakland to fund a local Green Jobs Corps for 2008.

These are important advances. But more needs to be done.

#### **‘Social Uplift Environmentalism’**

In other places, our organization has described the need for green-collar jobs and mechanics for delivering training. I want to propose a politically useful framework for our elected officials who are seeking to lead their constituents to support bold action on this subject.

The time has come to embrace a new concept: **“social uplift environmentalism.”** We can best address the ecological crisis by creating green pathways out of poverty for millions of Americans.

To give everyone a stake in the clean-energy future, we must make available “green-collar jobs,” “green enterprise zones,” “green technology training centers” in urban schools and more.

The time has come to expand the movement seeking ecological solutions. To do that, we must birth a new kind of positive and creative environmentalism, one deeply rooted in the lives, values and needs of millions of ordinary people who work every day (or desperately wish they could). We need a “social uplift environmentalism” that can fight poverty and pollution at the same time – by creating green-collar jobs for low-income people and displaced workers.

Now is the time for a “hard hat and lunch bucket” brand of environmentalism ... a “we-can-fix-it” environmentalism ... a muscular, “can-do” environmentalism. We need a pro-ecology movement with its sleeves rolled up and its tool-belt strapped on. We need an environmental

movement that can put millions of people back to work, giving them the tools and the technologies they need to retrofit, re-engineer and reboot the nation's energy, water and waste systems. America's new "green wave" can and should lift all boats.

The success of the next stage will require building massive political support – in both major parties and in every part of the country – to generate the political will to make massive changes and investments. An increased and focused federal commitment to increasing "green-collar job training" would represent an important step toward a new and different kind of environmentalism, altogether – one that can take hold in urban neighborhoods and capture imaginations in small towns, all across America.

#### **All For Green & Green For All ...**

As members of this Committee and the United States Senate, you are in a unique position to summon Americans to act as voters and engaged community members, not just as smarter consumers. No individual can buy enough smart-energy light bulbs, bicycles or hybrid cars to solve the global ecological problem by herself. But by working together, as legislators, state and local leaders, voters and engaged community members, we can reposition our government: not just to be a regulator of dirty-energy "problem-makers," but as a partner to the clean-energy "problem-solvers."

More importantly, you have the opportunity to unite the country in a common cause – putting urban and rural youth to work to install tens of millions of solar panels, build thousands of wind and wave farms, weatherize millions of homes and create countless rooftop and community gardens. Such an effort would transform America – sparking a green economic renaissance that would put jobless people to work, spur investment in needy communities and spread opportunity and prosperity.

Greener products and production processes can do more than just break our oil addiction, save endangered species and solve global warming. They can also create new jobs, increase wealth and improve health for everyday Americans. Both major political parties can support this pro-business, pro-family, pro-worker and pro-environment approach.

Such efforts can help us avert the ecological nightmare and bring into being a better tomorrow – one that boasts a clean and green U.S. economy, strong enough to lift whole communities out of poverty.

Thank you for allowing me this opportunity to testify and look forward to working with you to build this pathway to a new green economy and workforce.

Senator BOXER. Now, as promised, I will hand the gavel over to Senator Sanders. You are in charge, sir.

**OPENING STATEMENT OF HON. BERNARD SANDERS,  
U.S. SENATOR FROM THE STATE OF VERMONT**

Senator SANDERS.

[Presiding.] Thank you very much, Senator Boxer, for holding this hearing. I want to thank all of our guests for being here. I must say that Senator Inhofe and I have never had a honeymoon.

[Laughter.]

Senator SANDERS. As liberal as I am, Senator, I don't want to marry you. I want to be very clear about that.

I think that in fact to a very significant degree the scientific debate is over. I think what the most knowledgeable people in this world are telling us is that if we do not act and if we do not act boldly, the world that we are going to leave to our kids and our grandchildren will be a world in which the climate will be inhospitable. There will be droughts. There will be famine. There will be wars. There will be forest fires. That is the bad news.

The good news is that in fact we do know how to address this issue. We know it, and we will clearly learn more and more as the years go by. But right now, we have the knowledge and we have the technology to address this issue. It seems to me that it will be a terrible, terrible thing for our kids and our grandchildren if we do not address this crisis and if we do not address it boldly and aggressively.

Now, some people say, well, if you go forward aggressively, there is going to be economic dislocation, and they are right. I think it is the moral responsibility of Congress, the U.S. Government, to make sure that those people who are hurt as we transform our energy system are in fact protected, whether it is loss of jobs, higher bills or whatever. We must protect them.

But on the other hand, and I think we are going to hear testimony to this today, the evidence is overwhelming that if we go forward in addressing the crisis of climate change, we can create millions of good-paying jobs. There will be economic dislocation, but at the end of the day I believe we will create far more jobs than we will lose.

I come from a rural State, the State of Vermont. The evidence is out there now. While family farmers are being driven off of the land, we can create hundreds of thousands of new jobs as we move toward biofuels making our Country more energy independent.

In terms of energy efficiency, there are huge numbers of jobs to be created as we retrofit our homes, as we build automobiles that get good mileage per gallon, as we recognize the fact that our rail system today is far behind the rest of the world. Just think about the jobs we create as we develop a new rail system which can compete with Europe and Japan.

In terms of sustainable energy, I read in the Los Angeles Times today that homes in California that have solar units are selling far faster than other types of homes. We have yet to begin to scratch the surface in the potential of what solar energy can do for our Country. Think of the jobs that will be created when millions and millions of homes throughout this Country have solar units—both

manufacturing the photovoltaics and installing them, maintaining them—huge numbers of jobs.

There will be testimony later from a gentleman from the State of Vermont, David Blittersdorf, who is manufacturing small wind turbines. Think of what job creation means in the United States when millions of people in rural America have small wind turbines in their homes, which on average can produce half the electricity that they need.

So Madam Chair, I believe that if we are smart, we accomplish two things: We reverse global warming; we reduce CO2 emissions, and at the same time, we can create millions of good-paying jobs. I believe it is the moral responsibility of our government in a variety of ways to lead us in that direction.

[The prepared statement of Senator Sanders follows:]

STATEMENT OF HON. BERNARD SANDERS, U.S. SENATOR FROM THE  
STATE OF VERMONT

Good afternoon. I want to begin by thanking Sen. Boxer for offering me the opportunity to chair today's hearing—"Green Jobs Created by Global Warming Initiatives." As she knows, I feel very strongly that there are huge opportunities associated with taking bold action to combat global warming and this hearing is meant to focus our attention on one of the most important: green job creation here in America. I have more than 3 minutes worth of opening statement, so I ask that my full statement be submitted for the record.

The science is settled: to avert the worst effects of global warming, we must change our ways and we must do it quickly. We must do it quickly not only because millions of people across the globe are at risk of losing access to clean drinking water or because our military leaders tell us we should expect armed conflicts due to environmental refugees, for these reasons are obvious. In my view, it is absolutely imperative that we be bold, that we be aggressive, that we listen to the scientific community, that we save this planet from irreparable damage.

I know some have suggested that if we move forward aggressively severe economic dislocation will take place. Let me respectfully disagree. While there will be, of course, economic dislocation, dislocation that Congress must address, at the end of the day as we move away from fossil fuels and toward energy efficiency and renewable energy, we can create millions of good paying jobs, jobs that will help us create a stronger economy, not a weaker economy.

I come from a rural State and there are estimates that we can create hundreds of thousands of good paying jobs in rural America as we move forward toward bio-fuels.

We are beginning to see in Germany, Japan and California the creation of large numbers of jobs in solar technology, an area I believe has enormous potential for our entire country. Imagine what it would mean in America if we were building photo-voltaic units for millions of homes, if we were building solar power plants, if we were researching improved solar technology. How many new jobs would be created as we make this planet cleaner and safer?

The same is true for wind technology—both in terms of small wind turbines and large wind farms. Imagine what it would mean to our economy if we produced and installed millions of small wind turbines all across our country that can provide, on average, half the electricity a home utilizes.

And there is geothermal, and many other technologies. Of course, there is the whole issue of energy efficiency and retrofitting our homes, our offices, our schools, our factories. And, what about our transportation system, with a more efficient way of producing cars that get more miles per gallon, as well as a new rail system.

Our job as a government is to send a strong signal about where we want to go in the future. We do this by supporting green technologies and getting them in the hands of consumers. By doing this, we will transform and modernize our economy and create millions of good paying jobs.

To be clear, a weak signal won't do the trick—it won't lead to nearly as many new "green collar" jobs as will a strong one. The bolder we are, the clearer it is that America is going to help lead the way to a new global future. In fact, the United States must reduce emissions by at least 80 percent compared to 1990 levels, by the year 2050.

It is time for a new green economy to make these reductions a reality and today's hearing will begin to illustrate some of the tremendous opportunities that are out there—if only we are brave enough to put in place the policies that will open the floodgates for jobs in energy efficiency and renewable energy.

We know that in a purely economic analysis, inaction on global warming is more costly than action. According to Sir Nicholas Stern, former Chief Economist of the World Bank, "If no action is taken we will be faced with the kind of downturn that has not been seen since the great depression and the two world wars."

Let me note that it is quite appropriate for us to be having this hearing today—2 days before the President begins his "Major Economies Meeting on Climate Change." As I understand it, the Administration has made it clear going into this meeting that two things are off the table: 1) Mandatory limits on greenhouse gas emissions, and 2) Cap and Trade proposals. I hope today's hearing shows the Administration that everyday they spend fighting against bold action is a day that this country loses opportunities for job development and economic advancement. Pure and simple—this administration is holding back growth in the green economy of the future.

In closing, there is no doubt that if we act boldly, if we act aggressively, we can break our dependency on fossil fuels, substantially lower greenhouse gas emissions, move to sustainable energy and, in the process, create millions of good paying jobs.

I look forward to hearing from the witnesses and appreciate their appearing in front of the Committee this afternoon.

Senator BOXER. Now it is yours.

Senator SANDERS. Now it is mine. All right. OK.

We are delighted to have a very wonderful panel with us, and I want to thank all of the panelists for being here. Panelists will have 5 minutes to make their presentation. We are going to begin with Hon. Sigmar Gabriel, who is the German Minister for the Environment, Nature Conservation, and Nuclear Safety. Mr. Gabriel, we thank you very much for being with us today.

**STATEMENT OF SIGMAR GABRIEL, FEDERAL MINISTER FOR ENVIRONMENT, NATURE CONSERVATION AND NUCLEAR SAFETY, FEDERAL REPUBLIC OF GERMANY**

Mr. GABRIEL. Thank you, Madam Chair, members of the Committee, ladies and gentlemen. Thank you very much for giving me the opportunity to explain the German and European strategy for combining the reduction of greenhouse gases with economic growth and economic success.

In Germany, climate policy became last year the major pillar for economic modernization and growth. We want to be more efficient in using energy. We want to become more independent from energy imports, and we want to create a new industry and new jobs in our country.

For us, the markets of the future are green. The needs of a growing world population, and in particular the growing consumer demands of the global middle and upper classes can only be satisfied by a more efficient use of resources and the sustainable use of the environment.

Today, we are 6.5 billion people on our planet. Fifty years ago, we were only 2.5 billion. We have needed millions of years to become 2.5 billion people in the world, and now we will only need 50 years to become 6.5 billion people. We know that in the middle of the century, we will be more than 9 billion people, and from then on, half of the population will live in industrialized regions with industrialized mass production.

Environmental technologies, and in particular innovative energy technologies, are the lead markets for this future. We estimate that

the turnover in Germany in these markets alone will grow from 150 billion Euro today, to 1,000 billion Euro in the year 2030. This means that it will significantly exceed the turnover of traditional sectors of industry such as motor vehicle manufacturing and engineering.

The German government and the governments of the European Union member states want to make the most of these opportunities, want to make Europe the most innovative and efficient economic region in the world. To achieve this, we need a new deal for environment, economy and employment. For us, we believe we are able to combat climate change through energy efficiency and through renewable energies.

Just as your United States President Franklin D. Roosevelt responded to the Great Depression in the last century with his New Deal by combining public investment, social policy and economic reforms, we too need such a deal in view of today's climate crisis.

The Government has the task of laying down clear framework conditions and creating incentives for innovations. During Germany's European Union presidency, the Union adopted a far-reaching decision in May 2007. Our goal in the European Union is to reduce greenhouse gas emissions by 30 percent by the year 2020 if other industrialized countries also make commitments, but in any event, by 20 percent. In doing this, we are already securing investment in the European Carbon Market. In the long term, the European Union is aiming for a 60 percent to 80 percent reduction of its greenhouse gas emissions by 2050.

Germany has also set itself ambitious targets. By 2020, we are aiming for a 40 percent reduction in greenhouse gas emissions as compared to the base year 1990. This is 10 percentage points more than the European Union target. With the recently adopted future-oriented energy and climate package, which is unique worldwide, we have moved a big step closer to reaching our target. The package of measures will provide impetus for all carbon dioxide relevant key areas, promote climate protection and create jobs in our country.

Environment and climate protection are already real job promoters. Currently, around 3.5 million people are employed in the environmental protection sector in the European Union. In Germany, this figure is around 1.5 million. This means that already 3.8 percent of the German work force is employed in the environmental protection sector.

Let me highlight only two examples. The expansion of renewables shows how our country is benefiting from its role as a driving force for climate protection. Within just 2 years from 2004 to 2006, employment in the renewable sector rose by 50 percent, to 235,000 jobs. At least 134,000 jobs, almost 60 percent of the employment figures calculated for 2006, can be directly attributed to the Renewable Energy Resources Act.

The dynamic employment development in the field of renewables will create more than 400,000 jobs by 2020. This generates demand in other industries, too, and gives the industry sustainable growth in lead markets. Solar power installations and wind turbines made in Germany are an export hit all over the world.

The second example is that of combined heat and power. By 2020, we want to double the share of electricity from combined heat and power to 25 percent in our country. The additional demand in plant manufacturing and the local construction industry leads to major labor market effects, securing and creating jobs on a six figure scale.

Thank you very much for your attention.  
[The prepared statement of Mr. Gabriel follows:]

STATEMENT OF SIGMAR GABRIEL, FEDERAL MINISTER FOR ENVIRONMENT, NATURE  
CONSERVATION AND NUCLEAR SAFETY, FEDERAL REPUBLIC OF GERMANY

The markets of the future are green. The needs of a growing world population and in particular the growing consumer demands of the global middle and upper classes can only be satisfied by a more efficient use of resources and the sustainable use of our environment.

Environmental technologies and in particular innovative energy technologies are the lead markets of the future. For Germany, Roland Berger Strategy Consultants predicts that turnover in these markets alone will grow from 150 billion euro today to 1000 billion euro in the year 2030. This means that it will significantly exceed the turnover of traditional sectors of industry such as motor vehicle manufacturing and engineering.

The German government and the governments of the EU Member States want to make the most of these opportunities—we want to make Europe the most innovative and efficient economic region in the world. To achieve this we need a new deal for environment, economy and employment.

Just as President Franklin D. Roosevelt responded to the Great Depression in the last century with his “New Deal” by combining public investment, social policy and economic reforms, we too need such a “deal” in view of today’s climate crisis. The government has the task of laying down clear framework conditions and creating incentives for innovations.

Under Germany’s EU Presidency the European Union adopted a far-reaching decision in March 2007: our goal is to reduce greenhouse gas emissions by 30 percent by the year 2020 if other industrialised countries also make commitments, but in any event by 20 percent. In doing this we are already securing investment in the European carbon market. In the long term, the EU is aiming for a 60–80 percent reduction of its greenhouse gas emissions by 2050.

Germany has also set itself ambitious targets: by 2020 we are aiming for a 40 percent reduction in greenhouse gas emissions as compared to the base year 1990; this is 10 percent more than the EU target.

With the recently adopted future-oriented energy and climate package, which is unique worldwide, we have moved a big step closer to reaching our target. The package of measures will provide impetus for all CO<sub>2</sub>-relevant key areas, promote climate protection and create jobs in Germany.

Environmental and climate protection are already real job motors: currently around 3.5 million people are employed in the environmental protection sector in the EU. In Germany this figure is around 1.5 million. This means that already 3.8 percent of the German work forces are employed in the environmental protection sector.

With this policy, Germany will continue in its pioneering role on the lead markets of the future. Successful energy and climate policy also has positive impacts for Germany as a location for business and innovation. It secures both jobs and a livable environment.

The example of renewable energies: we have ambitious expansion targets for renewable energies (in the electricity, heat and fuel sectors): we want to achieve a share of 25 to 30 percent by 2020.

The expansion of renewables shows how our country is benefiting from its role as a driving force for climate protection: within just 2 years, from 2004 to 2006, employment in the renewables sector rose by 50 percent—to 235,000 jobs. At least 134,000 jobs almost 60 percent of the employment figures calculated for 2006 can be directly attributed to the Renewable Energy Sources Act. The dynamic employment development in the field of renewables will create more than 400,000 jobs by 2020. This generates demand in other industries too and gives the industry sustainable growth in lead markets. Solar power installations and wind turbines made in Germany are an export hit all over the world.

The example of combined heat and power: by 2020, we want to double the share of electricity from combined heat and power, to 25 percent. The additional demand in plant manufacture and the local construction industry leads to major labour market effects—securing and creating jobs on a six-figure scale.

The example of low-emission power plants: scenario calculations assume a global growth in the construction of power plants up to 2020, with an estimated capital requirement of several trillion Euros. This will have a corresponding effect on the labour market. We will implement measures and strategies to speed up investments in state-of-the-art, low-emission power plant technologies.

The example of energy efficiency: energy efficiency standards and consumer-friendly labelling will be developed for all energy-consuming appliances and products. Efficient and rational energy use particularly benefits labour-intensive sectors in the building industry, engineering and trades. Private budget restructuring and the demand for domestic products stimulate employment and growth at home. At the same time, it encourages the improvement of technological know-how and keeps the domestically generated value added at home, instead of transferring it abroad for energy imports.

The example of building modernisation: raising the energy standards for buildings under the Energy Saving Ordinance triggers investments on a large scale. These standards comprise considerably stricter requirements for new buildings, modernisation obligations for existing buildings etc.

---

RESPONSES BY SIGMAR GABRIEL TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

*Question 1.* Germany has a population not quite a third the size of the U.S. and has nearly doubled the installed wind power. How has Germany managed such success? Do you think the U.S., with even better wind resources, could have a similar degree of success if the right incentives and price signals are in place?

Response. Germany's main means of promoting electricity generation from renewable energy sources, the Renewable Energy Sources Act (EEG), has proven to be extremely successful. This was revealed in the first progress report on the EEG, (refer to <http://www.erneuerbare-energien.de/inhalt/39915/>). The EEG has proven a huge success with respect to climate protection and intergenerational justice, technological leadership and innovation, energy supply, and jobs. Guided by this act, German manufacturers have achieved a leading position on the world market in this important market segment. On a macroeconomic scale, the benefits arising from the EEG already outweigh the costs.

Under the EEG, grid operators have to pay fees for electricity from renewable energy sources. The difference between the fees and the market price for electricity from traditional sources is returned to the consumers on their electricity bills as the EEG apportionment. The different types of renewable energy sources receive different fees based on the cost of electricity generation. The fee level is guaranteed for a period of 20 years. This created a perfect investment environment which, in turn, led to a strong domestic industry with enormous innovations, making Germany the technological leader in this regard. It offers new and profitable business opportunities for traditional industries such as shipping, concrete, metals, and mechanical engineering.

The EEG's success is evident: In 2006, 45 million fewer tons of carbon emissions (CO<sub>2</sub>) were emitted because of the EEG. That is 8 million tons more than in 2005. These figures show that the EEG significantly contributes to climate protection. The use of renewable energy sources prevented over 100 million tons of carbon emissions in 2006. The EEG furthermore helps generate jobs. Of the 236,000 jobs in the renewable energy sector, 134,000 were created through the EEG, approx. 75,000 of which are in the wind energy sector. Renewable energies are also a considerable investment factor and have become important for the export industry. Nine billion euros were invested in EEG installations in Germany in 2006. More than 70 percent of the wind power plants produced in Germany were exported, and the prospects of the photovoltaic sector developing in a similar way are promising.

Electricity from renewable energy sources expands the range of offerings on the electricity market and thus causes prices to fall due to this "merit-order-effect". Wholesale prices for electricity declined by about 5 billion euros in 2006. In addition, fuel imports (0.9 billion euros) and adverse effects on the environment and the climate (about 3.4 billion euros) are avoided. The economic benefit of the EEG therefore came to approx. 9 billion euros. On a macroeconomic scale, the benefits from the EEG thus already clearly outweigh the costs. Furthermore, the share of renewable energies and the corresponding savings in carbon emissions are increasing,

while wholesale electricity prices are falling at a faster rate than the EEG apportionment.

This long-term policy framework was the driving force behind the German success story. In addition, wind power is a relatively low-cost renewable energy source which allows for competition in some locations with conventional fuels, particularly during peak load.

I am absolutely convinced that the U.S. can do at least as well as Germany. In fact, wind energy is booming in the U.S. According to estimates, plants with a capacity of approx. 3,000 megawatts are likely to be installed this year ? much more than we currently have installed in Germany. I am very pleased that many U.S. states have agreed on targets for renewable energies and implemented funding programs. Currently, there are 24 states plus the District of Columbia that have Renewable Portfolio Standards in place. Four other states—Illinois, Missouri, Virginia, and Vermont ? have nonbinding goals for the adoption of renewable energy. Hence, the U.S. is catching up quickly.

*Question 2.* Germany has experienced a significant increase on jobs in environment related industries with about 1.5 million people employed in this sector. Though there may have been a cost involved in the creation of these jobs, do you think Germany is better off having created these jobs and caused the industry to grow?

Response. Growing global demand for technology that helps protect the environment is leading to the creation of new markets and opening up considerable economic opportunities. The German environmental protection industry has always played a leading technological role over the past years. For example, German companies were more active than their competitors in securing patents for new products and production methods in environmentally related fields. With world market shares between 15 and 25 percent, German companies are today major international suppliers of environmental goods and services. This leading role in environmental protection also has a positive effect on the labor market. Employment remains stable, with over 1.5 million workers. At the same time, the market for renewable energy is undergoing particularly dynamic expansion. It currently employs about 230,000 people, compared with just 57,000 in 1998.

According to current estimates, about 1.5 million workers are engaged in environmental protection in Germany, totaling 3.8 percent of the overall workforce in Germany. Environmental protection does not limit itself to “traditional” end-of-pipe activities. Instead, the employment effect of integrated environmental protection—energy efficient products ? and the effect of central environmental policy action fields are taken into account.

In our opinion, we will not be able to achieve sustainable economic growth without promoting resource efficiency and environmental technology. Due to scarce resources, the market share of these technologies will substantially increase in the future. Environmental policy therefore provides valuable impetus for innovation and the labor market. We have been very successful in generating positive effects on the labor market through environmental policy. German firms would not have been leading companies worldwide without a progressive and reliable environmental policy.

*Question 3.* You predict that investment in renewable energy will create more than 400,000 green jobs in Germany alone. Would you describe what kinds of jobs these would be?

Response. The estimate of some 400,000 green jobs in 2020 is taken from recent research studies carried out on behalf of the Federal Ministry for the Environment. They refer to a cautiously optimistic scenario for the future development of the German market share in renewable energy.

Under these assumptions, total employment in Germany can be estimated as 415,000, of which 320,000 will be in production. The dominant sector is wind industry (160,000 jobs) followed by biomass and biogas technologies (55,000) and the photovoltaic industry with some 30,000 jobs. The remaining jobs in production will be created in the other sectors.

Operation and maintenance will require 55,000 jobs and the production and distribution of fuels from renewable resources will employ 40,000 people. These estimates suppose increases in productivity for the respective sectors that reflect the maturity of each sector.

As to the types of jobs, new specializations and training will be required in operation and maintenance. Additionally, agricultural production of biomass secures employment in rural areas. Since Germany has rather high wages and therefore high production costs, the competitive advantages will be in the high-tech sectors of the respective technologies. Off-shore wind energy, high-end solutions of photovoltaic

systems (facade integration, polymers, dyes, other new materials), and solar thermal power technologies as well as engineering solutions for the distribution of power will be the main fields.



Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety

## **Integrated Energy and Climate Programme**

**Decision of German Cabinet on August 23<sup>rd</sup>/24<sup>th</sup> 2007 at Meseberg**

**Contents**

- 0 Introduction
- 1 Combined heat-and-power generation
- 2 Expansion of renewable energies in electricity generation
- 3 CCS technologies
- 4 Smart metering
- 5 Clean power-station technologies
- 6 Introduction of modern energy management systems
- 7 Support programmes for climate protection and energy efficiency (apart from buildings)
- 8 Energy-efficient products
- 9 Provisions on the feed-in of biogas to natural gas grids
- 10 Energy Saving Ordinance
- 11 Operating costs of rental accommodation
- 12 Modernisation programme to reduce CO<sub>2</sub> emissions from buildings
- 13 Energy-efficient modernisation of social infrastructure
- 14 Renewable Energies Heat Act
- 15 Programme for the energy-efficient modernisation of federal buildings
- 16 CO<sub>2</sub> strategy for passenger cars
- 17 Expansion of the biofuels market
- 18 Reform of vehicle tax on CO<sub>2</sub> basis
- 19 Energy labelling of passenger cars
- 20 Reinforcing the influence of the HGV toll
- 21 Aviation
- 22 Shipping
- 23 Reduction of emissions of fluorinated greenhouse gases

- 24 Procurement of energy-efficient products and services
- 25 Energy research and innovation
- 26 Electric mobility
- 27 International projects on climate protection and energy efficiency
- 28 Reporting on energy and climate policy by German embassies and consulates
- 29 Transatlantic climate and technology initiative

## 0 Introduction

1. In the spring of this year, meeting under the German presidency, the European Council of heads of state and government set the parameters for an integrated European climate and energy policy. This will include ambitious climate protection targets, as well as targets for the expansion of renewable energies and increases in energy efficiency. With the key elements of an integrated energy and climate programme set out in this document, the German Government is implementing these fundamental European policy decisions at national level by means of a concrete programme of measures. The guiding principles remain the three objectives of security of supply, economic efficiency and environmental protection. The integrated energy and climate programme draws on the comments made in the government policy statement of 26 April 2007 and the results of the energy summit held on 3 July 2007.

2. The approach taken to the implementation of the energy and climate programme will ensure that Germany's climate targets are achieved in a continuous process by 2020 and the requisite measures organised cost-effectively. These aims will be reviewed by monitoring carried out every two years. The German Government will also conduct an impact assessment, which will apply the criteria of economic efficiency and the effectiveness of the planned measures, as well as involving the business community, consumers and academic experts.

3. In implementing this energy and climate programme, the German Government can build on the results achieved by emissions trading. 58 % of CO<sub>2</sub> emissions are attributable to the sectors subject to emissions trading. The Allocation Act 2012, which has already been adopted and entered into force, will reduce the CO<sub>2</sub> emissions from installations by 57 million tonnes during the second trading period from 2008 to 2012 compared to the first trading period from 2005 to 2007.

4. Climate protection is a task for the whole of society that cannot be mastered by the German Government alone. Rather, for their part, the business community, the *Länder* (Germany's constituent states) and local authorities are called upon to make the necessary contributions to climate protection.

5. The challenges of global climate change are linked extremely closely with the question of how future security of supply can be ensured at economic prices at a time when there is rising demand for energy worldwide and, in this way, sustainable supplies of energy

generally guaranteed. An ambitious strategy to increase energy efficiency and the further expansion of renewable energies are the right responses if we are to reduce emissions of greenhouse gases.

6. The measures necessary from the point of view of climate policy can and must be undertaken in such a way that they also make sense from the point of view of energy policy and take account of growth and employment. This includes the energy sector and industry having a reliable, competitive regulatory environment in which to make their investments. At the same time, consumers need cost-effective solutions and a transparent framework for their decisions about consumption and investments.

7. The choice between various climate-friendly technologies should be restricted as little as possible as a result of requirements imposed by the state. This package of measures is intended to stimulate innovation. The German Government is therefore supporting research and development in the field of energy technologies and climate protection with additional funds, which have been allocated as part of its High-Tech Strategy.

8. A total sum of 2.6 billion euro is available for climate policy under the federal budget for the 2008 financial year (including up to 400 million euro from the sale of emissions certificates). This is 1.8 billion euro more than in the 2005 federal budget and represents an increase of about 200 %.

In the subsequent financial years, from 2009 onward, the action taken to build up an efficient energy and climate policy will have to be harmonised with the budget consolidation targets set by the German Government, the financial plan it has adopted for the period to 2011 and the further reductions that need to be made in the Federation's new borrowing requirements.

Additional expenditure on climate protection can therefore be financed out of potential supplementary revenues from the auctioning of emissions certificates, shares of possible additional tax revenues that still remain to be negotiated or reallocations of resources within the federal budget. The Federal Cabinet will take these decisions in the course of its future deliberations on budgetary matters.

9. With our national climate protection policy, we are facing up to our responsibilities and setting an example for others. However, if we are to be capable of effectively limiting global climate change, joint action at the international level will be a decisive prerequisite. We made a good deal of progress in this respect at the G8 summit in Heiligendamm. For the period

after the expiry of the Kyoto Protocol in 2012, we need a comprehensive international agreement in which all the industrialised countries commit themselves to comparable reductions in emissions and the major newly industrialising countries commit themselves to make appropriate contributions to climate protection.

10. With the key elements of an integrated energy and climate programme presented in this document, the German Government is implementing fundamental European policy decisions at national level by means of a concrete programme of legislation and measures. Energy and climate policy is only credible to the extent that its ambitious targets are actually achieved by means of concrete measures. The programme also incorporates the results of the national energy summit and the reports from the summit working groups. As was agreed unanimously at the summit by those who attended it, the three objectives of security of supply, economic efficiency and environmental protection remain the guiding principles of energy policy for the German Government.

11. In essence, this programme of legislation and measures is a matter of optimising what is already being done. For example, how can the generation of power from renewable energies best be integrated into future power supply systems? Which approach makes economic sense if we are to drive ahead what has until now been the sluggish expansion of highly efficient combined heat-and-power generation? How can the market penetration of energy-efficient products be increased by means of improved labelling or further-developed guidelines for the award of public contracts? How will it be possible for the enormous potential for improvements in energy efficiency that can be exploited comparatively cost-effectively, in particular in Germany's building stock, to be mobilised through a combination of binding energy efficiency standards for buildings, state funding and information for consumers and owners, which would also include examples of best practice? How can integrated approaches to the solution of these problems be found for individual buildings, urban districts and whole towns or cities?

12. The targets set in this programme of measures will be flanked by an approach to foreign energy policy that will help in its own way to secure the supply of fossil fuels and, at the same time, ensure progress is made with respect to the expansion of sustainable energy structures in all the world's countries. This requires a dialogue with long-term perspectives, in particular between the industrialised and newly industrialising countries, as well as cooperation on the modernisation of power stations, the expansion of renewable energies, increasing energy efficiency and, consequently, the reduction of greenhouse gas emissions.

13. The national mix of energy sources used will not be determined by the German Government but will result from the decisions taken by the actors responsible on the basis of the frameworks put in place at the national and European levels. The German Government is of the opinion that the replacement of inefficient coal and lignite-burning power stations with highly efficient new power stations will make an important contribution to climate protection and the modernisation of power supplies. The upper limits for emissions of carbon dioxide, which have been clearly reduced in the Allocation Act, will ensure that Germany's national climate protection targets are met. These upper limits will be reduced further in the third European trading period that will begin in 2013. To make sure they do not exceed their upper limits, power-station operators can buy additional emissions-trading allowances, convert emission credits from climate protection projects abroad (CDM/JI) into allowances or – over the longer term – capture and store carbon dioxide (CCS technologies). As provided for in the programme, it is necessary to create the requisite legal framework for CCS.

14. There are differing opinions in society and within the German Government about the future significance of nuclear energy. However, this is not preventing the German Government from tackling the issues that have to be dealt with from the point of view of climate protection and energy policy. As shown by the decisions Europe has taken, an ambitious energy efficiency strategy and the expansion of renewable energies make sense regardless of the approach taken to this issue.

15. It is important for our economy that manufacturers and energy-intensive industries also continue to be internationally competitive in a transformed regulatory environment. There was unanimity among the participants at the energy summit that increases in energy efficiency, in particular on the demand side, in Germany's building stock, the transport sector, product design and among small and medium-sized businesses, hold out great economic potential. By contrast, manufacturing companies, especially energy-intensive businesses for which the use of energy represents a major cost factor, already have incentives to exploit the scope they enjoy to enhance energy efficiency. Those incentives will be strengthened even further by emissions trading.

16. With its efficiency strategy, the German Government is giving essential stimuli to modernisation. Anyone who produces energy-saving machines and pumps or manufactures vehicles with low fuel consumption will have competitive advantages when energy prices are rising both on the domestic market and on export markets. If we can markedly reduce the amounts of oil and gas consumed by the transport sector, heating systems and water

heating, we will lessen our dependence on energy imports, cutting fuel costs and consumers' heating bills. This package of measures includes stimuli for research and development, moves to tighten the binding efficiency standards buildings and products have to meet and economic incentives for the introduction of energy-efficient products onto the market. As in the field of renewable energies, Germany will continue to expand its leading international role in energy efficiency technologies. The German Government will support this as part of an effective export drive.

## 1 Combined heat-and-power generation

Current situation: So far, the reduction in CO<sub>2</sub> emissions through combined heat-and-power generation promised by German business in the CHP Agreement of 2004 has not been delivered to the necessary extent.

Goal: A doubling of the proportion of power generated from combined heat and power to approximately 25 % by 2020.

### **Measures:**

- i) Appeal to industry to stand by the CHP Agreement.
- ii) Revision of the CHP Act with the following key elements:
  - Updating and capping of the CHP levy at the current level (approx. 750 million euro/year).
  - Retainment of the support systems put in place by the CHP Act, i.e. bonus payments made by grid operators for cogenerated power fed in from approved combined heat-and-power plants, refinanced by passing on costs to power-grid customers.
  - Discontinuation of support for existing plants as planned (current legal situation).
  - Funding for the new build and modernisation of combined heat-and-power plants commissioned between 2007 and 2013.
  - The expansion of local and district-heating grids (up to 20 % investment grant) will be incorporated into the levy procedure put in place by the CHP Act without the maximum level of funding being exceeded (up to 150 million euro).
  - Funding only for highly efficient combined heat-and-power generation.
  - Introduction of a guarantee of origin for cogenerated power.

- Limitations on the duration of funding both by time (years) and in quantitative terms (full-load hours) (funding to be discontinued once one of the two criteria has been satisfied).

Lead responsibility: Federal Ministry of Economics and Technology (BMWi)

## 2 Expansion of renewable energies in electricity generation

Current situation: Renewable energies currently hold a share of about 13 % of gross electricity consumption. The Renewable Energy Sources Act, which promotes the expansion of renewable energies, will be due for revision in 2008. According to the coalition agreement, the fees payable, degression steps and funding periods should be adjusted to the progress made in the development of the individual renewable energies.

Goal: Increase in renewable energies' share of power production to 25-30 % by 2020 (cf. resolutions adopted by the Christian Democratic Union/Christian Social Union [CDU/CSU] and Social Democratic Party of Germany [SPD] parliamentary groups in the German Bundestag) and further expansion by 2030. Expansion of electricity grids to ensure the demand-oriented integration of renewable energies, giving due consideration to economic efficiency, security of supply and environmental compatibility, and the creation of incentives for the demand-oriented feed-in of power from renewable energies in the Renewable Energy Sources Act.

### Measures:

1. Revision of the Renewable Energy Sources Act on the basis of the progress report on its implementation, with the following key elements:
  - Increase in degression steps for photovoltaics.
  - Extension of time limits for offshore wind and adjustment of fees to reflect increased costs.
  - Optimisation of the repowering of existing wind farms.
  - Improvement of feed-in, generation and grid management for power from renewable energies and incentives for the demand-oriented feed-in of power from renewable energies to the electricity grid.
  - Adjustments to the regulatory framework for biomass (in particular CHP).
  - Improvement of the regulatory framework for hydro power and geothermal power (in particular the efficient use of heat).
  - Maintenance of ecological standards intended to reduce environmental impacts, in particular with regard to biomass (e.g. palm oil).
2. Improved integration of renewable energies into the electricity grid while maintaining security of supply:

- Improved use of the grid capacities already installed, also taking into consideration the findings of the German Energy Agency (dena) Grid Study II; these issues include:
    - the creation of storage facilities to cope with fluctuations in the amounts of power being fed into the grid,
    - the use of economically acceptable opportunities for grid optimisation (e.g. temperature monitoring) and
    - the elimination of obstacles to the use of wind turbines with feed-in performance optimised to meet the requirements of grid operation, including obstacles in aviation law.
  - The German Government will examine what legal and other measures are required in order to drive ahead the necessary expansion of the grid.
3. Spatial plan for Germany's exclusive economic zone to be issued by the Federal Ministry of Transport, Building and Urban Affairs as a piece of secondary legislation defining the areas at sea designated for particular uses, in particular for offshore wind energy.
  4. Development of a concept for action in the field of development planning/regional planning to support the repowering of wind turbines (in cooperation with the *Länder* and the national associations that represent German local authorities).
  5. Introduction of a bundled approval procedure for the connection of offshore wind farms to the grid that combines the consideration of structures in the territorial sea and on-shore connections.

Lead responsibility: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)/BMWi/Federal Ministry of Transport, Building and Urban Affairs (BMVBS) within the scope of their respective competences

### 3 CCS technologies

Current situation: If lignite and coal-burning power stations are also to have a future over the medium to long term, given the tightening of reduction targets under emissions trading, it will be necessary to develop power stations with high efficiency factors and CCS technologies (capture and storage of CO<sub>2</sub>) capable of meeting the challenges of the future. A suitable framework should be created for the implementation of CCS technologies.

Goal: The technical, environmental and economic feasibility of CCS technologies is to be confirmed by demonstration power stations. This has also been agreed at the EU level. Other storage projects under which several hundred thousand tonnes of CO<sub>2</sub> are deposited each year should be implemented as soon as possible.

There must be rapid moves to organise the legal framework for the capture, transport and storage of CO<sub>2</sub> (CCS) so that the planned pilot facilities and, subsequently, power stations have a stable legal basis for the installation and operation of these systems. Taking into consideration the results of relevant R&D projects, the German Government will draw up proposals for a "capture-ready" standard. This standard could then be applied when new power stations are constructed.

Measures:

- Development of a suitable legal framework for CCS:
  - The German Government will act rapidly to formulate its position in order to develop a stable legal framework for CCS at the European level. The European Commission will present proposals for a directive intended to put in place a legal framework for CCS before the end of the year.
  - As concerns the measures for the development of CCS technology being pursued at the moment in Germany, current mining and environmental law provides a basis for the conduct of the forthcoming research projects. A suitable legal framework for underground CO<sub>2</sub> storage on an industrial scale (including the planned demonstration

power stations), transport and capture must be developed in Germany on the basis of the European directive announced for November 2007.

- To make sure that industrial-scale projects for the permanent storage of carbon dioxide can be realised while taking account of European targets, binding standards are to be drawn up that ensure the carbon dioxide is sealed off permanently from the atmosphere and otherwise guarantee its secure, environmentally compatible storage over the long term.
- It is intended to include a provision in the Federal Regional Planning Act that would grant the Federal Government the power to lay down binding stipulations in spatial plans concerning spatially significant projects and measures of national significance relevant to climate protection. This would make it possible to secure significant locations for the storage of CO<sub>2</sub> across Germany.
- The German Government is working vigorously for the inclusion of CCS in the European Emissions Trading Scheme and its incorporation into the post-Kyoto regime.
- The BMWi, Federal Ministry of Education and Research (BMBF) and BMU are developing a detailed roadmap for CO<sub>2</sub> capture (BMW/BMU) and storage (BMBF/BMU).
- Construction of demonstration power stations in Germany:
  - Construction of at least two or three of the up to 12 demonstration CCS power stations to be built across the EU, subsequent permanent storage of the carbon in Germany and the earliest possible implementation of smaller-scale CO<sub>2</sub> storage projects.

Lead responsibility: BMWi/BMU/BMVBS/BMBF within the scope of their respective competences

## 4 Smart metering

Current situation: The methods used to determine power consumption in Germany do not reflect the latest technological advances. As a rule, the power consumption of households and small and medium-sized enterprises is only recorded once a year. However, the real-time analysis of consumption is a precondition if users are to control their own consumption and energy services (contracting) are to be optimised.

Goal: Rapid dissemination of new technologies for the real-time measuring of consumption on the liberalised power-metering market as a precondition for energy savings.

Measures: The German Government will create the preconditions for these technologies to be applied more frequently, in particular by businesses:

- This field will be opened up to competition as soon as possible by means of amendments to the legislation regulating the energy industry (Energy Industry Act and secondary legislation). (Currently, meters still have to be provided by the grid operator.)
- Creation of the necessary basis in the legislation regulating the energy industry so that smart electronic meters can be introduced, which will also promote a broader range of variable-load tariffs. Smart metering will initially be introduced for commercial and industrial clients, then somewhat later for domestic clients as well, provided its use makes economic sense. Provision has been made for a transitional period of six years, which will be accompanied by a monitoring process intended to evaluate the results of liberalisation.

Lead responsibility: BMWi

## 5 Clean power-station technologies

Current situation: There is increasing resistance among the public to the construction of new power stations, with accusations that not enough is being done to protect the climate and air quality. Projects that are to be advocated from the perspective of climate protection frequently find themselves exposed to the accusation of insufficient immission control. When plans are put forward for the construction of new power stations, the charge is raised that nothing has been done to provide for carbon dioxide capture.

Goal: To increase acceptance, the climate protection and immission-control systems installed should meet the most advanced technical standards.

In addition to this, measures are necessary that are oriented towards the avoidance of increased pollution loads (including nitric oxides).

This will also put the preconditions in place for demanding air-quality targets to be met in the context of a revision of the NEC Directive.

Measures:

Introduction of an obligation to use the most modern emissions-reduction systems made available by developments in plant engineering with the goal of markedly reducing NO<sub>x</sub> emissions from new furnaces, waste incinerators and co-incineration plants with thermal output greater than 50 MW as of 2013 compared to current requirements.

Lead responsibility: BMU

## **6 Introduction of modern energy management systems**

Current situation: At present, industrial enterprises enjoy extensive relief from energy and electricity taxes (the tax privileges alone amount to more than 2 billion euro/year). The current regulations provide for net-burden compensation to be granted until 31 December 2012 at the latest.

At the same time, there is also an awareness today that businesses still have enormous unexploited potential to enhance their energy efficiency. Examples of the measures that could be taken include the deployment of energy-efficient drives, the installation of energy-saving lighting systems, the use of heat, the optimisation of furnaces, etc.

Goal: Exploitation of the extensive potential for energy efficiency improvements in industry.

Measure: An agreement on the coupling of tax relief with the introduction of energy management should be reached with the German business community by 2013 at the latest.

Under an energy management system, the existing potential for the improvement of energy efficiency and the reduction of costs is identified and documented by a trained energy consultant. The process results in recommendations about the measures with which CO<sub>2</sub> emissions can be reduced, so achieving energy savings, and the costs these measures would involve.

Often, the potential savings identified are highly profitable, since many companies, above all small and medium-sized enterprises, have not focussed on energy costs in the past when optimising their management systems. It remains a matter for the businesses themselves to decide how the potential identified during an energy management exercise should be exploited.

Lead responsibility: Federal Ministry of Finance (BMF)

## **7 Support programmes for climate protection and energy efficiency (apart from buildings)**

Current situation: There is still considerable potential to enhance energy efficiency that can be exploited comparatively cost-effectively in all sectors if economic incentives are put in place.

Goal: Various support programmes are being expanded or set up in order to complement the regulatory legislation/standards by mobilising the most cost-effective energy efficiency measures in commerce, domestic households, agriculture, forestry, the retail sector, services and the transport sector.

### Measures:

- Energy efficiency in small and medium-sized enterprises:  
Support for energy consulting and loans at favourable interest rates (BMWf).
- Extension of energy consulting for households (BMWf).
- Support for energy consulting in the agriculture and forestry sectors (Federal Ministry of Food, Agriculture and Consumer Protection [BMELV]).
- Implementation of the European Directive on Energy End-Use Efficiency and Energy Services (BMWf, also BMVBS for measures relating to buildings and the transport sector).
- Contracting: consulting initiatives, standardisation of contracting arrangements: coverage for the financial risks of energy-conservation and plant-services contracting (BMWf).
- Market introduction programmes for new, highly efficient, climate-friendly technologies for use in appliances and the transport sector (BMWf/BMVBS/BMU/BMELV).
- Expansion of the Energy Efficiency Initiative (dena) – information campaign (BMWf).
- Energy Efficiency Export Initiative (BMWf).
- CCS (BMWf/BMU).
- Climate protection campaign (BMU).
- Consolidation of the market incentive programme for renewable energies (BMU).

- Further national climate protection projects (BMU).
- International climate protection activities, including:
  - Climate protection funds, JI/CDM (BMU).
  - Seawater desalination (BMU).
  - Strategies for adapting to climate change (BMU).

Lead responsibility: BMU/BMWi/BMVBS/BMELV

## 8 Energy-efficient products

Current situation: At present, there are no challenging energy efficiency standards for power-consuming products. Furthermore, when they buy an appliance, consumers do not know how much its power consumption will cost and can therefore not take account of this when making decisions about the products they purchase. The legislation applying hitherto at the EU level and in Germany (Ecodesign Directive and Energy Consumption Labelling Ordinance) has still not unfolded the intended effects (reduction of energy consumption, transparency).

Goal: Use of standards and the clear, consumer-friendly labelling of all power-consuming appliances to encourage the broad-based introduction of energy-efficient products onto the market with the aim of achieving the EU energy efficiency target (+20 % increase in efficiency above the trend).

Measures:

- The German Government will demand immediate action to set high, challenging standards for appliances and products in the Ecodesign Directive and update them regularly (EU-top-runner approach). It will work for procedures to be streamlined and speeded up, and more product groups to be covered by the Ecodesign Directive.
- It will call on the Commission to update and extend obligatory energy labelling in the short-term and urge rapid steps to update the Energy Labelling Directive or the adoption of a more comprehensive directive on the labelling of energy consumption. Products should be labelled in such a way that consumers can easily identify efficient products, with data being given on annual power costs in euro as well as energy efficiency classes.
- The German Government is working with producers, importers and retailers for a voluntary agreement on the consumer-friendly labelling of electrical appliances to the extent that this is possible under European law. Should these efforts remain unsuccessful, it will – as far as possible under European law – adopt provisions on obligatory labelling.

Lead responsibility: BMWi/BMU (voluntary labelling with eco-labels)

## **9 Provisions on the feed-in of biogas to natural gas grids**

Current situation: Germany has the potential to produce enough biogas to supply 10 percent of the country's current consumption of natural gas by 2030. By 2020, production should have reached 6 percent of that level. It is necessary to amend the existing legal framework and fill it out with more concrete provisions if this potential is to be exploited economically.

Goal: Facilitation of biogas feed-in to the natural gas grid in order to reduce Germany's dependence on imports of natural gas and stimulate climate-safe energy generation. Decentrally produced biogas should be used in more efficient, targeted ways for combined heat-and-power generation and as a fuel.

Measures:

- Setting of targets for biogas' share of natural gas consumption for the years 2020 and 2030.
- Specification of concrete prioritisation provisions (obligations placed on grid operators to ensure biogas benefits from priority connections and priority purchasing and transmission).
- Market-oriented fees: agreed price; alternatively: market price plus the charges for the use of the grid not incurred (market price based on price for natural gas).
- Drafting of precise provisions on annual balancing and measures that allow the grid charges not incurred to be taken into account.
- Definition of specific quality requirements for biogas, in particular with regard to the necessary composition of the gas.

Lead responsibility: BMWi/BMU

## 10 Energy Saving Ordinance

Current situation: The requirements set out in the Energy Saving Ordinance concerning energy efficiency standards for buildings no longer reflect the latest technological developments. We are not making the most of the potential for the improvement of energy efficiency and use of renewable energies in buildings that could be exploited economically. In addition to this, the low-cost night-storage heaters still to be found in about 1.4 million homes should be replaced over the long term.

Goal: The energy efficiency requirements placed on buildings will be progressively adjusted to reflect the latest technological developments and movements in energy prices. As of 2020, new buildings should be heated as far as possible without the use of fossil energy sources.

Measures: Revision of the Energy Saving Ordinance as far as economically justifiable with the following key elements:

### A) Raised level of requirements and retrofitting obligations

- Energy efficiency requirements to be raised by an average of 30 % (revision during 2008/2009).
- In a second stage (envisaged for 2012), the energy efficiency requirements will once again be raised by up to the same percentage.
- Extension of certain retrofitting obligations for plants and buildings under the general technical requirements concerning repair work, with allowances being made for cases of financial hardship among those affected. Exceptions, in particular, for buildings protected by heritage-conservation law or scheduled for demolition. Provisions for hardship cases/exemptions; retrofitting obligations will cease to apply if retrofitting is uneconomic even when funding options are taken into consideration. Appropriate transitional periods for the cost intensity of the measures. Funding under the modernisation programme to reduce CO<sub>2</sub> emissions from buildings.
- Strengthening of enforcement through the intensification of private duties to demonstrate compliance (e.g. certificates issued by specialist contractors).

- It is intended to introduce uniform provisions concerning fines for non-compliance with the requirements placed on new and existing buildings.

Lead responsibility: BMVBS/BMWi, BMU involvement

#### **B) Replacement of night-storage heaters**

- Regulations on the gradual removal of night-storage heaters used for space heating.
- Changeover to be completed within a period of at least 10 years; provisions for hardship cases/exemptions; duty to remove night-storage heaters will cease to apply if replacement is uneconomic even when funding options are taken into consideration.
- Support under the modernisation programme to reduce CO<sub>2</sub> emissions from buildings.
- Examination of the possibility of a commitment from the power industry to fund replacement with heat pumps.

Lead responsibility: BMVBS/BMWi, BMU/BMF involvement

## 11 Operating costs of rental accommodation

Current situation: It is true that current landlord and tenant law contains incentives for the implementation of energy conservation measures, but there is also further potential that remains unexploited in this field.

Goal: Accelerated energy-efficient modernisation and exploitation of further energy conservation potential in rented multi-dwelling houses.

### Measures:

#### Revision of the Heating Costs Ordinance

- The model for the distribution of heating costs (balance between flat-rate/consumption-dependant distribution) and the relevant rules will be amended to distribute a greater proportion of the charges involved on the basis of consumption while ensuring that these financial burdens continue to be shared equitably (heat losses from pipes).
- For buildings that meet what is known as the passive-house standard, provision should be made for an exemption from the application of the Heating Costs Ordinance as a way of creating incentives for compliance with the passive-house standard when multi-dwelling houses are built or refurbished.
- Examination whether a right to withhold payment of a certain percentage of the charges billed by a landlord can be established in the Heating Costs Ordinance (based on the model in Section 12 of the Ordinance) for cases where there is a serious infringement of an obligation under public law to meet energy efficiency standards or retrofit installations.

#### Contracting

- Since no reliable, up-to-date statements about the energy conservation potential of contracting have been available to date, a report should be drawn up by an independent institution to clarify whether contracting can make a significant contribution to energy conservation and so the reduction of CO<sub>2</sub> emissions, the share of Germany's housing stock for which contracting could be considered and the scale of the energy conservation potential that could be mobilised. It will be

examined how existing legal and other constraints on energy conservation contracting can be eliminated.

Lead responsibility: BMVBS/BMWi, BMU involvement

## **12 Modernisation programme to reduce CO<sub>2</sub> emissions from buildings**

Current situation: Under the modernisation programme to reduce CO<sub>2</sub> emissions from buildings, 700 million euro a year are available for the energy-efficient modernisation of residential buildings in 2008 and 2009, and 200 million euro for the modernisation of local authority facilities. This funding will be continued beyond 2009 in order to exploit the potential these buildings have for energy conservation.

Goal: The existing modernisation programme to reduce CO<sub>2</sub> emissions from buildings should be further developed. In addition to this, the energy conservation potential to be found in urban structures and social infrastructure will be exploited more fully.

Measures:

1. Stabilisation of the modernisation programme to reduce CO<sub>2</sub> emissions from buildings at the present level beyond 2009 to 2011.
2. Grant funding for the replacement of night-storage heaters.
3. As part of the modernisation programme to reduce CO<sub>2</sub> emissions from buildings, a module for the optimisation of energy efficiency in existing urban structures will be developed in consultation with the housing and energy industries. This will include the following components:
  - The use of district-based systems to heat and cool buildings (CHP, CCHP, use of waste heat).
  - Production and use of renewable energies in urban districts.
  - Intelligent energy storage and use inside and outside buildings.
4. Holding of a public competition under the title 'Construction of New Low-Energy Houses in Town-Centre Areas in Every County Borough/County'. Prizes for energy-efficient innovations and the architectural quality of the entries, e.g. buildings on disused land and in gaps between existing structures.

Lead responsibility: BMVBS, BMF/BMBF/BMWi/BMU involvement

### **13 Energy-efficient modernisation of social infrastructure**

Current situation: More than half the buildings that make up Germany's social infrastructure (approx. 40,000 schools, 48,000 day nurseries, 50,000 youth facilities, etc.) are in urgent need of energy-efficient modernisation. In particular, there is a considerable investment backlog in local authorities that are having to cope with very tight budgets.

2008 will therefore see the launch of an investment pact between the Federation, the *Länder* and local authorities on the energy-efficient modernisation of social infrastructure with 200 million euro of federal financial aid. When this is combined with the equal contributions from the *Länder* and the local authorities (each providing one third of the financial backing), the volume of funding available will amount to 600 million euro. In addition to this, there will be 200 million euro to subsidise the interest rates on loans under the modernisation programme to reduce CO<sub>2</sub> emissions from buildings.

However, this special programme can only be used to undertake the most urgently needed modernisation work in schools and day nurseries (approx. 600 schools or 1,200 day nurseries).

Goal: Primary energy savings of up to 50 % per refurbished building. This will also help to strengthen local economic activities and employment.

Lead responsibility: BMVBS

## 14 Renewable Energies Heat Act

Current situation: Renewable energies' share of the heat generation market was 6.0 percent in 2006 and has only grown slowly in the last few years (2005: 5.4 percent). The technologies for the use of renewable energies in this field are widely available, but they have failed to penetrate the market, in part due to a lack of economic efficiency. Renewable energies are the "slumbering giant" on the heating market.

Goal: Increase in renewable energies' share of heat consumption to 14 % in the year 2020.

### Measure:

#### 1. Renewable Energies Heat Act:

- A duty to use a particular proportion of renewable energies will be introduced. Apart from solar radiation and heat pumps, use may be made of other renewable energies and CHP (e.g. district heating or fuel cells) to fulfil this duty. When solar radiation is used, there will be a duty to ensure that 15 % of the heat consumed in a new building comes from renewable energies, while 10 percent of the heat consumed in existing buildings following thorough modernisation will have to come from these sources. In future, the proportion of renewable energies used to heat a building will be declared and, as previously, counted towards the satisfaction of energy efficiency requirements. Alternatively, it will also be possible to fulfil the duty to use renewable energies by means of district-based solutions or energy-saving features 15 % more efficient than those required by the Energy Saving Ordinance in each particular case. Urban planning concerns will be taken into account, e.g. in inner cities.
- Provisions for hardship cases/exemptions and situations in which the duty to use renewable energies will cease to apply if the fulfilment of that duty or alternative measures would be disproportionate in each particular case.
- The market incentive programme for renewable energies will be strengthened with funding of up to 350 million euro (financed from the proceeds of auctions). An efficient industry will only be built up if it is possible to plan for the future (as under the Renewable Energy Sources Act). In particular, funding should be approved if

the owner does more than the minimum required by the statutory duty to use renewable energies or deploys innovative technologies.

- The Renewable Energies Heat Act maintains the principle of economic justifiability and will be harmonised with the technical requirements set out in the Energy Saving Ordinance.

2. District-based heating solutions that use renewable energies should be driven ahead and closely coordinated with the regulations applying under building law.

Lead responsibility: BMU (Renewable Energies Heat Act), BMVBS/BMWi (Energy Saving Ordinance and technical harmonisation with the Renewable Energies Heat Act)

## **15 Programme for the energy-efficient modernisation of federal buildings**

Current situation: At present, a programme for the energy-efficient modernisation of federal buildings subject to direct federal administration (used by supreme federal authorities) has been put in place for the period 2006-2009 with funding of 120 million euro/year. 5 percent of these funds are earmarked for high-tech measures (e.g. fuel cells). The overall cost of the energy used in the properties occupied by the Federation amounts to almost 0.5 billion euro/year. There is considerable potential for energy savings slumbering in this field that could be exploited by means of architectural, design and technical modernisation measures (including contracting) – and the same is also true of buildings subject to indirect federal administration (used by indirectly administered federal corporations, institutes and foundations under public law).

Goal: Realisation of the extensive potential for energy and cost savings, reduction of CO<sub>2</sub> emissions from federal buildings in accordance with the commitments entered into by the German Government.

Measure: Stabilisation of the programme at the current level beyond 2009 to 2011 with the following key elements:

- Additional energy-efficient modernisation work on buildings subject to indirect federal administration (including the Federal Employment Agency).
- Increase in the share of the programme devoted to innovative, but hitherto uneconomic, technologies (e.g. fuel cells, photovoltaics, vacuum-insulation panels) to up to 15 %.
- Funding also for more recent service systems in buildings (equipment installed since 1995) that are to be expanded or modernised (above all for the use of renewable fuels, etc.).
- Monitoring of CO<sub>2</sub> emissions by the Federal Office for Building and Regional Planning in cooperation with the Federal Environmental Agency in accordance with the commitments entered into by the German Government.

As a result of the extension and stabilisation of these programmes, it will be possible to make energy savings worth 30-90 million euro/year.

Lead responsibility: BMVBS/BMU (monitoring of action on commitments)

## **16 CO<sub>2</sub> strategy for passenger cars**

Goal: Under the Commission's CO<sub>2</sub> strategy, the average CO<sub>2</sub> emissions from new cars in the EU are to be reduced to 120 g CO<sub>2</sub>/km by 2012, with allowances being made for the competitiveness and diversity of the European automotive industry. At the same time, however, the use of biofuels and various other measures will also be counted towards this target at a level of 10 g CO<sub>2</sub>/km, which means the vehicles themselves will only have to reach a target of 130 g CO<sub>2</sub>/km by 2012.

Measures:

- (1) The German Government will work for the introduction of appropriate binding CO<sub>2</sub> values, which must be anchored legally at the EU level.
  
- (2) The German Government will only deliberate on the consequences for the tax treatment of company cars once the European Commission has finalised how its CO<sub>2</sub> strategy is to be implemented.

Lead responsibility: (1) BMU with BMVBS, BMF involvement on (2)

## 17 Expansion of the biofuels market

Current situation: The Biofuels Quota Act, which has been in force since January 2007, obliges enterprises that place fuels onto the market to sell a statutorily determined minimum proportion (quota) of those fuels in the form of biofuels.

Goal: Assessment of biofuels on the basis of their potential to reduce greenhouse gas emissions and greater use of second-generation biofuels, accompanied by action to ensure the sustainable cultivation of raw materials for the production of biofuels

Measures:

- Adoption of secondary legislation on the sustainable cultivation and use of biofuels (Biofuels Sustainability Ordinance), which is essential if they are to be counted towards the quotas and receive favourable tax treatment (Bundestag Finance Committee to be tasked with implementation).
- In order to create additional incentives for investment and lasting prospects for biofuels in the period after 2015 as well, the Biofuels Sustainability Ordinance should provide for biofuels to be assessed on the basis of the extent to which they reduce greenhouse gas emissions, with the consequence that biofuels with a good greenhouse gas balance would count more towards the fulfilment of quotas under the relevant provisions and, as a result, would be treated favourably in comparison to other biofuels.
- Increase in the contribution to climate protection made by biofuels: The quota to be fulfilled (in the Biofuels Quota Act) will be set as a net climate protection contribution (decarbonisation) at 5 percent until 2015 and 10 percent from then until 2020. Since the greenhouse gas emissions from the production of biofuels will be factored into the calculations, a correspondingly higher quantity will have to be added to conventional fuels in order to fulfil this quota. This means that by 2020 blends will have to contain approx. 20 % biofuels by volume (equivalent to 17 % by energy content).
- To ensure that quota obligations above 7 percent biofuels by volume can also be complied with by means of blending, the combined hydrogenation of high-quality vegetable oils with mineral-oil-based oils will be permitted as of 2010, subject to the precondition that the cultivation and use of the vegetable oils are certified.

The amount of vegetable oil that can be hydrogenated with mineral oils will be limited to 3 percent by volume.

Lead responsibility: BMF/BMU/BMELV

## 18 Reform of vehicle tax on CO<sub>2</sub> basis

Current situation: The average CO<sub>2</sub> emissions from newly purchased cars currently lie at approx. 164 g CO<sub>2</sub>/km.

Goal: By 2012, the CO<sub>2</sub> emissions from new cars in the EU should go down to 130 g CO<sub>2</sub>/km, incentives for which are to be created using vehicle tax

Measure: While maintaining rates differentiated by pollution-emission standards, a revenue-neutral restructuring of vehicle tax will be initiated by means of the incorporation of CO<sub>2</sub> emissions into the basis on which it is calculated. As a result, it will be possible to reduce the tax burden on economical vehicles while increasing the tax burden on vehicles with high consumption. Key elements:

- A revenue-neutral reform of vehicle tax will take place at the next possible point in time, applying to all new vehicles.
- Older vehicles will continue to be taxed by cubic capacity and pollutant emissions. Moderate increases in the tax rates for older vehicles – beginning with vehicles covered by the Euro 2 pollution emission standard – should be used to ensure that new vehicles are not placed at a disadvantage when it comes to taxation and scope is allowed for financial incentives to purchase new vehicles.
- Every gram of CO<sub>2</sub> will be taxed equally and the different mineral-oil tax rates on petrol and diesel will be harmonised as in the past.

Lead responsibility: BMF

## 19 Energy labelling of passenger cars

Current situation: To date, the energy labelling of passenger cars (transposition of the European CO<sub>2</sub> Labelling Directive) is not approached uniformly across Europe. Customers in Germany are not provided with any significant information about vehicles' energy efficiency.

Goal: The German Government will present a concept intended to improve national labelling. The goal is consumer-friendly, clear labelling that also selectively incorporates the EU targets for CO<sub>2</sub> emissions and provides information about the energy efficiency of vehicles on sale. Basing itself on this concept, the German Government will also seek to persuade the Commission to introduce a harmonised consumer-information scheme.

Measures:

- Immediate amendment and notification of the Passenger Car Energy Consumption Labelling Ordinance to improve the information provided about CO<sub>2</sub> emissions from passenger cars. This proposal will also be submitted to the European Commission as soon as possible for harmonisation within the EU. The improved labelling should include a graphic representation of the vehicle's efficiency and the level of carbon dioxide emissions per kilometre driven, as well as information about the level of annual vehicle tax to be paid and fuel-consumption costs.
- If the Commission does not wish to adopt uniform European provisions in the short term, the German Government will introduce the notified legislation into the decision-making process.

Lead responsibility: BMWi

## 20 Reinforcing the influence of the HGV toll

Current situation: The level of freight moved – in particular by road hauliers – will rise strongly in the years to come. The toll on vehicles of 12 tonnes max. gross weight and above has already exerted a positive influence on this vehicle segment with regard to the more efficient use of vehicle capacities and the deployment of low-emissions vehicles.

Goal: Further reduction of emissions from the transportation of goods by means of increases in efficiency, the deployment of the least polluting vehicles and the prevention of evasive strategies.

Measures: The toll system should be further developed in order to achieve an even stronger climate protection effect:

- Broader spread and greater differentiation of toll rates by emissions classes: 100 % spread between lowest and highest rates (hitherto 50 %). This will further reduce the charges for less-polluting vehicles and increase the charges for more-polluting vehicles.
- Toll rates that recognise the retrofitting of particle-filtering systems.
- Differentiation of toll rates to control the formation of traffic congestion.
- Greater coverage of roads below motorway level.
- Development of a concept for the incorporation of external costs when the level of the toll is being calculated that takes account of the forthcoming amendment of the Infrastructure Charging Directive (BMVBS).

A broader spread of toll rates is possible in the short term, other steps will depend on the further evolution of the on-board units (OBUs, electronic devices used to record vehicle movements). The financial effects of this measure will not result in the revenues from the toll falling below the planned level in the period covered by the current financial plan.

Lead responsibility: BMVBS

## 21 Aviation

Current situation: Since 1990, the greatest growth in transport-related CO<sub>2</sub> emissions has been in the aviation sector.

Measures:

- **Extension of emissions trading to air traffic**

The German Government is working actively for the competition-neutral extension of the European Emissions Trading Scheme to air traffic. At the ICAO Assembly due to take place in September, the German Government will argue that no regulations should be adopted that obstruct the extension of the European Emissions Trading Scheme to air traffic envisaged by the EU in the planned form. This means that, in order to avoid distortions of competition, the scheme would also have to be extended to non-European airlines.

Lead responsibility: BMU

- **Creation of the “Single European Sky”**

It is hoped that the creation of a unified European airspace will reduce the CO<sub>2</sub> emissions per flight from European air traffic by up to 10 percent.

Measures: These targets can only be achieved in a European context. However, the German Government will work actively at all levels for the creation of the Single European Sky.

Lead responsibility: BMVBS

- **Emissions-related landing charges at airports**

Incentives for the use of less-polluting modern aircraft may be created by the emissions-related structuring of landing charges. In view of the indirect impact NO<sub>x</sub> have on the climate, this would constitute a direct contribution to the limitation of the greenhouse effect.

Munich Airport and Frankfurt Airport have declared their willingness to operate a three-year, revenue-neutral test phase that is intended to start on 1 January 2008. After approx. one year, the German Government will present a report on the experience that has been gained. If the conclusions reached in this report are positive, the German Government will seek to ensure that other airports apply this instrument.

Lead responsibility: BMVBS

## 22 Shipping

Current situation: With the growth of the shipping industry, emissions of greenhouse gases and other air pollutants (a problem at ports in particular) are increasing strongly.

- **Extension of emissions trading to maritime shipping**

Measure: The German Government has a positive attitude towards the competition-neutral extension of emissions trading to shipping. It will therefore, firstly, work at the international level for the adoption of regulations on emissions trading in this sector by the IMO and the UNFCCC and, secondly, call upon the European Commission to present analyses and proposals concerning action on this issue.

Lead responsibility: BMU (UNFCCC), BMVBS (IMO)

- **Further development of limit values for shipping**

Measures: The German Government is working for the relevant regulations to be tightened in various ways in order to reduce emissions from ships, as is currently being discussed in the International Maritime Organisation (IMO). The goal is to put in place more rigorous standards, including provisions on the quality of ship fuels, in order to facilitate the improved aftertreatment of exhaust gases.

Lead responsibility: BMVBS

## 23 Reduction of emissions of fluorinated greenhouse gases

Current situation: Fluorinated greenhouse gases have a very high greenhouse potential (up to 20,000 times higher than CO<sub>2</sub>). They are particularly used as coolants and propellants. Each year, considerable amounts of these gases are released directly during the operation of the systems where they are found and as a result of leakage. A rise in emissions can be expected on account of the moves to halt the use of CFCs/HFCs. Alternative technologies (e.g. refrigeration and air-conditioning systems and appliances with natural coolants such as CO<sub>2</sub>) are already available for certain applications.

Goal: Reduction of extremely climate-damaging emissions of fluorinated gases

Measures:

- Adoption of a Chemical Climate Protection Ordinance, which will include requirements concerning the impermeability (limit values for coolant losses) of new and existing stationary refrigeration systems with fluorinated coolants. These restrictions will be based on state-of-the-art technology (German Engineering Federation) and depend on the quantity of coolants the systems contain (exception for hermetically closed systems containing less than 6 kg fluorinated greenhouse gases).
- Measures that lead to an early changeover from fluorinated-gas air-conditioning systems to air-conditioning systems with a GWP value clearly lower than 150 in new cars.
- Funding from the Climate Protection Efficiency Fund for the development and market introduction of particularly energy-efficient, climate-friendly refrigeration systems with natural coolants (funding will be graduated in line with the systems' TEWI contributions and structured degressively over time).
- In addition to this, the German Government will make representations to the European Commission, arguing for the European legislation on fluorinated gases to be updated, particularly in relation to aerosols, foams, mobile and stationary refrigeration systems and air-conditioning systems, with the goal of further reducing emissions of fluorinated gases.

Lead responsibility: BMU

## **24 Procurement of energy-efficient products and services**

Current situation: Public procurement activities have a quite considerable exemplary function. Despite the fact that demand from the public sector is spread between a large number of contract-placing public authorities and individual contracts, its overall volume is still of major economic significance. Hitherto, energy consumption has, as a rule, been of secondary importance in public procurement, although in most cases energy costs represent a considerable proportion of operating costs.

Goal: The Federal Government will cut its energy consumption, reduce the pressures on its budget and act as a model for the procurement of energy efficiency technologies and the integration of climate protection into other activities.

Measure: The German Government has decided to develop environmentally friendly, in particular energy-efficient, technical guidelines that will form the basis for the procurement decisions made by the Federation. To this end, the German Government has decided that, when the Federation makes procurements, the foreseeable operating costs over the serviceable life of the system being considered (above all the costs for the energy consumption of the devices to be procured) are to be taken into account as well as purchasing costs during the evaluation of offers (life-cycle-costs principle). The action required to implement this decision, including appropriate monitoring, will be taken by and with the support of an inter-ministerial Working Group on Green Purchasing.

The German Government is also calling upon all the *Länder* and local authorities to introduce guidelines for environmentally friendly and, in particular, energy-efficient procurement and to scrutinise compliance with these guidelines by means of monitoring.

Lead responsibility: BMWi

## 25 Energy research and innovation

Current situation: The German Government's 5th Energy Research Programme will form the basis of the Federation's ongoing funding policy in the years to come. It sets the right priorities with its focus on energy efficiency and renewable energies. Work on these topics is also being supported by the funds additionally directed into energy research by the High-Tech Strategy under the 6 Billion Euro Programme. This means energy and climate research is able to build on solid foundations.

Goal: Implementation of the roadmap for energy research presented at the energy summit.

Measures: The German Government will consolidate ongoing activities in energy and climate research and launch a number of selected new initiatives. This will require the identification of pioneering projects and initiatives. It will also involve support for strategic partnerships between publicly and privately funded research. Furthermore, fundamental and applied research should be expanded, on the one hand, in order to exploit the potential to optimise energy systems over the short to medium term and, on the other hand, to ensure innovative climate protection technologies continue to become available in the period after 2020 as well.

To this end, the German Government has further increased the funding for energy research from 2008 onward.

Examples of concrete measures in this context include:

- Launch of a technology programme on climate protection and energy efficiency (BMWi).
- Expansion of research into the use of renewable energies, in particular in innovative fields (BMU).
- Launch of a programme of fundamental energy research, including activities focussed on CO<sub>2</sub> storage (BMBF).
- Consolidation of research into the use of biomass to produce energy (BMELV/BMU/BMBF/BMVBS).
- Technology and efficiency programme for future drive technologies (BMVBS/BMU/BMWi/BMBF).

- Expansion of applied research into measures that can be taken in buildings (BMVBS).
- High-tech strategy for climate protection, under which important areas of concern will be addressed together with business, to be presented by October 2007.

Lead responsibility: BMWi (overall approach)/BMU (renewable energies and climate protection/BMBF (in particular High-Tech Strategy/6 Billion Euro Programme), BMVBS/BMELV (subprogrammes)

## **26 Electric mobility**

Efficient vehicles and drive technologies will be crucial factors in the efforts to further exploit the potential to reduce CO<sub>2</sub> emissions in the transport sector and, at the same time, lessen Germany's dependence on energy imports. As far as drives for passenger cars are concerned, the electrification of drives and fuel-cell technology will become ever more prominent in future.

The automotive industry and the German Government are already working jointly on the development of innovative drive technologies under various programmes, such as the National Hydrogen and Fuel Cell Technology Innovation Programme (NIP). The automotive industry is also engaging in complementary activities, looking to various variants of hybrid technology for increases in efficiency and CO<sub>2</sub> savings. Almost all the manufacturers have this technology in their product range or are at least preparing to introduce it in the near future.

Thanks to the development of battery technology, new possibilities are opening up for hybrid vehicles: short journeys could be made using an electric motor and a battery charged up from the fixed power grid. This would create new opportunities for certain market segments.

Vehicles with electric drives do not release any fine particulates or NO<sub>x</sub> emissions in the location where they are driven. The only noise pollution produced is tyre noise. This means, above all, that they are able to make an important contribution to improvements in the quality of the environment and of life in conurbations. With regard to CO<sub>2</sub> emissions, the advantageousness of electric mobility depends on how power is generated and hydrogen produced.

With intelligent measures to integrate the additional demand for power into the future energy system, vehicle batteries will make an important contribution to the improvement of grid management. This would, above all, simplify load management by increasing storage capacities, given that a growing proportion of Germany's power will come from renewable energies with fluctuating levels of output, and at the same time make it possible to exploit efficiency reserves.

Just as in Japan and the USA, for example, long-term, coordinated funding for research into batteries is needed in Germany. This should also encompass modern high-voltage

drive batteries in order to develop alternative drive technologies (hybrid, fuel-cell and battery vehicles).

Goal: Provided certain conditions are taken into consideration, the use of vehicles with hybrid and pure electric drives can improve the environmental balance of the transport sector. At the same time, the integration of these vehicles into modern power grids could make a further contribution to the improvement of grid management.

Measures:

The German Government will:

- Collaborate with industry under the auspices of the National Hydrogen and Fuel Cell Technology Innovation Programme to develop an R&D and demonstration concept for battery systems and electric drives.
- Carry out a field test with plug-in-hybrid vehicles in consultation with the automotive industry.
- Conduct practically relevant research projects intended to analyse questions relevant to the practicality, acceptance and efficiency of this technology, as well as the material flows it requires.
- Present and consult with the relevant business groups on a concept detailing how the efficiency reserves available in the field of grid management, in particular, can be exploited as electric mobility increases its share of the transport sector, given the marked increases in the amount of power being supplied from renewable energies.

Lead responsibility: BMWi/BMVBS/BMBF/BMU

## **27 International projects on climate protection and energy efficiency**

Current situation: At the moment, Germany holds only a very small share of the market for project-based mechanisms under the Kyoto Protocol (Germany's share of Joint Implementation/CDM projects is about 3 percent – market leaders: UK, Spain, Italy, Netherlands, Denmark).

Today, very few exports from German companies are marketed with claims about "climate protection" and "energy efficiency".

Nevertheless, German industry is a technological leader or one of the top global providers on the world market in many fields relevant to climate protection and energy efficiency.

Goal: Support for, and systematic strengthening of, the participation of German companies in project-based mechanisms, partly so that they fulfil their obligations under emissions trading cost-effectively. Support for the export of climate-safe, energy-efficient products and services by German businesses.

Measures:

1. Consistent implementation of CDM/JI initiatives (BMU)
2. Implementation of the Energy Efficiency Export Initiative (BMWi)
3. Strengthening of efforts by German business (German Association of Chambers of Industry and Commerce/Federation of German Industries, with support from the German Government)

Lead responsibility: BMU/BMWi (Export Initiative)

## **28 Reporting on energy and climate policy by German embassies and consulates**

Current situation: To a great extent, national energy and climate policy is made through the implementation of European and international agreements; developments in energy and climate policy abroad have repercussions for national policy.

Goal: Comprehensive, up-to-date reporting from German representations abroad.

Measures: The Federal Foreign Office will instruct German embassies, consulates and representations at international organisations to submit more frequent regular and occasional reports on energy and climate policy topics.

Apart from the continuation of the annual reporting on energy policy from strategically important countries, this relates in particular to reporting on:

- Developments in the energy sector of the host country (political structures, changes to legislation, etc.).
- Developments with consequences for the security of energy supply in Germany and the EU (e.g. energy infrastructure projects, new extraction licenses).
- The host country's policies towards renewable energies (and at present the initiative started by Germany to establish an International Agency for Renewable Energies [IRENA]), as well as energy efficiency.
- Opportunities for German companies in the host country in the fields of energy and climate protection, including renewable energies; opportunities for cooperation on the basis of the CDM and JI mechanisms.
- Research projects and calls for tenders in the host country in the fields of new low-emission energy technologies, renewable energies and energy efficiency
- Energy and climate policy in international organisations.

Lead responsibility: Federal Foreign Office (AA)

## **29 Transatlantic climate and technology initiative**

Current situation: It is of decisive significance that, as one of the biggest emitters of greenhouse gases, the USA should be involved more in the fight against climate change. Energy and climate issues must be a central theme in the transatlantic dialogue.

In this respect, one key topic could be innovations in energy and climate-friendly technologies.

The Federal Foreign Office launched the transatlantic climate and technology initiative during the German presidency of the European Council as part of the German Federal Chancellor's efforts to promote a broad-based "new transatlantic economic partnership" between the EU and the USA. The focus of this initiative lies on the harmonisation of standards, joint research projects and coordinated calls for tenders in the research field. The first concrete measures to be taken as a result of these steps were agreed at the joint EU-US summit in April 2007.

Goal: Closer transatlantic cooperation and consultation on climate protection and technology, in particular in the following fields: clean coal, development of renewable energies and energy efficiency.

### Measures:

- Clean coal: the EU will fund demonstration power stations; the USA will increase financial incentives for CCS research; there will be joint action to encourage newly industrialising countries, such as India and China, to adopt CCS technology.
- Renewable energies: the EU has adopted a binding target of 10 percent for biofuels' market share by 2020; the USA wants to reduce fuel consumption by 20 % by 2017 through the increased use of alternative fuels; common standards for biofuels are to be drawn up jointly by the end of 2007.
- Continuation of the work of the joint US-EU Energy CEO Forum as part of the "transatlantic technology initiative": among other things through the involvement of entrepreneurial expertise in the following areas:
  - Biofuels (harmonisation of standards, sustainability aspects).

- Energy production (CCS, feed-in of renewable energies).
- Energy efficiency (harmonisation of construction regulations, labelling, e.g. ENERGY STAR).
- Research & development (CCS, second-generation biofuels, energy storage).
- Within the EU and in its discussions with the Commission, Germany is seeking an intensification of EU-US research cooperation in the field of climate-friendly energy technologies.

Lead responsibility: AA, BMWi

Senator SANDERS. Thank you very much.

Dick ArmeY is a previous colleague of mine in the House of Representatives. He was the Majority Leader there, and is currently the head of FreedomWorks. Dick, thanks very much for being with us.

**STATEMENT OF RICHARD K. ARMEY, CHAIRMAN,  
FREEDOMWORKS**

Mr. ARMEY. Thank you, Mr. Sanders, and thank you, Madam Chairwoman, and Senator Inhofe.

It is my pleasure to be here. When I received this invitation, I received the invitation and determined to respond to it as the professional economist that I am by academic training and as the Chairman of FreedomWorks, an organization of 830,000 American citizens, all devoted to understanding of free market economics and the application of free market economic solutions to our Nation's problems.

I, like yourselves, found this to be an intriguing question, and immediately consulted literature on the subject of environmental regulation and job creation. I found the literature to be somewhat divided on the matter. I may say, as Senator Inhofe suggested, that the literature tends to be moving from the direction of early writings demonstrating a belief that environmental regulation is a net job creator, to later writings that reflect some doubt on that.

My own judgment and evaluation is that the best that you could say is that there would be at the very best no net job reduction from increased environmental regulation, but even within that context, there would be a reallocation of jobs between the private and the public sector. Since the private sector is that sector of our economy that embraces free bilateral exchanges between willing individuals and the public sector embraces the mandates of behavior on people, I would argue that no freedom-loving individual could rejoice in seeing jobs shift from the private sector, where freedom reigns, to the public sector where regulation and mandates and control reign.

My own belief is that the greater result is that there would be a net loss of job opportunities within the context of opportunity costs. While there could still be net growth in the economy, it would simply be substantially less.

Why would that be? Because whatever we do with respect to concerns with the environment, it inevitably relates to energy: electricity, fossil fuel energies and so forth. These are among the three or four highest linkage factors in our economy. That is, when the cost of energy goes up, the cost of everything goes up. When the cost of everything goes up, you see a leftward, as it were, a leftward shift in the supply curve. That means, of course, there will be reduced output and reduced job opportunities. I think American labor, for example, instinctively knows that.

As I further looked at it, I found myself going back to ArmeY's axiom No. 1: the market is rational; the government is dumb. I know that seems very harsh. I love that axiom more, quite frankly, for the alliteration than for the harshness of the alliteration. But when you use this axiom, you must understand that when an economist uses the term "rational," he does not mean "sensible," as in

agreement with me. The term “rational” means “rationing,” the market is the chief instrument for rationing scarce resources, which is the fundamental problem of an economy. How you take the wealth of your Nation, as Adam Smith demonstrated, which is your resources, and your resourcefulness, and in fact get the most you can out of it. The market has a history of leading people to decisions that best utilize, most efficiently utilize and most effectively conserve scarce resources.

The unhappy story about government policy is that government policy generally leads you in exactly the opposite direction. One need not look further than the world’s history of agriculture policy to see how dramatically obscene it is with respect to the question of effectively allocating and conserving scarce resources. To wit, I would suggest that it is so insane that even the Russians wouldn’t have attempted to shut down perfectly good agriculture land in the Midwest, with almost ideal climatic conditions for the production of crops, so that you could open up a similar amount of acres in the Southwest desert, and produce exactly those same crops by irrigating with one of our most precious resources, clean water. Now, if that doesn’t demonstrate the folly of government choice.

Well, just parenthetically, why is it that government is so less rational than the market? It is the choice criteria. Governments make decisions by criteria called political choice criteria, which is inherently intellectually and morally inferior to virtually any criteria I can think of, because political criteria is about what is in it for me now or my party in the next election.

The economic criteria by which market choices are made are in fact objective criteria based on fact toward rational objectives.

I thank you.

[The prepared statement of Mr. Armev follows:]

STATEMENT OF RICHARD K. ARMEV, CHAIRMAN, FREEDOMWORKS

Good afternoon. Madam Chairman and Members of the Committee: as you may know, after leaving my post as Majority Leader of the U.S. House of Representatives, I became Chairman of FreedomWorks, an 850,000-member grassroots organization that promotes market-based solutions to public policy problems. Thank you for inviting me here today to discuss “Green Jobs Created by Global Warming Initiatives.” On behalf of the members and supporters of FreedomWorks, I urge the Committee to conduct a careful assessment of the economic impacts of climate change policies as it evaluates policy options. While it is true that subsidies and regulatory incentives can increase employment in particular greener industries, this can only be done by reallocating resources away from existing uses. A new regulatory regime to reduce greenhouse gas emissions is a costly undertaking that will have a significant impact on the economy; Congress should not ignore the economic aspects of this issue.

While a significant new regulatory program and subsidies for green businesses undoubtedly would expand the resources devoted to greenhouse gas reductions, these gains come at the expense of everyday activities elsewhere in the economy, especially activities in more carbon-intensive industries. In effect, limitations on the use of carbon-based fuels constitute a supply shock in the energy market. Throughout the economy, consumers will face increased energy costs as well as higher prices associated with new product efficiency standards. These higher prices will reduce economic activity and have an adverse impact on employment. Academic analysis demonstrates the cost of previous oil supply shocks.<sup>1</sup>

<sup>1</sup>See, for example, James Hamilton and Anna Maria Herrera, “Oil Shocks and Aggregate Macroeconomic Behavior: The Role of Monetary Policy,” *Journal of Money, Credit, and Banking*, vol. 36, pp. 265–286, April 2004, which examines the impact of oil supply shocks and argues the Fed policy could not offset their consequences.

Any action to reduce greenhouse gas emissions entails a significant reduction in the use of carbon-intensive forms of energy, which will affect all consumers and businesses. Assessing and understanding these costs must be an integral part of the current debate on climate change. Uncertainty may frame the scientific debate over global warming, but from an economic perspective, most studies analyzing the economic effects of climate change policies note that the transition is not costless.

For example, a recent study by Michael Canes identifies four main categories of costs associated with a cap and trade program, a prominent policy option for addressing climate change: the restriction on the use of fossil fuels, which could cost tens of billions annually; the price volatility associated with the cap on energy use, which could have “periodic GDP growth impacts of a few tenths of 1 percent”; rent seeking costs, which could be as high as \$60 billion per year; and the monitoring and information costs, which could be as much as \$1 billion per year in the United States alone.<sup>2</sup> A paper by Arthur Laffer and Wayne Winegarden notes that under a cap and trade program, the economy could shrink by 5.2 percent by the year 2020.<sup>3</sup>

New regulations and Federal spending to mitigate greenhouse gas emissions create new opportunities for some sectors of the economy. However, these jobs come at the expense of activity elsewhere in the economy. At best, the shift in economic activity will create no new jobs or wealth; it simply reallocates employment among sectors of the economy. At worst, it means that other economic actors will have to forgo investment decisions that would have expanded the economic pie rather than simply reapportion the existing slices.

A regulatory program shifting production to new “green” sectors of the economy will require significant expenditures throughout the economy. With the current role of more carbon-intensive energy in our economy, these costs could be substantial. Such mandates would increase the supply of greener energy and production, which, given current technologies, would increase energy costs throughout the economy. It is true that particular sectors of the economy may gain, but this cannot be said for the economy as a whole. With resources diverted from other uses, we may actually be poorer than we otherwise would be. We must realize that this is a costly venture that can decrease economic growth. These programs take resources from one group to be spent by others. Real economic growth, on the other hand, requires policy changes that create incentives to produce.

Major regulatory efforts to reduce greenhouse gases are broad in their impact and run the gamut from a carbon tax (an idea recently floated by Rep. Dingell) to discourage the use of fossil fuels, to a cap and trade system for allocating permits to emit greenhouse gases. To varying degrees, economic research on programs to reduce emissions of greenhouse gases concludes that there will be a reduction in output, particularly in the short-run. This drop in output suggests a lower degree of economic activity associated with the higher costs of factor inputs. With economic output decreasing, it becomes difficult to demonstrate that mandates for greener energy can increase employment opportunities for the overall economy.

Examining the response to previous environmental regulations may provide insights into the impact of climate change policies. A recent paper by Michael Greenstone examines some of the potential economic effects of clean air regulations.<sup>4</sup> The author notes that, according to the U.S. Bureau of the Census, American manufacturers spend roughly \$30 billion per year on pollution abatement. To determine the economic impact of these costs, Greenstone examines the Clean Air Act Amendments of 1970 and 1977. The Clean Air act establishes regulatory standards for the four criteria pollutants; more importantly, it also establishes requirements for attainment across the country. Industries that emit criteria pollutants in counties that are in non-attainment are subjected to more rigorous regulation. This provides a useful way to compare economic activity in regulated (non-attainment) and unregulated (attainment) counties in order to determine the impact of environmental regulations.

The findings provide a cautionary note on the ability to create green jobs through regulation. In particular, Greenstone concludes, “The paper provides new evidence that environmental regulations retard industrial activity. I find that in the first 15 years after the CAAs [Clean Air Act Amendments] became law (1972-1987), non-

<sup>2</sup>Michael E. Canes, “The Adverse Economic Impacts of Cap-and-Trade Regulations,” September 2007.

<sup>3</sup>Arthur Laffer and Wayne Winegarden, “The Adverse Economic Impacts of Cap-and-Trade Regulations,” Arduin, Laffer, & Moore Econometrics, September 2007.

<sup>4</sup>Michael Greenstone, “The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 & 1977 Clean Air Act Amendments and the Census of Manufactures,” National Bureau of Economic Research Working Paper 8484, September 2001.

attainment counties (relative to attainment ones) lost approximately 590,000 jobs, \$37 billion in capital stock, and \$75 billion (1987\$) of output in polluting industries.<sup>5</sup>

New mandates and subsidies to reduce greenhouse gas emissions would obviously spark employment in less carbon-intensive sectors of the economy, but this may not offset the employment dislocations created by regulations. As Greenstone notes in his evaluation of past regulations, “recent research indicates that these frictions [dislocations due to environmental regulations] may be quite substantial and can persist as long as a decade (Blanchard and Katz 1992). Jacobson, LaLonde, and Sullivan (1993) document that displaced workers endure substantial wage losses. Consequently, people who lost their jobs due to environmental regulations may have suffered long-run wage declines.”<sup>6</sup> The impact of reducing greenhouse gas emissions is even more sweeping in nature than previous regulations, especially when considering the state-of-the-art for alternative energy sources, which are currently more costly and a limited substitute to existing energy supplies.

In another study, similar results are found with respect to decisions to build new manufacturing plants. Examining data on location decisions for plants in New York, the results suggest that, in fact, environmental regulations can have a real and significant impact on economic activity. The authors conclude: “Our major results are consonant with the received literature, namely that “dirty” firms respond to environmental regulations. But, the matching method, by controlling for differences in lagged plant formations, indicates that the effect of environmental regulation on new plant formation may be drastically higher—as much as 3.5 times—than previously reported.”<sup>7</sup>

Randy A. Becker and J. Vernon Henderson examine a similar issue in a paper assessing the costs of clean air regulation.<sup>8</sup> Also using the impacts of the Clean Air Act, the authors study the issue of environmental compliance from the cost side, focusing on plant operating costs if moved from an attainment to non-attainment area. Using this methodology, they are able to identify a lower bound on regulatory costs.

Becker and Henderson conclude, “In terms of quantifying the costs of air quality regulation, our basic results show that heavily regulated plants indeed face higher production costs than their less-regulated counterparts. This is particularly true for younger plants, which is consistent with the notion that regulation is most burdensome for new (rather than existing) plants. “Unregulated” plants, however, also appear to be affected by regulation (or at least the threat of regulation), as we found that they produce at levels far short of the levels that minimize average total costs.”<sup>9</sup>

That these results suggest that mandates or environmental regulations could have adverse effects on economic growth are not surprising. In a competitive economy, firms seek to maximize profit, and they organize themselves accordingly. Firms are already structured in ways that achieve the greatest efficiency and minimize costs. New mandates that increase the price of factor inputs will affect the ability of firms to achieve the same levels of output for the same levels of cost. As far back as Adam Smith economists have noted that in a free and competitive market firms will seek out profit opportunities. In fact, the market is a discovery process that seeks to use resources more efficiently; for example, energy efficiency has improved dramatically in the United States as businesses have been able to reduce the amount of energy required to produce a dollar’s worth of output. Government policies that impede the market process will impose costs on the economy by limiting the ability for firms to adapt to new circumstances.

Indeed, government policies can also generate unintended consequences as firms respond to political incentive and engage in rent-seeking behavior. For example, as Bruce Ackerman and William Hassler detailed in their 1981 book, *Clean Coal/Dirty Air: How the Clean Air Act Became a Multibillion-Dollar Bail-Out for High-Sulfur Coal Producers*, earlier attempts to regulate environmental problems such as sulfur

<sup>5</sup>Ibid. p. 28.

<sup>6</sup>Ibid., p. 28.

<sup>7</sup>John A. List, Daniel Millmet, Per G. Fredriksson, and W. Warren McHone, “Effects of Environmental Regulations on Manufacturing Plant Births: Evidence from a Propensity Score Matching Estimator,” *Review of Economics and Statistics*, November 2003, Vol. 85, No. 4, Pages 944-952.

<sup>8</sup>Becker, Randy A. and Henderson, J. Vernon, “Costs of Air Quality Regulation,” National Bureau of Economic Research Working Paper No. W7308, August 1999.

<sup>9</sup>Ibid. p. 23.

dioxide pollution from coal plants produced counterproductive results.<sup>10</sup> Eastern coal producers, saddled with dirtier coal than other parts of the Nation, and environmentalists infatuated with a specific technology—in this case, smokestack scrubbers—formed an alliance to mandate the technology on all coal plants in America. This was despite evidence that coal scrubbers were often ineffective, and that combining lower-height smokestacks with the use of low-sulfur coal could produce cleaner outcomes. Instead of focusing on results, such as clean air, too often the political dynamics in Congress lead to rent-seeking, protectionism, and mandates, with results that run contrary to the stated purpose of the initial effort. With respect to coal, this counterproductive dynamic continued into the 1990's, when the Clinton administration blocked the development of the largest deposit of low-sulfur coal in America by declaring Utah's Kaiparowits Plateau a "National Monument." New, green technology programs can generate similar incentives to use the political process rather than the market process for allocating scarce resources, and the potential costs of rent-seeking should be included in an evaluation of such policies.

Madam Chairman and Members of the Committee, FreedomWorks urges caution and a thorough economic analysis of the costs and benefits associated with policies for greenhouse gas reduction. Sound energy policies are critical to a strong economy. Energy is an input to all the goods and services we consume. It heats and cools our homes, and fuels our transportation system. Affordable and reliable energy is an important component to continued economic growth, and the potential for new global warming mandates poses real costs for the economy and for consumers.

Thank you.

---

Senator SANDERS. Thank you.

Let me give the gavel back to the Chairman for a second.

Senator BOXER.

[Presiding.] Momentarily here, I have asked to go out of order because one of my most famous constituents is here. I wanted to have the honor of introducing him to everyone. I think that Dick's talk about the private sector and capitalism and how he believes in that is a perfect introduction for our next speaker.

Vinod Khosla is one of the most influential people in the Silicon Valley and beyond. He is listed in Forbes magazine as one of America's most successful 400 people. Vinod is a world-renowned venture capitalist. He co-founded Sun Microsystems and ran it until 1984, I believe, when he joined Kleiner Perkins venture capitalists, a firm, and he was one of the first venture capitalists to visualize that a combination of internet technology and fiber optics could make communications so fast, cheap and easy.

So we are so happy that you are here to share your wisdom with us. Taking off on what Dick Armey said about the brilliance of the private sector, here you are. Tell us what you think we should be doing in terms of global warming, and if you feel it will create jobs or lose jobs.

**STATEMENT OF VINOD KHOSLA, FOUNDER,  
KHOSLA VENTURES**

Mr. KHOSLA. I come before you here today not to make an environmental case for climate change legislation, but rather an economic one. I believe climate change legislation is good for our economy, our national security, and our competitiveness. It is good for job creation and GDP growth.

I come here as a believer in free markets and a level playing field. Today, we carry immense risks associated with commodities

---

<sup>10</sup>Bruce Ackerman and William Hassler detailed in their 1981 book, *Clean Coal/Dirty Air: How the Clean Air Act Became a Multibillion-Dollar Bail-Out for High-Sulfur Coal Producers* Yale University Press (1981).

upon which our society depends, risks we desperately need to start mitigating. Lord Oxburgh, the former Chairman of Shell, has predicted that oil prices could hit \$150 a barrel within the next 20 years. We spend over \$300 billion a year on oil imports and estimate that we spend \$50 billion a year on protecting just our oil interests in the Middle East. Should we be spending more money lining Hugo Chavez's pockets and funding the people who fuel terrorism?

The case for coal is similar. The cost of coal is felt directly on our health and our health care costs. The American Lung Association notes that a 2004 study estimated 24,000 premature deaths each year due to power plant pollution. In my written testimony, I submit a chart of the death rates around coal power plants. But one does not need to believe in climate change to support climate change legislation. The uncertainty around such legislation is hurting the U.S. economy and jobs creation, and many executives would prefer to deal with the known legislation, even if unwarranted, than dealing with the uncertainty of unknown future legislation.

Delays in investment delay job creation and increase the cost of power to industry consumers and reduce our competitiveness. Climate legislation will, on the other hand, create real competition for fossil energy.

First, the issue of price impact of coal versus renewable power. From a consumer and industry cost of energy point of view, we need to create competition for traditional energy sources and to account for external costs associated with them. Competition will drive down the cost of oil energy, but because of huge subsidies provided to traditional energy sources in the past, alternative greener technologies will need legislation to get started before they achieve economies of scale.

With declining cost curves and rapidly improving technologies, these alternatives I believe will be cheaper than traditional energy sources, helping both industry and our environment. We are particularly optimistic about solar CSP technologies when it comes to power. In its cost advantages over coal, one of our investments, AUSRA, is expecting costs below 7 cents a kilowatt hour at market interest rates, a cost even nuclear power and IGCC coal cannot achieve.

Corn ethanol has reduced demand for gasoline in the past year, but beyond corn ethanol, the cheaper and more economical future is that of cellulosic ethanol. In fact, Range Fuels, one of our investments, can produce cellulosic ethanol that is cheaper than oil and will be in production by the end of next year. We believe this technology will achieve \$1 a gallon wholesale prices within the decade. Competition for fossil energy sources is what we are asking for on a level playing field.

When it comes to job creation, the solar CSP technology I mentioned creates twice as many jobs as a coal power plant. Black and Veatch, a traditional power industry engineering firm, has estimated that not only does it create almost twice as many jobs, but for each dollar spent it generates \$1.40 of gross State output compared to roughly 90 cents to a dollar for each dollar invested in natural gas fuel power generation.

The job creation data is not just a study. The numbers have been validated at AUSRA, one of our investments, is starting to build plants and compute construction costs and operations costs. When it comes to costs of biofuels and oil creation, in Brazil they estimate that a dollar invested in biofuels generates 20 times the number of jobs as a dollar invested in oil. Range Fuels will build its first plant in Soperton, Georgia. The first plant will create 70 jobs, but more importantly a University of Georgia analysis, an independent analysis, estimated that it could be worth \$110 million per year to the county, including \$500,000 in tax revenues.

Moreover, as paper mills have shut down across the Country, these plants will offer opportunity to reduce their impact. Imagine 1,000 such plants spread across 1,000 counties across America.

There is also substantial risk to the status quo. Business in the status quo is in a holding pattern. No sane CEO would bet that no climate change legislation will be enacted in the next 50 years, the typical life of their plants. We must remove this unnecessary risk for our businesses. The devil we know is better than the one we don't when it comes to climate change legislation.

Even a conservative magazine like The Economist documents both insured and uninsured costs of climate change. I submit a graph in my written testimony, but most importantly the editor there told me that 2 years ago, he wouldn't have believed an economic case for climate change. Today, he does. And that is from a conservative organization like The Economist.

Thank you very much.

[The prepared statement of Mr. Khosla follows:]

STATEMENT OF VINOD KHOSLA, FOUNDER, KHOSLA VENTURES

#### INTRODUCTION

Madam Chairman and honorable members of the Committee, there is a climate crisis, a security crisis and an impending oil crisis and these crisis's have the potential to create a large jobs crisis. As Stanford economist Paul Romer has said, a crisis is a terrible thing to waste. America's scientists and technologists, powered by new ideas and the energy of America's entrepreneurs, are best equipped to solve this problem. Specifically, the focus on environmental technologies, often criticized by some for potentially hurting the US economy, are an unprecedented economic opportunity with many beneficial side effects. Many business leaders like the CEOs, from companies like DuPont, GE and Duke Energy, who have called for tough Federal limits on carbon dioxide emissions. Recently, that call was echoed by institutional investors managing \$4 trillion in assets. Climate change and climate change legislation presents an opportunity for the country. It will create jobs, not destroy jobs. Climate change is principally about our dependence on oil, coal and efficiency. I respectfully come before you today not to make an environmental case for climate change legislation but rather an economic one. Climate change legislation is good for our economy, our national security and our competitiveness. It is good for job creation and GDP growth. I come before you as a believer in free markets and in our advantage in innovation driven economic competition.

Madam Chairman, I submit the evidence of the U.S. Climate Exchange partnership, a group whose members run the gamut from automakers (GM, Ford) to utilities and power producers (PG&E, Duke Energy), from insurance (AIG, Marsh) to oil (Shell, Conoco Phillips, BP). As they note:

"In our view, the climate change challenge, like other challenges our country has confronted in the past, will create more economic opportunities than risks for the U.S. economy. Indeed, addressing climate change will require innovation and products that drive increased energy efficiency, creating new markets. This innovation will lead directly to increased U.S. competitiveness, as well as reduced reliance on energy from foreign sources. Our country will thus benefit through increased energy security and an improved balance of trade."

However, there are many forces that will oppose this change. Each \$4 change in the price of a barrel of oil costs Saudi Arabia (a country with a smaller population than California) a trillion dollars. Oil interests will and are funding massive PR campaigns against the moves to replace oil. In my Wall Street Journal editorial on January 23, 2007, I called on President Bush to declare a war on oil. This war is winnable, politically feasible with small compromises, and a great boon to all Americans—rural or urban, workers or shareholders, educated or unskilled.

#### MACRO TRENDS: OIL, COAL & NATURAL GAS

Today, we carry immense risk associated with the commodities upon which our society functions—risk we desperately need to start mitigating, risk that is costing us dearly and has the potential to cost us even more. Lord Oxburgh, the former chairman of Shell, noted recently that the oil industry had its head “in the sand”, and predicted that oil prices could hit \$150 per barrel within 20 years. What would that do to our competitiveness given our large oil consumption? In addition, he noted that “we may be sleepwalking into a problem which is actually going to be very serious and it may be too late to do anything about it by the time we are fully aware.”<sup>1</sup> In the last 8 years, oil has gone from roughly \$15 a barrel to \$80—a rise of greater than 500 percent. Senator Richard Lugar has pointed out that we spend over \$300 billion a year on oil imports, and estimates that we spend an additional \$50 billion a year (at least) on protecting just our oil interests in the Middle East. He goes on to note that by 2025, we will require almost 30 million barrels of oil per day! Should we really be spending more money lining Hugo Chavez’ pockets and funding the people who fuel terrorism?

The risks of coal (and to a lesser extent, natural gas) are similar. Over the last few years, coal plant costs have risen rapidly—Innovest Strategic Advisors noted that “In 2006, the cost of new coal-fired power plants increased by 40 percent. This is representative of a continuing trend in which capital costs have increased by 90—100 percent since 2002.”<sup>2</sup> The president of Siemens Power Group noted that “There’s real sticker shock out there.”<sup>3</sup> One common example is Duke Energy’s proposed Cliffside plant, which was initially priced at \$2 billion for 2 800-MW units. 18 months down the line, the price tag had risen to \$3 billion. When the State utility approved only one of the two units, Duke came back with a cost estimate of \$1.83 billion—an 80 percent rise before construction had even started! Elsewhere, even newer, touted “clean coal” is prohibitively expensive—The AEP power plant in West Virginia had construction costs rise to \$2.23 billion for a 630 MW plant, more than 70 percent higher than previous estimates. This is a capital cost of \$3,539/kW! These cost increases impacts U.S. competitiveness and job creation.

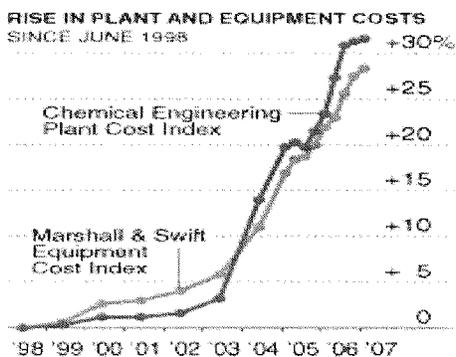
<sup>1</sup><http://news.independent.co.uk/business/news/article2966842.ece>

<sup>2</sup><http://www.net.org/proactive/newsroom/release.vtml?id=29196>,

<sup>3</sup><http://www.nytimes.com/2007/07/10/business/worldbusiness/10energy.html?—r=1&oref=slogin>

### Sticker Shock

Builders of all kinds of power plants say construction costs have risen sharply. Two indexes for related types of projects show the trend.



Sources: Chemical Engineering; Electric Power Research Institute

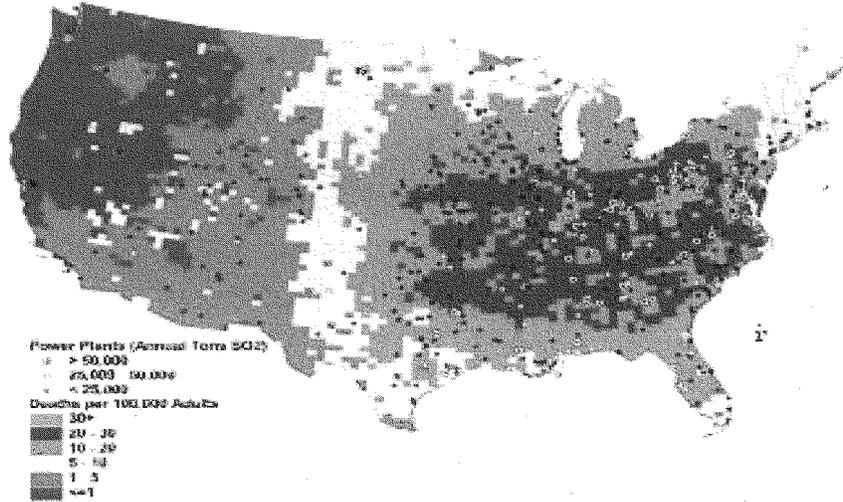
The New York Times

Meanwhile, the immense pollution and carbon dioxide emissions of coal power loom over us like a dark cloud. The health risks of coal pollution have been cited often, but it bears repeating—The cost of coal is felt directly on our health and our healthcare costs. The American Lung Association notes that a 2004 study attributed 24,000 premature deaths each year due to power plant pollution. In addition, the ALA notes that “research estimates over 550,000 asthma attacks, 38,000 heart attacks and 12,000 hospital admissions are caused annually by power plant pollution.”<sup>4</sup> In the last century, more than a 100,000 deaths have been a result of mining, with over 200,000 black lung deaths.<sup>5</sup> This is part of the burden of coal. The typical 500 MW coal plant generates as much CO<sub>2</sub> as 600,000 cars! These effects impact healthcare costs and hence US competitiveness and job creation. The chart below (from the Clean Air Task Force) shows the death rate around current coal power plants.

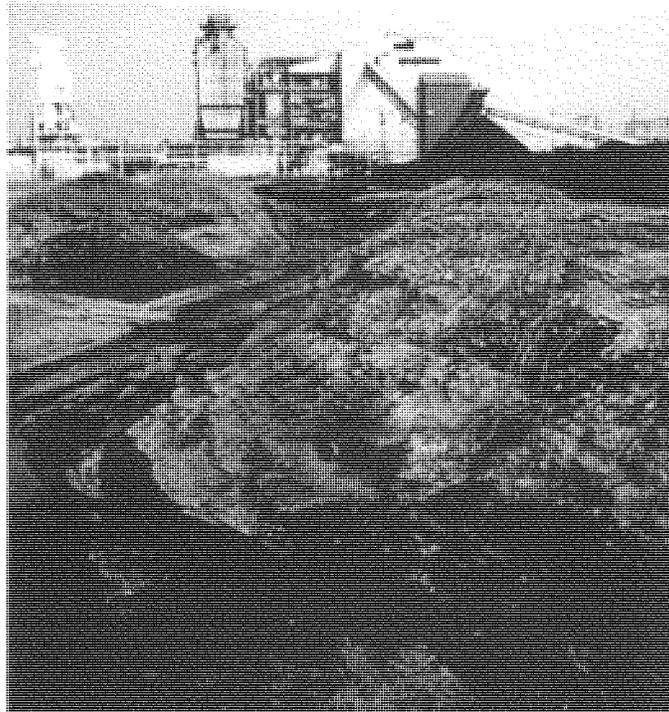
<sup>4</sup><http://lungaction.org/reports/sota06—protecting.html>

<sup>5</sup><http://stateofnature.org/sagoMineDisaster.html>

### Power Plant Deaths Per 100,000 Adults...



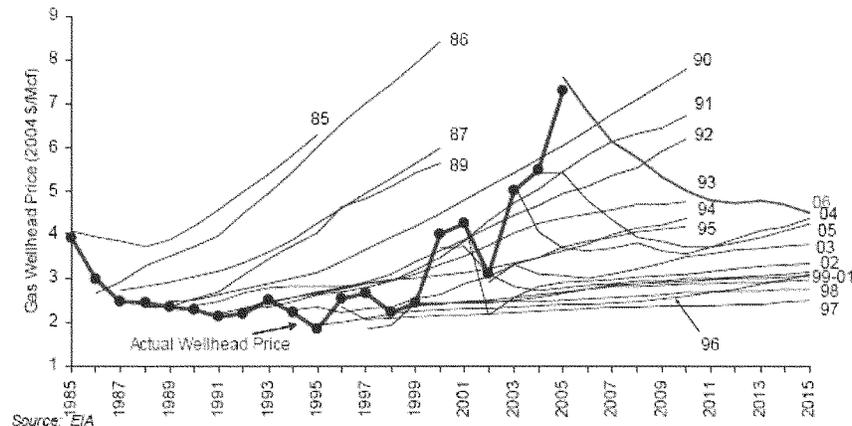
Coal plants produce approximately 130 million tons of toxic solid waste yearly—approximately three times the total municipal garbage in the U.S.<sup>6</sup>



<sup>6</sup>“Big Coal: The Dirt Secret Behind America’s Energy Future”, Jeff Goodell

Most importantly, the risks associated with these older energy technologies and future carbon emission costs has decreased investment and hurt job creation. One does not need to believe in climate change to support climate change legislation. The uncertainty around such legislation is hurting the US economy and jobs creation and many executives would prefer to deal with known legislation even if unwarranted rather than dealing with the uncertainty of unknown future legislation. In the last few years, we have finally started to realize the enormous externalities associated with coal, and public opinion has demanded that action be taken. There is strong consensus that some sort of carbon regulation is just around the corner. A 2004 survey of power company executives suggested that 50 percent of them expect carbon-trading laws in place within the next 5 years. Why? Because the uncertainty is making investment decisions difficult. And the perceived risk of climate legislation is worse than the legislation itself. David Crane, the CEO of NRG Energy noted that “I’ve never seen a phenomenon take over the public consciousness” and that “This is the kind of thing that could stop coal.” Gary Serio of Entergy Corp. notes that “It’s very likely the investment decisions many are making, to build long-lived high-carbon-dioxide-emitting power plants, are decisions we’ll all live to regret.” This investment risk is a significant factor associated with coal—a new coal plant is not a one or 5 year investment, but rather a 50 year one. Many companies are delaying or canceling plans ( see Appendix A for examples) to build new plants due to the cost and the sense of uncertainty of carbon emissions risk—a coal plant built without accounting for carbon costs may well prove to be uneconomic when carbon prices are taken into account. Synapse Energy Economics conducted a study and noted “Any utility proposing to build a coal plant would be reckless to make such a long term investment without fully assessing a variable [carbon pricing] that could easily increase costs by \$86 million per year on average, or \$4.3 billion over a 50-year period, for a 600 MW coal plant [projections for the Big Stone II plant with the mid-range CO<sub>2</sub> price projections of approximately \$20 per ton].”<sup>7</sup> This is a significant reason why 6 of the 10 largest power companies in the US support a carbon cap-and-trade regulation scheme—uncertainty about the costs and environment is not conducive to making large, long-term investments. Delays in investment delay job creation and increase the cost of power to industry, reducing our competitiveness. Climate legislation will on the other hand create real competition for fossil energy.

This investment risk and the cost to consumers and industry “risk” is captured well when we examine what happened to natural gas prices and the investment in gas power plants.



The history of gas prices is a cause for pause—the chart above compares the predicted prices of natural gas in each year to actual prices that were realized on the market. The basic message: 5 years is impossible to predict, let alone fifty! When making a 50-year plant investment, commodity price-variability has to be considered; it does not seem to be accounted for today. Today, many of the gas plants built in the 1990’s are essentially uneconomic, reduced to a role as peaking plants—with

<sup>7</sup>UCS, “Gambling With Coal”, [www.ucsusa.org](http://www.ucsusa.org) and <http://www.State.sd.us/puc/commission/dockets/electric/2005/el05-022/testimonyschhisselsommer.pdf>.

the capital investment essentially a sunk cost. Newer technologies like that from Great Point Energy that I will discuss later ameliorate these effects.

#### PRICE IMPACT ON CONSUMERS & INDUSTRY: COAL VERSUS RENEWABLES

From a consumer and industry cost of energy point of view, we need to create competition for traditional fossil energy sources and to account for external costs associated with them. We need to give them choices. Competition will drive down the costs of all energy but because of the huge subsidies provided to traditional energy industries in the past alternative greener technologies will need legislation to get them going to the point where they can achieve economies of scale. Given there immature technologies and rapidly declining cost curves (while traditional fossil energy costs are rising), we believe these alternatives will be cheaper than traditional energy sources in the future, helping both our industry and our environment, while materially improving our energy and national security.

Fortunately, renewable energy sources across the spectrum offer ways to alleviate much of the risks and costs outlined, providing us energy and fuel at lower costs with significantly reduced environmental impact. The Union of Concern Scientists (UCS) conducted a study on the effects of the implementation of a basic RPS (20 percent of electricity be renewable by 2020). The study noted that such an energy standard would result in the lowering of “business-as-usual” electricity prices by 1.8 percent each year (and natural gas prices at 1.5 percent lower) with a cumulative effect of approximately \$49 billion by 2020.<sup>8</sup> Importantly, these benefits would be felt across the economy, in the commercial, industrial, and residential sectors. Meanwhile, rising coal plants costs (as detailed earlier) have led the firms to ask for higher electricity rates, further burdening consumers and industry. In response to the price rise in its IGCC coal plant, AEP filed testimony in West Virginia requesting a \$108 million rate increase to support the construction!<sup>9</sup>

We are particularly optimistic about concentrated solar power (CSP) technology, and its cost advantages over coal (one of our investments—Ausra, is working in this area). We expect prices to decline to the \$0.07/KWh range (when the first 700MW plant is built<sup>10</sup>), below that of next generation IGCC coal (\$0.08 + carbon pricing, commodity risk), IGCC coal plus carbon capture and sequestration CCS (\$0.10 + commodity risks, cost of sequestration, insurance against leakage liability), and gas-fired CC (\$0.12 + commodity risk). The recently announced PG&E power purchase agreement (for 550MW) to purchase solar thermal power came in at approximately \$0.10/KWh.<sup>11</sup> Environmentally, CSP plants produce no CO<sub>2</sub> emissions (or NO<sub>x</sub>, SO<sub>2</sub>, Mercury, sludge or any of the other coal “externalities”). CSP bears no transportation, supply or commodity price risk—the sun is a viable source of solar energy for a few billion years, slightly longer than coal. Meanwhile, any traditional pulverized coal plant built now is both an environmental menace for 50 years (with increasing emissions as the plants get older), as well as an investment failure once carbon pricing is introduced. I’d also like to question the “conventional wisdom” about solar power across the country. Traditional wisdom holds that solar power is not competitive in the Southeast. However, at Senator Lamar Alexander’s request, we were able to compute the cost of solar power in Tennessee at below \$0.06 KWh (using TVA’s cost of capital).

#### PRICE IMPACT ON CONSUMERS & INDUSTRY: OIL VERSUS RENEWABLES

Elsewhere, oil offers one of the best opportunities toward reducing consumer and industry transportation costs. And it offers America, with its abundant land resources compared to other economies, a competitive advantage. Initially ethanol and other biofuel products will serve as an effective substitute product for oil, helping to give American consumers more options and choice (while oil prices were significant in 2006, demand was partially satisfied by the 5 billion gallons of ethanol consumed domestically—how much higher might gasoline prices have risen if an additional 4 billion gallons of gasoline was required?). Contrary to popular belief it also reduced net Federal subsidies and helped the rural economy too. Discussing corn ethanol, economist John Urbanchuk notes “A 33 percent increase in crude oil prices—which translates into a \$1.00 per gallon increase in the price of conventional

<sup>8</sup><http://www.ucsusa.org/clean-energy/renewable-energy-basics/renewing-americas-economy.html>

<sup>9</sup><http://www.energyonline.com/Industry/News.aspx?NewsID=7158&Costs-Rise-fo>

<sup>10</sup>Dr. David Mills, Ausra

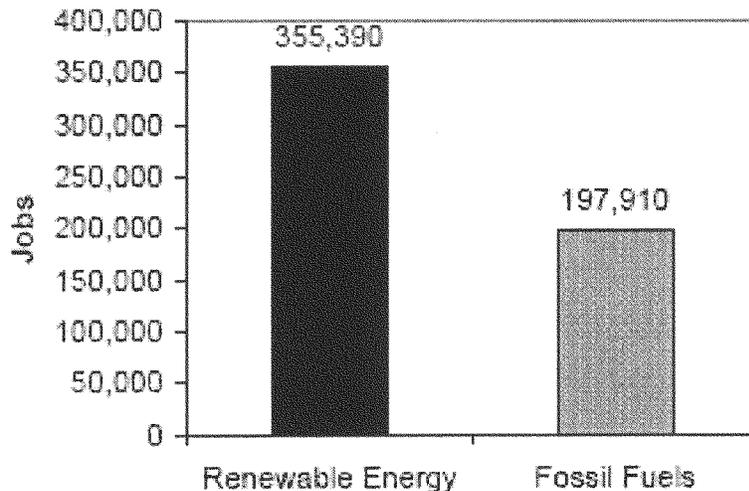
<sup>11</sup><http://www.iht.com/articles/2007/07/25/business/solar.php>

regular gasoline—results in a 0.6 percent to 0.9 percent increase in the CPI for food while an equivalent (33 percent) increase in corn prices (\$1.00 per bushel) would cause the CPI for food to increase only 0.3 percent.<sup>12</sup> (The next time someone suggests a food v. biofuel problem with ethanol, its worth pointing out that food v. oil is the real problem. Incidentally a 16oz steak takes the same amount of corn to produce as a gallon of ethanol.). More importantly, corn ethanol subsidies have actually been a net benefit to the Federal treasury—The USDA's chief economist noted recently that if you look at the Fiscal Year 2006 corn program, the cost was about \$8.5 billion [2005 crop]. Shift forward 1 year to Fiscal Year 2007 costs (2006 crop), direct payments are \$2.1 billion for corn—a net decrease of \$6 billion in corn subsidy costs because of \$3 billion ethanol subsidies. Beyond corn ethanol, the cheaper and more economical future is that of cellulosic ethanol. In fact, Range Fuels (one of our investments) can produce cellulosic ethanol that is cheaper (on a per mile driven basis) than oil and will be in production next year! Furthermore, we believe that \$1 a gallon wholesale cellulosic ethanol (with mpg similar to that of gasoline today) is possible within a decade. Even accounting for the 25 percent less mileage of ethanol as compared to gasoline (in today's gasoline optimized engines), this will provide significant cost savings to consumers and industry across the board, without the commodity risk of big oil.

#### JOB CREATION: COAL VERSUS SOLAR CSP

Many of the old economy jobs are dying slowly The National Mining Association reports that employment in the coal industry (coal miners) is almost half of what it was 25 years ago.<sup>13</sup> From a job creation and economic perspective, renewable energy will be a significant boom. The previously cited UCS study estimated that a 20 percent renewable power standard would create 355,000 new jobs over the period—far more than electric generation from fossil fuels (197,000 is the estimate for the latter). The threshold would spur more than \$72 billion in new capital investment; by 2020, it would likely be providing an additional \$8.2 billion income and \$10.2 billion in GDP for the U.S. economy.<sup>14</sup>

### Renewable Energy vs. Fossil Fuel Jobs, 2020 (20 percent by 2020 RES)



Elsewhere, a study at UC Berkeley (assuming a 20 percent national renewable standard by 2020) concluded that “Investing in renewable energy such as solar, wind and the use of municipal and agricultural waste for fuel would produce more

<sup>12</sup><http://www.ethanolrfa.org/objects/documents/1157/food—price—analysis—urbanchuk.pdf>

<sup>13</sup><http://www.nma.org/pdf/c—trends—mining.pdf—NMA>

<sup>14</sup><http://www.ucsusa.org/clean—energy/renewable—energy—basics/renewing-americas-economy.html>

American jobs than a comparable investment in the fossil fuel energy sources in place today.”<sup>15</sup> California has been one of the leaders in the usage of renewable energy, and benefits are set to flow—estimates suggest that the adoption of AB 32 will reduce CO<sub>2</sub> emissions by 25 percent, while creating 83,000 new jobs and \$4b in income.

In California, Black and Veatch, a traditional power industry engineering firm, conducted an extensive study on the economic benefits of solar CSP plants. They noted that each 100 MW of CSP resulted in 94 permanent operation and maintenance jobs, compared to 56 and 13 for a combined-cycle and simple-cycle turbine (technology used in coal IGCC and PC respectively) plant. It also noted that each 100MW would bring \$628 million in impact to the state’s gross output, compared to just \$64 million for a combined-cycle and \$47 million for a single-cycle turbine plant.

	Base Case Parabolic Trough	Combined Cycle Combustion Turbine	Simple Cycle Combustion Turbine
<b>Construction</b>			
Gross State Output, \$1,000	628,000	64,000	47,000
Earnings, \$1,000	196,000	23,500	17,700
Employment, job-years	3,990	448	327
<b>Operation</b>			
Gross State Output, \$1,000/year	12,800	10,000	2,000
Earnings, \$1,000/year	5,680	2,700	700
Employment, jobs	94	56	13
<b>Operation</b>			
Gross State Output, \$1,000/GWh	36	24	23
Earnings, \$1,000/GWh	16	6	8
Employment, jobs/GWh	0.26	0.16	0.15

Black & Veatch notes that “For each dollar spent on the installation of CSP plants, there is a total impact (direct plus indirect impacts) of about \$1.40 to gross State output for each dollar invested compared to roughly \$0.90 to \$1.00 for each dollar invested in natural gas fueled generation.”<sup>16</sup> Going further, Black and Veatch estimated the impact of low-deployment (2,100MW) and high-deployment (4,000MW) scenarios for CSP in the State. They determined:

“The deployment scenarios would result in about \$7 billion and \$13 billion in investment, respectively, of which an estimated \$2.8 and \$5.4 billion is estimated to be spent in California. This level of in-State investment has a total impact on Gross State Product of nearly \$13 billion for the low deployment scenario and over \$24 billion for the high deployment scenario, not including impacts from ongoing O&M expenditures. This level of investment creates a sizable direct and indirect impact to employment during construction at about 77,000 and 145,000 job-years for the low and high deployment scenarios, respectively. Ongoing operation of the CSP plants built under the deployment scenarios creates a total annual economic impact of \$190 and \$390 million.”

<sup>15</sup><http://www.scienceblog.com/cms/node/2618>

<sup>16</sup>“Economic, Energy, and Environmental Benefits of Concentrating Solar Power in California”, Black and Veatch, April 2006

The study also noted “that the installation of CSP, wind or other non-gas plants in lieu of new natural gas fueled generators can relieve a portion of the demand pressure behind gas price volatility. Lawrence Livermore Laboratory and others suggest that the natural gas price could decline by one to 4 percent for each change of 1 percent in demand. The 4,000 MW high deployment scenario could result in a savings of \$60 million per year for natural gas in California for a 1 percent price reduction for a 1 percent usage reduction. At the higher price impact range, the California savings could be four times greater.” On top of all the economic benefits, CSP would also be significantly more environmentally friendly than coal—with almost no carbon footprint. The job creation data has been validated by the actual plant construction plans and jobs estimates of one of our investments, Ausra.

#### JOB CREATION: OIL VERSUS BIOFUELS

The previously cited UC Berkeley study noted that a biomass-centric approach would be a substantial boon to the US economy. Professor Daniel Kammen stated that “Renewable energy is not only good for our economic security and the environment, it creates new jobs . . . At a time when rising gas prices have raised our annual gas bill to \$240 billion [2003–2004 oil prices], investing in new clean energy technologies would both reduce our trade deficit and reestablish the U.S. as a leader in energy technology, the largest global industry today.”<sup>17</sup> Today, an \$80 barrel of oil provides limited value-added here in the US. By importing oil and refining the fuel domestically, we capture perhaps \$5 or so of “value add” on top of the \$80 of value of the import. With corn ethanol and cellulosic ethanol, and other advanced biofuels offer us an opportunity to do far more—instead of capturing \$5 of \$85 in value, we can capture all of it within the country! America’s availability of land, technology, and know-how gives us a significant competitive advantage. Imagine the scenario—cellulosic ethanol technology developed in Denver, utilizing available land and forest waste in Oklahoma, Georgia, Montana, Idaho, and Washington, and delivering cheap \$1 cellulosic ethanol across the country! This isn’t some pipe dream—rather, something we expect as reality within the next couple of years! Can we imagine the impact of spending the \$320 billion (that we currently spend on oil imports) fueling agriculture in rural America, and reducing the trade deficit domestically?

Beyond the general examples cited here, we see specific examples of how action to combat climate change can help. Range Fuels (one of our investments), is soon to break ground on the first commercial-scale cellulosic ethanol plant in Soperton, Georgia, using wood waste that lies uncollected in Georgia’s forests. The first plant will create 70 jobs for the area, with subsequent plants to follow. A University of Georgia analysis notes that “the ethanol plant would be worth \$110 million per year to the county, including nearly \$500,000 of tax revenue. . . . Range Fuels also expects to hire up to 80 full-time employees at wages much higher than the regional average.”<sup>18</sup> Moreover, as paper mills have shut down across the country, both Range Fuels and Mascoma (as well as other cellulosic ethanol approaches) offer an opportunity to help replace their impact and utilize their feedstock. Imagine a thousand such plants spread across a thousand counties across America.

#### IMPACT ON RURAL AMERICA

While we have made the case that renewable energy will be good for America, it’s worth emphasizing that it will offer significant benefits to rural America in particular. The UCS study estimated that an extra 30,000 jobs would be created in agriculture alone, and that the 20 percent RPS would generate approximately \$16.2 billion in income to farmers, ranchers, and rural landowners. Elsewhere, a 2004 NRDC study estimates producing the biomass feedstock necessary for biofuels could generate more than \$5 billion a year in income for farmers (by 2025)<sup>19</sup>. While some will ignore studies from environmental organizations as biased, it is hard to overcome the logic of replacing all \$80 of the value of imported oil by products produced in America. This makes economic sense, especially since it also creates competition for oil. Biomass and agricultural based energy could permanently correct the rural/urban economic development imbalance that has developed over the last 50 years. It could shift much of the oil portion of our GDP to rural GDP and create millions of new jobs.

<sup>17</sup><http://www.berkeley.edu/news/media/releases/2004/04/13—kamm.shtml>

<sup>18</sup><http://www.agobservatory.org/headlines.cfm?refID=99779>

<sup>19</sup><http://www.nrdc.org/air/energy/biofuels/biofuels.pdf>

## RISKS OF COAL, OIL AND THE STATUS QUO

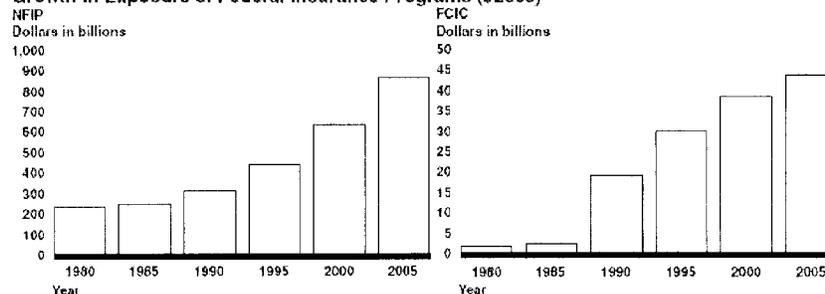
While the economic case for action is significant, it's worth reiterating the risks inherent in our current status quo. From an investment perspective, the current climate finds businesses in a holding pattern, unwilling to fully commit resources because of what may happen next—carbon pricing and a fuller appreciation of the externalities of our current energy sources has the potential to blow the old investment models out of the water. What sane CEO would bet that no climate change legislation will be enacted in the next fifty years, the typical life of their investments? We must remove this unnecessary risk for our businesses. The devil we know is better than the one we don't when it comes to climate change legislation.

As we've detailed with coal and natural gas plants, an investment is not simply a one or 5 year gamble—it's a fifty year belief that prices and the economic climate will continue to allow the plant to be an economical source of power. Can you imagine the economic impact of \$100 billion coal plants that are no longer economic (in a carbon-constrained world), their capital written-off almost completely? This sense of investment risk is present with oil as well—despite claims that the oil industry is doing all it can to lower prices, no new refinery has been built for 30 years. Lynn Westfall, the chief economist of Tesoro (an oil refinery owner) notes that “if you were to ask us to go build a brand new refinery anywhere in the world, I would tell you you'd be lucky to have it up and running in six or 7 years,” Westfall says. “And then you'd need 10 to 15 years of today's margins to pay it back. So building a new refinery is a 20-year bet that margins are going to remain very high.”<sup>20</sup> These are the kind of gambles that we can no longer afford to continue taking.

There are real costs to climate change and they are becoming very visible. The effect of previous (and current) fossil fuel usage on our climate can be perceived in economic costs as well as environmental ones. A GAO report notes that “Using computer-based catastrophe models, many major private insurers are incorporating some near-term elements of climate change into their risk management practices. One consequence is that, as these insurers seek to limit their own catastrophic risk exposure, they are transferring some of it to policyholders and to the public sector.”<sup>21</sup> It goes on to point that insurers (public and private) have paid \$320 billion in weather-related claims since 1980, and as a result, private insurers are factoring in climate change into their weather models and accounting for it—in a way public insurers haven't. As the report notes:

“Major private and Federal insurers are both exposed to the effects of climate change over coming decades, but are responding differently. Many large private insurers are incorporating climate change into their annual risk management practices, and some are addressing it strategically by assessing its potential long-term industry-wide impacts. The two major Federal insurance programs, however, have done little to develop comparable information. GAO acknowledges that the Federal insurance programs are not profit-oriented, like private insurers. Nonetheless, a strategic analysis of the potential implications of climate change for the major Federal insurance programs would help the Congress manage an emerging high-risk area with significant implications for the Nation's growing fiscal imbalance.”

**Growth In Exposure of Federal Insurance Programs (\$2005)**



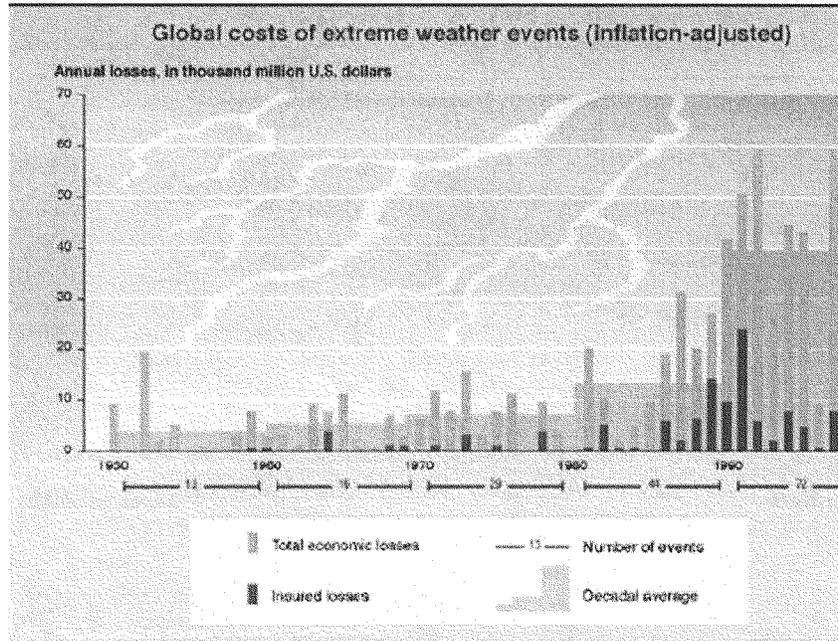
Source: GAO.

Without significant action on the climate change problem (by reducing our usage to fossil fuels), the public taxpayer could be stuck with the bills of willful ignorance.

<sup>20</sup><http://www.npr.org/templates/story/story.php?storyId=10554471>

<sup>21</sup><http://www.gao.gov/new.items/d07285.pdf>

When a very conservative magazine like the Economist documents through a skeptic's lens the actual cost, insured and uninsured, of extreme weather related events, we must take note and consider this an economic not an environmental "nice to have" phenomenon.



Recently, an Economist editor admitted to me that 2 years ago you could not convince him to do anything about climate change on an economic basis. Today, he went on to say, they can document the real costs and risks of this potentially catastrophic problem as the chart above shows. He is now a believer that we should be addressing climate change as an economic phenomenon. When even those who would ignore the environmental aspects perceive renewable energy as a winning alternative, isn't it about time that we start listening?

Despite our apprehension about most coal plants, we do believe coal is a valuable economic resource and we should use it: given the scale of U.S. coal reserves, utilizing them does seem like a prudent approach if the externalities are not overwhelming. One such approach is converting the coal to an environmentally friendlier fuel, such as natural gas (GreatPoint Energy—one of our investments, is working on such an approach). The advantages include cleaner fuel's and cheaper transportation using the existing pipeline network as well as higher reliability (as compared to expected reliability of IGCC coal plants). Moreover, the overall cost of production is expected to be less than \$4.00/MMBtu, far below today's natural gas prices of \$7—8 /MMBtu. At this cost, GreatPoint Energy's gasification technology represents one of the lowest cost incremental sources of natural gas in North America—lower than new exploration and production, LNG imports, and other means of producing natural gas from carbon feedstocks through conventional gasification. Just as hybrid technology increases automobile efficiency and effectively reduces carbon emissions by roughly 20 percent, the GreatPoint technology reduces CO<sub>2</sub> emissions by over 20 percent from coal use versus conventional coal technology. Add carbon sequestration to this process and carbon emission from coal based power plants can be reduced by more than 40 percent while keeping coal as a fuel source! The net effect is one of replacing \$7 MMBtu natural gas with a cheaper alternative, while using less energy (and less need for imported LNG), and reduced carbon emissions—all while utilizing a resource, coal, that we have plenty of. No less a coal supporter than Senator Dorgan has told me he is a supporter of such approaches.

ENERGY & THE ROLE OF THE “INNOVATION ECOSYSTEM” AS A  
DISRUPTER

Massive change in our energy industries is possible. For those of you who don't believe this is possible, there are many precedents for massive change. In 1982 when I started Sun Microsystems, I was told that one could not compete against IBM, Digital Equipment Corporation, Data General, Burroughs, Control Data and other stalwarts of the computer business. Most of them are now gone and a few have adjusted, humbled by the seemingly “toyish” microprocessor. In 1996 I got in a room with the CEO's of nine major US media companies, including the Washington Post, New York Times, Knight-Ridder, Tribune, Cox, Times-Mirror and others and tried to explain how the internet would disrupt their business models, and little companies like Yahoo, Ebay, Google and others would be a threat. Today Google is worth as much as all of them combined. The pharmaceutical companies went through a similar experience, ignoring biotechnology in the early days. Ten years ago every major telecommunications company told me that they would never adopt the internet IP protocol as their core network just as we were starting a telecommunications equipment company called Juniper to produce IP equipment. Major “experts” like AT&T laughed at the idea that all long distance calls would be virtually free to consumers. Today, for failing to heed that trend, major players like AT&T are mere brands, their company sold for a song. In each of these cases less than 10 years later, yesterday's “unthinkable fact” is today's “conventional wisdom”. I expect to see the same in the energy business, with biofuels cheaper than oil, with more environmentally sound power generation technologies cheaper than coal based power generation, and increases in efficiency reducing the cost of power and offering our country an economic advantage.

The country that gets to this new future first will have a significant advantage globally. Tens of new Google's and Yahoo's and Microsoft's will be created in the next two or three decades. The country to develop these technologies and companies first will have a large share of these new economic sectors. America can be that country given our large markets, our competitive advantage in innovation and technology industries, and our university and R&D system. Trillions of dollars of new market value are at stake and we are well positioned to capture this value and its associated jobs and economic growth. And we can make the whole world a better place in the process.

CONCLUSION

I believe that climate change will provide an opportunity for America to shine even further by leveraging the “innovation ecosystem”, our biggest economic advantage in the world economy. We can get a huge competitive advantage from our Universities and R&D ecosystem, something traditional providers of energy don't have. Investments in the clean tech sector have risen fourfold in the past 5 years, and rose 78 percent in 2006 to \$2.9 billion—and are projected to grow to about \$10 billion by the end of this decade (creating 500,000 new jobs)<sup>22</sup>. The smartest people, companies, and capital are recognizing the scale of the opportunity, are recognizing the sheer size and potential present in finding new energy solutions. All of the entrepreneurs present today will not succeed, but will all of the efforts fail? As Paul Romer puts it, new technologies will help demolish the old specter of diminishing returns, which led economic thinkers such as Ricardo and Keynes to suppose that growth had its limits. Instead, these new technologies create increasing returns, because new knowledge, which begets new products, is generated through research.<sup>23</sup> The combination of brilliant ideas and entrepreneurial spirit should lead us to a safer and more secure future. The power of ideas fueled by entrepreneurial energy is our future. Climate change legislation can help us get there faster and first—ensuring American dominance in the foreseeable future.

COAL'S UNPOPULARITY: A RISING TREND

The following is a report highlighting trends in coal power plant construction. Detailed are instances in states where key decisions by regulators, public officials or utilities themselves have led to coal plant construction being postponed or canceled all together. In addition, the renewable portfolio standards set by each of the 20 states that have passed them are detailed as well. Finally, maps illustrating the po-

<sup>22</sup><http://www.americanventuremagazine.com/articles/742>

<sup>23</sup><http://www.versaggi.net/ecommerce/articles/romer-econideas.htm>

tential for solar, geothermal and wind energy in Nevada are included. Below are specific examples as to why, nationwide, a growing trend against coal power plant construction may be occurring.

**Most Newly Proposed Coal Power Plants Are Never Built.** According to the Department of Energy, proposals to build new power plants are often speculative and typically operate on “boom & bust” cycles, based upon the ever changing economic climate of power generation markets. As such, many of the proposed plants will not likely be built. For example, out of a total portfolio (gas, coal, etc) of 500 GW of newly planned power plant capacity announced in 2001, 91 GW have been already been scrapped or delayed. [Tracking New Coal-Fired Power Plants: Department of Energy, 5/1/07].

**Since 2006 Nearly Two Dozen Coal Projects Have Been Canceled.** According to the National Energy Technology Laboratory, a division of the Department of Energy, nearly two dozen coal projects have been canceled since early 2006. [Tracking New Coal-Fired Power Plants: Department of Energy, 5/1/07].

**The Cost of Raw Materials Needed to Build Coal-Fired Plants Has Risen.** One industry study showed that the cost of raw construction materials such as cement and steel is far higher than thought just 2 years ago. [Spokesman-Review, 9/5/07].

#### COAL PROJECTS SCALED BACK: STATE SPECIFIC EXAMPLES

Below are highlights from states across the country where regulators or utilities themselves have taken the lead in curbing the new coal plant construction. In each instance, the decisions made were done with an eye toward concerns over public health and climate change. While the list below is not exhaustive, it provides insight into the recent decisions the could be implemented elsewhere.

#### *Colorado: Colorado’s Xcel Energy Agreed to Supplement its Coal Power Generated Electricity With Wind*

Power. Even in states where coal projects are going forward, they are happening more often with a nod to environmental concerns. Xcel Energy, through its Public Service of Colorado unit, agreed to obtain 775 megawatts worth of wind power to supplement the power that will come from a 750 megawatt coal plant it is building near Pueblo. It also has agreed to install more pollution controls at existing units, and to cut energy demand by more than 300 megawatts in coming years. “It will change their portfolio in a fundamental way,” says Vickie Patton, senior attorney for Environmental Defense in Colorado. [Wall Street Journal, 7/25/07].

#### *Florida: Florida Governor Charlie Crist Celebrated the Cancellation of a Key Coal Plant Project.*

Florida Governor Charlie Crist backed up the symbolism of his meeting on global climate change in Miami with a stern rebuke to the future of coal-powered energy plants in the State. After Florida’s Public Service Commission turned down an application for a coal plant in Glades County, Crist said the future of coal plants in the State is “not looking good.” Crist said followed with “We’re moving in a different direction.” [Sarasota Herald-Tribune, 7/4/07].

**Florida Governor Charlie Crist Said Utilities Must Stop Relying on Coal and Natural Gas Plants.** After the Public Service Commission denied Florida Power and Light Co.’s request to build a coal-fired plant in Glades County, Governor Charlie Crist hailed the decision and said that utilities must stop relying on coal and natural gas plants that generate carbon dioxide, a probable cause of global warming. [Palm Beach Post, 7/4/07].

#### *Kansas: Because of Colorado’s Newly Enacted Renewable Energy Mandate, a Two Utility Companies Have Canceled a Coal Plant Project.*

One of the most ambitious proposals for new coal power plants in 2006 was to construct three units with a total generating capacity of 2,100 megawatts in western Kansas. The two cooperatives involved, Tri-State in Colorado and Sunflower Electric Power in Kansas, have scaled down the project to two units. One reason was that Colorado adopted a law requiring rural electric co-ops to get 10 percent of their power from renewable resources. [Washington Post, 9/4/07].

*North Carolina: Due to Rising Costs Duke Energy Was Forced By the NC Utilities Commission to Cancel a Coal Plant Project.*

Duke Energy Inc. created a stir last year when it announced that the expected cost of a new twin-unit power plant in North Carolina had ballooned to about \$3 billion, up 50 percent from about 18 months earlier. That run up in cost and other factors compelled the North Carolina Utilities Commission to nix one of the two proposed units. According to a recent press report, the plant that was approved is expected to cost more than \$1.8 billion. [Wall Street Journal, 7/25/07; Baltimore Sun, 9/4/07].

*Oklahoma: Oklahoma Corporation Commission Rejected Application For Coal-Fired Plant, Opponents Argue Their Decision Will Save Rate Payers Money.*

The Oklahoma Corporation Commission rejected a request from the state's three largest public utilities to proceed with plans to build a coal-fired power plant. The commission turned down the proposal by Oklahoma Gas & Electric, American Electric-Power Service Company of Oklahoma and the Oklahoma Municipal Power Authority. The \$1.8 billion dollar plant would have been built in Red Rock in Noble County, about 80 miles north of Oklahoma City. Chesapeake Energy Corp. was one of the most ardent campaigners against the coal plant. Aubrey McClendon, the company's chairman and chief executive officer, said the decision will save consumers money in the long run. "This is a win for Oklahoma ratepayers," McClendon said. "Coal is cheap today, but we believe it won't always be cheap. It's only logical that there will be a day when something that's as detrimental to the environment and to public health is priced in a different way. Coal has done wonderful things for our national economy in the 19th and 20th centuries, but this is the 11th century. Oklahoma needs to show leadership here. It is a great first step from these courageous Oklahoma Corporation commissioners to say no to what we think was an ill-conceived idea for the 11th century." Oklahoma Treasurer Scott Meacham also came out publicly against the proposal, saying he was concerned with the plant's potential impact on global warming. [Daily Oklahoman, 9/11/07].

*Texas: In Order to Be Bought Out By Private Investors, Texas Utility Corporation Was Forced to Cancel Eight Coal Plant Projects.*

TXU Corp, the Texas energy giant, was faced with attacks from environmentalists after it proposed building 11 new coal plants in the State. The resulting legal skirmishes and investor concerns about the high cost of the plants sent its share price plummeting. As a result, a weakened TXU agreed in February to reduce the number of coal plants it planned to build from 11 to three as part of a deal to sell itself to two large private equity firms for \$45 billion. [Baltimore Sun, 9/4/07].

*Washington: One Western Utility Took it Upon Itself to Shift From Coal to Renewable Energy Sources.*

Avista Utilities planned to sell more electricity generated by natural gas plants and giant windmills rather than investing in new coal power plants, according to a long-term power plan released by the company. Clint Kalich, the company's resource planning manager, said he agrees with the assessment of Puget Sound Energy that the future of Northwest energy will be more "gassy, windy." Washington utilities submit 20-year power plans every other year to State regulators. The studies predict population and business growth and future energy needs. While the Northwest has long relied on river dams for generating ample megawatts, the future lies in underground gas stores and the wind. In a change from power planning in 2005, Avista this time around is ruling out new megawatts from coal plants. The company has also determined that building and partnering in a nuclear power plant is too expensive and too unpredictable. [Spokesman-Review, 9/5/07].

---

RESPONSE BY VINOD KHOSLA TO AN ADDITIONAL QUESTION FROM SENATOR BOXER

*Question.* (Senator Boxer): Can you elaborate on how the development of cellulosic ethanol will lead to the creation of new jobs, greener emissions, and energy independence?

Response. From an environmental perspective, the benefits of cellulosic ethanol are fairly indisputable: most projections suggest that it can reduce greenhouse gas emissions per mile driven by 60–80 percent over gasoline, thus making a substantial impact on total GHG emissions. The NRDC has projected that with certain choices, we could theoretically achieve negative GHG emissions per mile driven, setting up a scenario where driving more (and by extension, the demand for excess fuel it generates) could actually help the reduce carbon emissions! Growing feedstock for cellulosic ethanol offers other, ancillary benefits as well—miscanthus (and other would be grass cocktails) use significantly less water and almost no fertilizer (after the growing season it sends its nutrients back to the root system (stored in rhizomes for the winter) which is not harvested), almost no tillage, richer soil because it actually fixes carbon into the soil (hence the negative carbon per mile driven in the NRDC estimate), and much greater biodiversity.

From a jobs and economic perspective, I'd like to highlight the examples I noted in my written testimony. A UC Berkeley study (directed by Professor Daniel Kammen, who also testified) noted that a biomass-centric approach would be a substantial boon to the US economy. Professor Kammen stated that "Renewable energy is not only good for our economic security and the environment, it creates new jobs . . . . At a time when rising gas prices have raised our annual gas bill to \$240 billion [2003–2004 oil prices—about 50 percent higher today], investing in new clean energy technologies would both reduce our trade deficit and reestablish the U. S. as a leader in energy technology, the largest global industry today." In Brazil, studies cited by the Ministry of Agriculture have shown the sheer economic impact of ethanol vs. gasoline—the ethanol production process (car and fuel) has led to 21.87 jobs for each job produced by gasoline!

The NRDC (in a 2004 study) noted that to displace 7.9 million barrels of oil daily by 2050, we would need to utilize approximately 1.3 billion tons of biomass. A University of Tennessee study model predicted that with a switchgrass price of \$40 per ton, total farmer net income would increase \$12.1 billion—or 32 percent more than a USDA baseline estimate (based on their price forecasts). The net returns for farmers would increase more than \$5.1 billion per year. Importantly, this benefit would not be confined to the Midwest—virtually every part of the country would benefit at some level. The DOE's Office of Science notes that "Conservative projections suggest that 10,000 to 20,000 jobs could be created for every billion gallons of biofuel produced." Elsewhere, Professor Bruce Dale (a cellulosic expert writing at the Aspen Institute, a non-partisan think tank) noted

"Assuming that each plant spends about \$165 million annually for biomass feedstock and that this raw material total represents 70 percent of total plant spending for all supplies and labor, then each plant will spend roughly \$240 million per year for operations, or about \$70 billion annually among all three hundred plants at the end of the 20 year transition period. Once again using data for corn dry mills, the local economic base surrounding these biorefineries would expand by about \$140 billion per year and household income would expand by \$25 billion annually, mostly in rural areas. The projected impact is very large, and would probably result in over 50 percent increase in total economic activity in affected areas. Assuming that each \$200,000 in plant sales would support one new direct job in the agricultural and biorefining sectors, and an ethanol selling price of \$1.00 per gallon, then a half million new direct jobs would be created, with a significant multiplier for indirect service and supporting jobs? These numbers, although imprecise, are not at all unreasonable. Currently the U. S. fuels and chemicals industry employs about 900,000 people, many of them in commodity organic chemicals and fuels with total sales on the order of \$1 trillion annually. As domestic oil and natural gas supplies have become more costly and scarcer, the fuels and chemicals industry is increasingly attracted to overseas locations where oil and natural gas are cheaper and supplies assured. As a result both domestic employment and economic activity suffer."

Beyond the general examples cited here, we see specific examples of how action to combat climate change can help. Range Fuels (one of our investments), is soon to break ground on the first commercial-scale cellulosic ethanol plant in Soperton, Georgia, using wood waste that lies uncollected in Georgia's forests. The first plant will create 70 jobs for the area, with subsequent plants to follow. A University of Georgia analysis notes that "the ethanol plant would be worth \$110 million per year to the county, including nearly \$500,000 of tax revenue? Range Fuels also expects to hire up to 80 full-time employees at wages much higher than the regional average."<sup>1</sup> Moreover, as paper mills have shut down across the country, both Range Fuels and Mascoma (as well as other cellulosic ethanol approaches) offer an oppor-

<sup>1</sup><http://www.agobservatory.org/headlines.cfm?refID=99779>

tunity to help replace their impact and utilize their feedstock. Imagine the potential when this model is replicated across the US!

Third, cellulosic ethanol offers a way toward energy independence. Can we imagine the impact of spending the \$320 billion (that we currently spend on oil imports) fueling agriculture in rural America, and reducing the trade deficit domestically? Instead of funding the Middle East (including Al Queda's backers), we invest in American farmers; instead of being held ransom by OPEC, we control our own supply. The DOE projects that by 2025, more than 70 percent of our consumption of petroleum will be imported, leaving the country susceptible to significant price and supply shocks. Petroleum accounted for approximately 35 percent of the US trade deficit in 2006, and projections have suggested that the proportion could rise as high as 70 percent over the next 10–20 years. Today, an \$80 barrel of oil provides limited value-added here in the US. By importing oil and refining the fuel domestically, we capture perhaps \$5 or so of "value add" on top of the \$80 of value of the import. Cellulosic ethanol and other advanced biofuels offer us an opportunity to do far more—instead of capturing \$5 of \$85 in value, we can capture all of it within the country! America's availability of land, technology, and know-how gives us a significant competitive advantage. Imagine the scenario—cellulosic ethanol technology developed in Denver, utilizing available land and forest waste in Oklahoma, Georgia, Montana, Idaho, and Washington, and delivering cheap \$1 cellulosic ethanol across the country! This isn't some pipe dream—rather, something we expect as reality within the next few years. Our projections show that by 2030, we can meet a significant majority of our gasoline demand (assuming a 1 percent demand growth rate—accounting for very conservative increases in CAFE and more efficient engines) through ethanol (primarily cellulosic).

Senator BOXER. Thank you so much, Bernard.

Senator SANDERS.

[Presiding.] OK.

Jerome Ringo is the President of the Apollo Alliance. Jerome, thanks a lot for being here.

**STATEMENT OF JEROME RINGO, PRESIDENT,  
APOLLO ALLIANCE**

Mr. RINGO. Thank you very much. Senator Sanders, Chairwoman Boxer, and Ranking Member Inhofe, thank you for inviting me here today.

As the president of an alliance of labor, business, environmental and urban interests working to catalyze a clean energy revolution in America, I am pleased to offer today these thoughts on meeting challenges of global climate change and creating millions of good green collar jobs.

Although we have not yet endorsed any specific climate change proposals, the Apollo Alliance understands the need to cap global warming pollution and decisively launch our Nation on the path to a cleaner energy future. A long-term national commitment to capping and reducing carbon emissions will send an essential market signal and drive investment into a whole new generation of cleaner energy technologies and services.

But capping carbon emissions alone will not position our Country to lead the world into the clean energy future, with all of the new businesses, products, jobs and exports applied therein. To do that, we must explicitly recognize the climate change challenge for the economic opportunity that it is, the opportunity to transform our Country into the cleanest, most energy efficient, most productive Nation on earth and the world's undisputed leader in clean technology.

That is where you come in. Our Country is respected the world over for the remarkable way we bring public and private sector resources to bear to solve scientific and technological challenges. We

have done that in medicine. We have done that in space. And now it is time to do the same in the field of clean energy.

Fortunately, there are strategies for capping and reducing carbon emissions which if properly designed would produce as much as \$100 billion per year in funding that could and should be reinvested to spur a clean energy revolution in America. Four years ago, we estimated that the public investment of \$30 billion per year over 10 years could generate three million new jobs, new clean energy jobs. A carefully targeted investment strategy funded with the value created from carbon credits could generate many more new jobs than our original estimate.

However, only a very disciplined approach to these investments would produce a good return for the American public in terms of jobs, economic opportunity, national security and reduced climate risk. I would like to suggest seven investment priorities.

First, Congress should fully fund American clean energy research and development programs, the first stage in the technology development cycle. Without adequate research and development, we might fall behind in such pivotal technologies as power storage from intermittent renewable energy technologies.

At the same time, Congress should take steps to ensure that public support translates into opportunities to manufacture and commercialize these products in America first. Solar PVs were invented in America with public dollars, but have been largely commercialized and marketed abroad. This is a mistake we cannot afford to repeat.

Second, the Federal Government should support early commercialization of the most promising and strategically important clean energy and energy efficiency technologies to emerge from our laboratories. New technologies that show promise on an experimental scale sometimes fail to attract sufficient private capital for the first full scale commercial prototypes because of the perception of higher risks. For instance, demonstration at commercial scale of advanced coal technologies with carbon capture and storage will essentially be attracting the private capital necessary for mass deployment.

Third, Congress needs to provide market certainty and predictability to renewable energy producers.

Fourth, Congress should develop policies to encourage the manufacture of clean energy components in the United States.

Fifth, Congress should use proceeds from the auction of carbon credits to catalyze a massive public and private initiative to retrofit American buildings, save energy, and dramatically cut domestic energy costs.

Again, also the carbon cap policy Congress adopts must level the playing field for American industry so the costs of compliance here in America also applies to importers with no comparable carbon restrictions of their own.

And the seventh is that Congress needs to support education and training initiatives to prepare America for a new generation of green collar jobs.

In conclusion, from Iraq to New Orleans, from the fuel pump to the melting ice sheets of the Arctic, the tragic consequences of our Nation's excessive dependence on fossil fuel are driven home to us every day. This is not a dependency that we can afford to ignore.

To do so would be a form of national betrayal, a betrayal for those who have already suffered so much, both at home and abroad, and a betrayal of our children and grandchildren whose future is quite literally in our hands.

Our Country is respected the world over for our technology prowess, our entrepreneurial energy, and our willingness to rise to global challenges. This is our moment to shine. Let's lead the world into a clean energy future with good jobs across America.

Thank you, Senator Sanders.

[The prepared statement of Mr. Ringo follows:]

STATEMENT OF JEROME RINGO, PRESIDENT, APOLLO ALLIANCE

Thank you for inviting me to testify today. As the President of the Apollo Alliance, an alliance of labor, business, environmental and urban interests working to catalyze a clean energy revolution in America, I'm pleased to offer these thoughts on meeting the challenge of global climate change and creating millions of good "green collar" jobs for men and women across our great nation.

Although we have yet to endorsed any of the specific climate change proposals currently moving through Congress, the Apollo Alliance understands and supports the need to cap global warming pollution and decisively launch our nation on the path to a cleaner energy future. A long term national commitment to capping and reducing carbon emissions will send an essential market signal to investors and decisionmakers, and drive investment into a whole new generation of cleaner energy technologies and services, here in America and worldwide. But capping and reducing carbon emissions ? alone ? will not position our country to lead the world into the clean energy future, with all of the new businesses, products, jobs and exports implied therein. To do that, we must explicitly recognize the climate change challenge for the economic opportunity that it is: the opportunity to transform our country into the cleanest, most energy efficient, most productive nation of Earth, and the world's undisputed leader in clean tech.

And that is where you come in. Our country is respected the world-over for the remarkable way we bring public and private resources to bear to solve scientific and technological challenges. We've done that in medicine, we've done that in space, and now it is time to do the same in the field of clean energy. Fortunately, there are strategies for capping and reducing carbon emissions which, if properly designed, will produce as much as \$100 billion per annum (from the auction of carbon emissions allowances)<sup>1</sup>, funds that can and should be reinvested to spur the clean energy revolution in America. If we channel the value of these credits to smart investments in clean power technologies, the revitalization of an advanced, fuel-efficient transportation sector, high-performance, energy-efficient buildings, and new education and training opportunities for green collar workers, our climate policy will create millions of good, new American jobs and foster the growth of a new generation of clean energy enterprises in America, while simultaneously reducing the risk of catastrophic global warming and enhancing our national security.

Four years ago, we issued an analysis of the job creation impacts of our clean energy investment agenda. The analysis showed that a public investment of \$30 billion per year over 10 years could generate 3 million good, new clean energy jobs.<sup>2</sup> While we have yet to assess the job creation potential of a larger, more comprehensive clean energy investment strategy, it is clear that a carefully targeted strategy could generate many more new jobs than our original estimate. The logic is straightforward:

First, while job growth in traditional fossil fuel powered-generation and fuels may level off over time with carbon caps, hundreds of thousands of additional jobs will be created in the clean energy technology sector, including renewables, clean coal, and bio-fuels.

Second, transitioning our power infrastructure to cleaner sources will stimulate significant growth in the construction industry. For instance, building an Integrated Gasification Combined Cycle (IGCC) plant with carbon capture and storage (CCS) creates a vast range of jobs for laborers, sheet metal workers, pipe fitters, equipment operators, engineers, project mangers, and others.

<sup>1</sup>Darren Samuelsohn, "Big Bucks at Stake in Cap-and-Trade Allocations," Greenwire, July 17, 2007.

<sup>2</sup>The Perryman Group, "New Energy for America ? The Apollo Alliance Jobs Report: For Good Jobs & Energy Independence," the Apollo Alliance, January 2004.

Third, done right, moving to a clean energy future could create a whole new generation of manufacturing jobs for clean energy parts and components, from advanced technology vehicles and drive trains, to wind towers, solar panels, steel pipes for geothermal plants and CCS, and stainless steel boilers for ethanol refineries. As data from the Renewable Energy Policy Project indicate, if we adopted a national strategy that resulted in 185,000 installed megawatts of renewable energy generation (about 20 percent of our current installed capacity), and if we ensured that component supply was anchored in the United States, renewable energy manufacturing alone could benefit 33,000 manufacturing firms and create 678,000 jobs in just 20 states (see attachment A), including Southeastern and Midwestern states hard hit with manufacturing job loss.

Fourth, jobs in clean energy and in energy efficiency tend to be domestic jobs. By replacing oil imports with domestic bio-fuels, and by moving to a new generation of hybrid-electric, advanced diesel, and other advanced-technology vehicles that use domestic fuel sources, we can keep our petrodollars at home supporting domestic jobs. In addition, if we fully exploit the huge untapped potential for energy efficiency retrofits of our nation's buildings, we will create jobs that, by their nature, must be done here. With the emerging slump in the nation's housing market, there is probably no smarter way to keep our trades people and contractors fully employed than through massive incentives for energy efficient building renovations.

In sum, extrapolating from our earlier estimates, we are confident that a carbon cap and reductions policy linked to a robust clean energy investment agenda will create substantially more than 3 million good, new jobs.

#### Priorities for Catalyzing a Clean Energy Revolution in America

While the prospect of making a \$100 billion public investment in our clean energy future is promising, only a very disciplined approach to these investments will produce a good return for the American public. In the balance of my testimony, I'd like to suggest seven priorities to guide our nation's clean energy investment strategy, priorities that will provide a fourfold return to the American public by simultaneously cutting greenhouse gas emissions, enhancing national security, expanding our economic competitiveness, and creating good jobs for men and women across America.

First, Congress should fully fund America's clean energy research & development programs, the first stage in the technology development cycle. Public funding for research and development, channeled through our nation's vast network of universities and research institutions, has been responsible for many of the most important technological and scientific breakthroughs we've made as a society. Today as we gear up to meet this critical energy challenge, a challenge of immense proportions both in its scope and its complexity, it is time to give our very best scientists and technologists the resources they need to make the next generation of important discoveries in the clean energy field. Without adequate public dollars flowing to R & D, for instance, we may fall behind in such pivotal technologies as power storage from intermittent renewable energy technology. Furthermore, to the extent that American ingenuity and public investment produce promising new energy technologies, we should not lose the opportunity to manufacture and commercialize these products in America first, much as our competitors now do, and export them to the rest of the world. In the past, we have watched as technologies pioneered in America were commercialized abroad. Solar photovoltaics, for instance, were invented in America with public dollars, but have been largely commercialized and marketed abroad. Clearly this is a mistake we can't afford to repeat.

Second, when necessary, the Federal Government should support early commercialization of the most promising clean energy and energy efficiency technologies to emerge from our laboratories. New technologies that show promise on an experimental scale sometimes fail to attract sufficient private capital for larger scale commercialization because of the costs involved and the perception of higher risks. Such is the case, for instance, with advanced coal technologies with carbon capture and storage. Demonstration of these technologies at commercial scale will be essential to attracting the private capital necessary for mass deployment.

Advanced coal with carbon capture and storage (CCS) has vast job-creation potential. As pressure grows to limit carbon emissions, more resources will be devoted to retrofitting outdated pulverized coal plants with more advanced, cleaner-burning technologies, creating thousands of good-paying construction jobs for operating engineers, electricians, laborers, and others. CCS may also require the construction and maintenance of an extensive pipeline system for transporting CO<sub>2</sub>; according to a recent study from MIT, the CO<sub>2</sub> pipeline system could eventually be one-third of the

size of the system now used to transport natural gas<sup>3</sup>, generating jobs for steelworkers, pipe fitters, and welders as well as heavy-equipment operators. Finally, exporting advanced coal and CCS technologies developed in the United States to trading partners like India and China will both curb carbon emissions from coal plants globally and create new international employment opportunities for American engineers and geologists.

Third, Congress needs to provide market certainty and predictability to renewable energy producers. The system of 2-year tax credits now in place hobbles the renewable industry and must be replaced with longer-term incentives that provide a higher level of certainty to renewable energy investors and producers. Doing so will not only level the playing field with well-subsidized traditional power sources, but establish the central importance of renewables to our nation's energy future. To encourage innovation, and avoid picking winners and losers, incentives should be based on performance, not technology.

The American Council on Renewable Energy estimates that with consistent public support, renewable energy could provide the equivalent of 50 percent of today's US generating capacity by 2025. Sixty-five percent of that renewable energy potential could come from wind and solar power; geothermal could provide an additional 16 percent, including all-important base-load power. Funds generated from the auction of carbon credits could be used to reimburse the Treasury for a 10-year extension of the renewable energy production and investment tax credits. Doing so would create a large array of jobs, from laborers who pour the footings for wind towers and iron workers who construct the towers, to pipe fitters who install geothermal facilities and steelworkers who manufacture and assemble components. The Solar Electric Industries Association predicts that just an 8-year extension of the solar investment tax credit would create 55,000 jobs within the solar industry and \$45 billion in economic investment.<sup>4</sup>

Fourth, Congress should develop policies to encourage the manufacture of clean energy components in the United States. Germany, China and other manufacturing powerhouses aren't shy about domestic manufacturing incentives; we shouldn't be either. In addition to its obvious economic benefits, domestic manufacturing furthers our carbon emissions reduction goals in measurable ways: a wind tower shipped halfway around the world has a much larger carbon footprint than a wind tower made in America. Finding ways to encourage domestic manufacturing would also help businesses around our country expand into this emerging manufacturing sector. According to analysis by the Renewable Energy Policy Project, many states have the industrial capacity, supply chains, and skilled workforce needed to expand into renewable energy manufacturing. (See Attachment A.)

Today, as you have probably heard from others, the United States is losing the race to capture the renewable energy manufacturing markets of the future. For example, eight of the world's ten largest wind manufacturers are foreign companies and nine of these companies are today building factories in China. Legislation to cap and reduce carbon emissions will help the United States resume the position it once had at the forefront of the renewable energy industry by expanding domestic demand for electricity generated with low-and zero-carbon emissions. Expanding domestic demand, coupled with reforms in our system of tax credits to provide greater certainty, will together do much to attract clean energy component manufacturers to build plants in America. But given the strategic importance of the renewable industry to our clean energy future, Congress may want to go further and consider providing Federal loan guarantees and other incentives to manufacturers who build new facilities in the United States or convert idled assembly lines to renewable energy technology. Clean energy manufacturing opportunities would provide high-wage employment opportunities to the 50 percent of the US workforce that has no more than a high school education. And, as you undoubtedly know, manufacturing tends to create larger multiplier effects through local economies than construction or service work by creating local supply chains.

Fifth, Congress should use proceeds from the auction of carbon credits to catalyze a massive public and private initiative to retrofit American buildings, save energy, and dramatically cut domestic energy costs. Heating, cooling, lighting, and industrial processes in buildings consume 40 percent of our energy and produce roughly the same share of our carbon emissions. Clearly, retrofitting our homes, businesses, and public buildings is one of the most immediate and significant steps we can take as a nation to cut energy costs and use, and reduce carbon emissions.

<sup>3</sup>Massachusetts Institute of Technology, "The Future of Coal," March 2007.

<sup>4</sup>Solar Energy Industries Association, Fact Sheet on the Securing America's Energy Independence Act, 2007.

Although energy retrofits can often pay for themselves with the money saved on electricity bills, Federal funding could help states and cities establish revolving loan funds and other financial mechanisms to jumpstart retrofits of public offices, schools, low-income residential properties and other priority properties. Money saved on the energy costs of public buildings could be recycled to hire more teachers, police, firefighters, or healthcare workers. As one of the largest energy users in the Nation, the Federal Government itself could save millions of taxpayer dollars on its own energy bills by expanding programs to retrofit Federal buildings across the Nation.

Retrofitting the stock of existing buildings will put American men and women to work as energy auditors, sheet metal workers to install advanced HVAC, electricians, plumbers & pipe fitters, building operations and maintenance, and more. Manufacturers of heating and cooling equipment will also get a boost from a national commitment to greater energy efficiency in buildings. Since most older buildings are located in urban areas, Congress should also support initiatives to create green pathways out of poverty for young Americans from the inner city. Building retrofit work offers career ladders starting with basic labor and moving up to glazer, sheet metal worker, electrician, and independent contractor.

Sixth, the carbon cap policy Congress adopts must level the playing field for American industry so the cost of compliance here in America also applies to importers with no comparable carbon restrictions of their own. As has been proposed, this goal could be accomplished by requiring importers of energy-intensive products not subject to strict carbon controls to buy and surrender US carbon credits before their products enter the US market. This proposal is critical to encouraging our trading partners to follow the US lead in controlling carbon emissions.

Seventh, Congress needs to support education and training initiatives to prepare Americans for a new generation of green collar jobs in the clean energy economy. The National Renewable Energy Labs have identified lack of skilled workers as one of the leading barriers to deployment of clean energy technologies.<sup>5</sup> High schools, vocational schools, junior colleges, labor-management apprenticeship programs, and universities will all be called on to prepare our young people, trades people, managers, engineers, and scientists to fill the gap. Green collar job training can provide pathways out of poverty for urban youth in renovating energy-leaking buildings. Labor-management training programs often provide some of the best skills training available for trades people and the companies that employ them. Congress should also consider creating a Clean Energy Corps, a service corps to engage Americans of all ages in the challenge of transforming our country's energy future.

#### Conclusion

From Iraq to New Orleans, from the fuel pump to the melting ice sheets of the Arctic, the tragic consequences of our nation's excessive dependence on fossil fuel are driven home to us every day. This is not a dependence we can afford to ignore. To do so would be a form of national betrayal: a betrayal of those who have already suffered so much, at home and abroad, and a betrayal of our children and grandchildren whose future is quite literally in our hands.

Let us not fail them. Let us instead carefully and thoughtfully transform this tremendous challenge into a powerful opportunity, an opportunity to make America stronger and more secure, strategically, economically and environmentally. Let us grow a new generation of clean energy businesses and put Americans to work transforming our nation into the clean energy capital of the world. We can do it, and with your leadership and strategic investments in our clean energy future, we will do it. Please, ladies and gentlemen, lead the way.

---

<sup>5</sup>R. Margolis and J. Zuboy, "Nontechnical Barriers to Solar Energy Use: Review of Recent Literature," National Renewable Energy Laboratory, 2006.

**Attachment A:  
US Renewable Energy Manufacturing Potential of 185,000 MW Installed Capacity  
(top 20 states)**

Location	# of Firms	New Jobs Wind	New Jobs Solar	New Jobs Geothermal	New Jobs Biomass	Total New Jobs
Alabama	635	10,085	2,035	997	982	14,099
California	5,409	32,046	48,896	8,465	6,209	95,616
Connecticut	772	8,160	7,757	812	813	15,542
Florida	1,617	8,467	7,718	1,070	1,449	18,704
Georgia	864	8,044	6,285	1,016	1,303	16,648
Illinois	2,289	30,010	19,298	3,396	3,875	56,579
Indiana	1,321	25,180	7,485	3,191	3,365	39,221
Massachusetts	1,193	7,971	12,264	1,186	1,286	22,707
Michigan	2,050	24,350	6,644	1,502	2,281	34,777
Minnesota	1,070	9,246	5,238	1,477	2,444	18,405
Missouri	785	10,260	7,532	2,907	2,097	22,796
New Jersey	1,351	7,870	6,741	1,620	1,467	17,698
New York	1,925	18,523	14,617	8,150	6,640	47,930
North Carolina	1,096	10,864	11,062	2,810	3,708	28,544
Ohio	2,465	29,820	11,833	5,079	4,537	51,269
Pennsylvania	2,188	19,588	15,767	3,402	3,911	42,668
South Carolina	488	11,204	3,559	5,223	2,365	22,351
Tennessee	853	9,011	5,122	1,078	2,451	17,662
Texas	3,358	25,044	23,221	4,660	7,175	60,100
Wisconsin	1,331	25,179	4,943	2,037	2,974	35,133
<b>Totals</b>	<b>33,060</b>	<b>329,022</b>	<b>228,017</b>	<b>60,078</b>	<b>61,332</b>	<b>678,449</b>

Source: Renewable Energy Policy Project, 2007

Senator SANDERS. Thank you very much, Jerome.

Wayne Winegarden is a Partner with Arduin, Laffer and Moore Econometrics. Thank you very much for being with us.

**STATEMENT OF WAYNE WINEGARDEN, PARTNER, ARDUIN,  
LAFFER AND MOORE ECONOMETRICS**

Mr. WINEGARDEN. Thank you. Thank you, Madam Chairwoman and to the Committee, thank you for inviting me to provide this testimony here today.

A recent study that I co-authored with Dr. Arthur Laffer examined the impacts of cap and trade legislation on the U.S. economy. Economic growth can be described as a process of creative destruction because in the process of creating jobs and economic opportunities, entrepreneurs destroy a smaller set of jobs. Cap and trade legislation has the inverse effect. In the process of creating a few green jobs, a larger number of jobs and economic opportunities would be destroyed.

Passing cap and trade legislation is akin to imposing an energy supply shock on the U.S. economy. Fossil fuels currently account for 86 percent of our total energy consumption. Renewable energy sources are not currently able to replace an adequate amount of the lost energy output from fossil fuels. Consequently, in the short term, meaningfully limiting greenhouse gas emissions can be achieved only by limiting the Country's energy supplies.

The U.S. economy has endured several significant energy supply shocks over the last 40 years. These shocks occurred in 1974 to 1975, 1979 to 1981 and in 1990. The previous energy supply shocks caused on average oil prices to spike 113 percent, the Nation's

economy to shrink by 2.1 percent, and the unemployment rate to rise by 2.6 percentage points.

With respect to today's economy, a 2.6 percentage point increase in the unemployment rate is equivalent to the loss of nearly four million jobs. Over a longer term horizon, a legislative energy supply shock would have significant negative implications. To provide a sense of the potential economic costs, we estimate that compliance with the Kyoto Protocol could reduce total economic activity by 5.2 percent in 2020, compared to where it would be without the cap and trade legislation. Due to a reduction in economic growth, by 2020 every man, woman and child would be about \$2,700 poorer in the baseline scenario, or about \$10,000 energy dollars for a family of four.

Additionally, regardless of one's position on the global warming consensus, cap and trade legislation is an inferior policy choice to address global warming concerns. The Congressional Budget Office, Alan Greenspan, Paul Volcker and Gregory Mankiw are just a few of the notable economists and economic organizations that have also concluded that cap and trade legislation is not the appropriate policy to address global warming concerns.

By definition of a cap and trade policy, which is called a quantity constraint in economics, the dynamics of the marketplace necessarily leads to significant price volatility. Price volatility increases overall economic instability, with detrimental effects for economic growth and jobs. The European experience with cap and trade exemplifies these fundamental flaws. The value of the greenhouse gas allowances in Europe nose-dived in April, 2006 due to a mismatch between the allowances granted and natural market demand. Such extreme price volatility is a natural consequence of policies that arbitrarily cap quantities.

Finally, global warming regulations will only be effective if these regulations are universally adopted. Failure to achieve universality in a global warming policy greatly reduces its environmental effectiveness, and yet the economic costs will remain higher, especially as energy-sensitive companies leave the U.S. in search of cheaper energy supplies.

As an example of companies locating jobs based on low cost energy, Dow Chemical has created an explicit strategy to expand its manufacturing capacity using overseas partners that, in part, have access to cheaper energy supplies. Another example, the aluminum industry, including United Company RUSAL, Alcoa, and Norsk Hydro, has been moving aluminum production out of countries with higher energy costs, including the United States, in search of cheaper power sources. Increasing energy costs in the U.S. relative to other countries through cap and trade legislation will accelerate these trends causing production and jobs to leave the U.S. at an even faster rate.

The costs of reducing carbon emissions are by no means trivial. Therefore, it is not enough to simply press forward in the name of global warming. Our analysis illustrates that cap and trade legislation is the wrong policy that will impose significant economic costs on the U.S. economy and will create significant economic disincentives.

However, if appropriately constructed, a proactive government policy can be implemented which reduces the amount of carbon emissions, while minimizing, if not eliminating, the potential adverse economic impacts. Such a policy will simultaneously implement a carbon tax with a static dollar for dollar reduction in marginal income tax rates. The pro-growth incentives from a marginal tax rate reduction are an integral part of an environmental policy that addresses a potential risk, while safeguarding our current economic progress.

Thank you for the opportunity to testify here today.  
[The prepared statement of Mr. Winegarden follows.]

STATEMENT OF WAYNE WINEGARDEN, PARTNER, ARDUIN,  
LAFFER AND MOORE ECONOMETRICS

Thank you to the members of the Committee on Environment and Public Works for inviting me to provide this testimony today.

I am Wayne Winegarden, a partner in the economics consulting firm Arduin, Laffer & Moore Econometrics. Our firm provides research and analysis to clients on economic, regulatory and fiscal issues.

A recent study that I have co-authored with Dr. Arthur Laffer, which is enclosed at the end of my testimony, examined the expected impacts of cap-and-trade legislation on the U.S. economy. Our analysis concluded that if implemented, cap-and-trade legislation would impose significant economic costs on the U.S. economy.

In my testimony today, I would like to emphasize three key economic consequences from passing cap-and-trade legislation.

First, passing cap-and-trade legislation is akin to imposing an energy supply shock on the U.S. economy.

Fossil fuels currently account for 86 percent of our total energy consumption. Renewable energy sources are not currently able to replace an adequate amount of the lost energy output from fossil fuels. Consequently, in the short-term, meaningfully limiting greenhouse gas emissions can be achieved only through limiting our supply of energy. Disrupting the country's energy supplies, whether by domestic legislation or from a foreign oil embargo, is the definition of an energy supply shock.

The U.S. economy has endured several significant energy supply shocks over the last 40 years. These have included:CO<sub>2</sub>

- The OPEC oil embargo of 1974-75, which dramatically increased oil prices as a direct result of OPEC's drastic reduction in world oil supplies.
- The oil supply disruptions of 1979-81, which also dramatically increased oil prices due, in part, to another Mid-East-related interdiction in world oil supplies.
- Iraq's invasion of Kuwait in 1990 that created another severe disruption in global oil supplies.

The experience from the historical energy supply shocks all tell the same story—energy supply shocks cause the U.S. economy to decline, the number of unemployed people to rise, and the value of the stock market to fall. On average, the previous energy supply shocks caused oil prices to spike 113.2 percent, the nation's economy to shrink by 2.1 percent, and the unemployment rate to rise by 2.6 percentage points. With respect to today's economy, a 2.6 percentage point increase in the unemployment rate is equivalent to the loss of nearly 4 million jobs.

Over a longer-term horizon, a legislated energy supply shock could have significant negative implications with respect to the potential growth prospects of our economy. The extent of the economic costs is directly related to the severity of the required emissions reduction and the speed with which the economy can adjust its productive and consumption behavior to the new incentives created by the cap-and-trade legislation.

To provide a sense of the potential economic costs, based on the average real growth rate in the economy of 3 percent a year, and assuming that energy efficiency (or the U.S. economy's ability to produce the same amount of output with less energy) accelerates to the higher energy efficiency rates that were associated with the energy crises of the 1970's, compliance with the Kyoto Protocol would reduce total economic activity by 5.2 percent in 2020 compared to where it would be without the cap-and-trade legislation.

The implications of such a discrepancy are significant. Due to the reduction in economic growth, by 2020 every man, woman, and child would be about \$2,700 poorer than the baseline scenario—or about \$10,800 for a family of 4.

The second key economic consequence from passing cap-and-trade legislation is that regardless of one's position on the global warming consensus, cap-and-trade legislation is an inferior policy choice to address global warming concerns. The Congressional Budget Office, Alan Greenspan, Paul Volker, and Gregory Mankiw are just a few of the notable economists/economic organizations that have also concluded that cap-and-trade legislation is the wrong policy to address global warming concerns.

Cap-and-trade legislation is inefficient, in part, because the supply and-demand curves across all of the markets that use energy are not known with certainty when the initial cap-and-trade policies are established; and the marketplace is dynamic causing the supply and-demand curves to shift over time, and oftentimes in unpredictable ways.

By definition of the cap-and-trade quantity constraint, the quantity of the emission allowances cannot change and may become substantially inappropriate in subsequent years. Changes in supply and-demand, then, can only be accommodated through changes in prices causing significant price volatility as the dynamic marketplace adjusts over time. Price volatility increases overall economic instability, with detrimental effects for economic growth and jobs.

The European experience with cap-and-trade exemplifies these fundamental flaws. The value of the greenhouse gas allowances in Europe nose-dived in April 2006 due to a mismatch between the allowances granted and actual market demand. While some observers try to explain these variations as a result of poor planning on the part of governments, such extreme price volatility is a natural consequence of policies that arbitrarily cap quantities. This price volatility is what should have been predicted prior to Europe's implementation of cap-and-trade, and supports the contention that cap-and-trade is not the appropriate policy response for addressing the issues related to greenhouse gas emissions.

The third key economic consequence arises because global warming regulations will only be effective if these regulations are universally adopted across the globe. Failure to achieve universality in a global warming policy will greatly reduce its environmental effectiveness and yet will not significantly reduce its economic costs. If only one-half of the earth implements pollution reducing environmental policies, total pollution emitted would decline but by far less than one-half of the decline if the whole earth implemented the same pollution reducing environmental policies. Pollution of the environment is truly as global as the earth's stratosphere. Chinese pollution affects global warming from Santiago, Chile to Vladivostok, Russia and from polar ice cap to polar ice cap. An environmental policy imposed on one specific location will only push polluting industries out of that location and into other locations more polluting tolerant. While the earth's atmosphere could be little impacted, production in the specific location could be devastated.

As an example of companies locating jobs based on low-cost energy, Dow Chemical has created an explicit strategy to expand its manufacturing capacity using overseas partners that, in part, have access to cheaper energy supplies. Another example, the Aluminum industry, including United Company RUSAL, Alcoa Inc., and Norsk Hydro ASA, has been moving aluminum production out of countries with higher energy costs (including the U.S.) in search of cheaper power sources. Increasing energy costs in the U.S. relative to other countries through cap-and-trade legislation will accelerate these trends causing production and jobs to leave the U.S. at an even faster pace.

The costs of reducing carbon emissions are by no means trivial; therefore, it is not enough to simply press forward in the name of global warming. Global warming may well be serious, but so are the economic consequences from combating global warming. What we can say with a high degree of certainty is that policies designed to reduce greenhouse gas emissions per se would have a large and negative impact on the long term growth of America. Consequently, environmental action at all costs is not the answer.

Our analysis illustrates that cap-and-trade legislation is the wrong policy that will impose significant economic costs on the U.S. economy, and will create significant economic disincentives, which are increased when global warming policies are used as a means to increase the government's revenues—regardless of the intended government spending program to which the money is dedicated.

However, if appropriately constructed, a pro-active government policy can be implemented which reduces the amount of carbon emissions while minimizing (if not eliminating) the potential adverse economic impacts. Such a policy will simultaneously implement a carbon tax with a static dollar for dollar reduction in marginal income tax rates. The combination of a higher carbon tax coupled with lower marginal income tax rates would simultaneously reduce overall carbon emissions while mitigating the potential adverse economic impacts from the proposed carbon tax in-

crease by increasing the incentives in the economy to work, invest and innovate. The pro-growth incentives from a marginal tax rate reduction are an integral part of an environmental policy that addresses a potential risk while safeguarding our current economic progress.

---

RESPONSES BY WAYNE WINEGARDEN TO ADDITIONAL QUESTIONS  
FROM SENATOR BOXER

*Question 1.* Could you explain in detail what the impact of a contraction of more than 5 percent in economic growth would do?

Response. Our analysis examined the economic impact from a reduction in energy use that would accompany any meaningful cap and trade regulation. Our analysis created a baseline scenario that estimated total economic output and total economic output per capita in 2020 based on:

- Total economic output growing at its historic rate of 3.0 percent per year through 2020;
- The U.S. population growing at its historic rate of 0.8 percent per year from the end of the U.S. Census projection in 2010 through 2020; and,
- Total energy consumption growing at its historic rate of 1.1 percent per year through 2020.

Our analysis then restricted total energy usage to the level consistent with adherence to the Kyoto Protocol as estimated by the Federal Energy Information Agency. We adjusted total energy usage due to the fact that the U.S. economy's energy usage rate changes when the price of energy increases: higher energy prices provide an incentive for people to economize on their energy use. Therefore, when energy prices are accelerating, people's energy efficiency also increases. Higher energy efficiency allows the economy to produce \$1 of economic output with less energy inputs. We assumed that overall energy efficiency would accelerate to the levels seen during the time period around the 1970's energy crises.

Based on these assumptions, total economic output in 2020 with cap and trade regulations would be 5.2 percent smaller than total economic output in 2020 under the baseline scenario. This is a reduction in per capita income growth of \$2,700, or a reduction in annual growth in GDP per capita of approximately 0.4 percent per year. A reduction in growth of this magnitude can lead to large differences in opportunities, jobs and overall welfare.

The historical performance of the U.S. economy illustrates the overall impact that a reduction in economic growth of this magnitude can have on the welfare of people in the U.S. The timeframe from 1961 ? 2006 can be divided into four periods based on overall economic performance that occurred:

- 1961—69
- 1970—83
- 1984—91
- 1992—06.

In 1961—69 overall GDP per capita rose at an average rate of 3.3 percent. This fell to an average 1.6 percent average rate from 1970 ? 83. Once the economy took off in the early 1980's, growth in GDP per capita accelerated rising an average 2.4 percent per year, which include the recession years of 1990—91. The resulting economic boom of the 1990's through today has maintained the strong growth experienced during the 1980's with GDP per capita rising 2.0 percent a year on average, which includes the recession year of 2001, see Table 1.

**Table 1: Average Annual Growth in Real GDP per Capita**

	1961-69	1970-83	1984-91	1992-06
Change in Real GDP per capita	3.3%	1.6%	2.4%	2.0%
Premium over 1970 – 83 GDP per capita growth	+1.7%	—	+0.8%	+0.4%

During the periods when real GDP per capita growth was stronger, the economy created more jobs, people's wealth increased at a faster rate, and the average income of the poorest people in the country (those with incomes in the bottom 20 percent of the income distribution) rose at a faster pace, see Table 2. As illustrated in Table 2, a reduction in annual economic growth of a percentage point or less a year, if it persists over a long period of time, significantly reduces the overall growth in people's well-being.

Table 2: Average Annual Growth in Employment, Wealth, and the Income of the Poorest Households in the U.S.

**Table 2: Average Annual Growth in Employment, Wealth, and the Income of the Poorest Households in the U.S.**

	1961-69	1970-83	1984-91	1992-06
Change in employment	3.0%	1.8%	2.3%	1.5%
Change in wealth of households and non-profits	4.0%	2.8%	4.6%	4.4%
Change in income for households in the bottom 20% of income earners		0.5%	0.9%	0.6%

Just like a small decrease in savings can have a large impact on a person's overall welfare in the long-run, policies that decrease our economy's growth rate will have large impacts on our overall welfare in the long-run. The result is that the overall income of the country will be smaller, the overall wealth of the country will be smaller, the growth in job opportunities for Americans will be reduced, and the income for the poorest households in the country will grow more slowly.

2. In terms of the U.S. economy, what can be expected to happen if we commit to unilateral caps on carbon emissions, but China and other developing countries do not?

Universality is a key precondition for a successful environmental strategy. An environmental policy imposed on one specific location raises the costs of production for that area. The Federal Energy Information Agency (EIA) examined the cost from implementing the cap and trade regulations associated with the Kyoto Protocol in the United States. This study, conducted in 1998 during the Clinton-Gore Administration, found that higher energy costs would result from adhering to the cap and trade regulations contained in the Kyoto Protocol.<sup>1</sup> According to the report, a cap and trade system that reduces carbon emissions in the U.S. by 7 percent below the 1990 level would raise gasoline prices by nearly 53 percent and energy prices by more than 86 percent. Of course, many of the caps on carbon emissions currently under consideration would lead to larger reductions in carbon emissions and, consequently, larger increases in energy prices.

The higher energy and regulatory costs are not benign to overall economic growth. One key ingredient for economic growth is growth in productivity or the ability to create more output with the same amount of inputs. Cap and trade regulations increase the costs to produce the same amount of output, thereby lowering productivity. Simultaneously, the cap and trade regulations are increasing the costs to consumers, causing consumers to spend more money in order to acquire the same amount of goods. Both of these effects negatively impact overall economic growth.

The adverse economic impacts on the United States if China and other developing countries do not commit to caps on carbon emissions (and other greenhouse gases) are amplified further. Companies do not locate jobs as a matter of social conscience. Instead, companies locate jobs based on which location is the most cost-effective. As current globalization trends illustrate, when the U.S. is not the most cost-effective location, industries and jobs leave the U.S. in search of the most cost-effective locale.

If the U.S. were to pass cap and trade legislation, manufacturers in the U.S. that emit carbon dioxide or other greenhouse gases would face additional costs. If other countries, such as China and India do not impose cap and trade regulations on manufacturers, manufacturing products in these countries will gain a cost advantage vis-a-vis the U.S. A decrease in the costs of production in countries such as China and India provides an additional incentive for manufacturers to relocate jobs from the United States to China, India or any other country that does not impose the cap and trade costs on manufacturers in their countries.

An environmental policy imposed on one specific location will only push polluting industries out of that location and into other locations more polluting tolerant; perhaps significantly reducing the amount of desired pollution reduction achieved. However, due to the incentives described above, production in the specific location that is imposing the cap and trade regulations could be devastated.

For instance, if the U.S. were to increase its gasoline tax, gasoline consumption in the U.S. will decline for sure. But, simultaneously, gasoline and other oil products will become cheaper and more plentiful to other nations such as China, India and Brazil. Greg Mankiw in his advocacy for a carbon tax stated explicitly: "as a higher

<sup>1</sup>(1998) Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity. Energy Information Administration October (SR/OIAF/98-03).

gas tax discouraged oil consumption, the price of oil would fall in world markets.”<sup>2</sup> The net effect from the gas tax is in part a relocation of carbon emissions that could ironically increase overall carbon emissions because China, India and Brazil are gallon-for-gallon far more serious polluters of the world’s environment.

The need for universality in a global warming policy holds true whether the policy is being considered in California, the United States, Europe, Japan, or any individual country or region. Without universal commitment to a carbon reduction regime, people will have the incentive to move businesses that emit carbon from the countries or regions with restrictive carbon policies to the countries or regions without restrictive carbon policies. The point is simple: failure to achieve universality in a global warming policy will greatly reduce its effectiveness and yet will not significantly reduce its costs.

---

<sup>2</sup>N. Gregory Mankiw, “Raise the Gas Tax,” *The Wall Street Journal*, October 20, 2006.



**The Adverse Economic Impacts of Cap-and-Trade Regulations**

**Arthur Laffer and Wayne Winegarden**

**September 2007**



**EXECUTIVE SUMMARY**  
**The Adverse Economic Impacts of Cap-and-Trade Regulations**

A cap-and-trade system for controlling greenhouse gas emissions (GHGs) would impose significant economic costs on the U.S. economy and, consequently, are an inappropriate policy response to current concerns about global warming. Our analysis of cap-and-trade's economic impacts reveals the following impacts:

- In economic terminology, cap-and-trade operates as a "quantity constraint" because the regulation establishes (or constrains) the GHGs that can be produced. As a quantity constraint, cap-and-trade regulations inherently create more price volatility in the GHG allowance market, as has already been observed in Europe. The Congressional Budget Office has also raised the price volatility issue, concluding that cap-and-trade regulations are not sound policies for addressing global warming.
- Cap-and-trade regulations would likely impose a large cost on the U.S. economy. The U.S. Energy Information Agency (EIA) estimates that overall economic growth could decline by up to 4.2 percent if a cap-and-trade system were implemented to achieve the Kyoto Protocol targets (7% below 1990 GHGs by 2008-2012). The costs to reach the ultimate goal of some GHG control proponents (e.g., reducing GHGs to 80% below 1990 levels by 2050) would be significantly greater. However, these estimates assume that the government will auction off the rights to emit greenhouse gases as opposed to simply giving these rights away, which is the approach often discussed in the U.S. and what has actually been implemented in Europe.
- Fossil fuels (oil, coal and natural gas) provide 86 percent of our current energy needs. It is not currently feasible for the alternative energy sources to significantly expand their energy contribution sufficiently in the near-term to substitute for the demand growth, according to the EIA. Consequently, a GHG cap could effectively become an energy production cap – or an energy supply shock.
- The U.S. economy's past experience with energy supply shocks supports the conclusions of the EIA study. During the previous oil supply shocks (energy supply shocks) of 1974-75, 1979-81 and 1990-91, the economy declined, unemployment rose, and the stock market declined in value.
- Based on the energy efficiency responses to the energy supply shocks of the 1970s, the U.S. economy could be 5.2 percent smaller in 2020 compared to what would otherwise be expected if cap-and-trade regulations are imposed. This equates to a potential income loss of about \$10,800 for a family of four for the initial Kyoto GHG reduction target.
- Technical difficulties in measuring and verifying the validity of traded GHG allowances imply that the global market will be inefficient, and subject to manipulation and fraud. Government regulations that fail to delineate future GHG control levels add more uncertainty. These uncertainties raise further questions regarding the efficacy of the cap-and-trade regulations.

When evaluated as a whole, cap-and-trade regulations are likely to impose significant economic costs on the U.S. economy. These costs argue against implementing cap-and-trade regulations as a response to concerns about the potential contribution of GHGs to global warming.

### The Adverse Economic Impacts from Cap & Trade Regulations

Arthur Laffer and Wayne Winegarden

In response to the global warming consensus, political momentum is building to cap greenhouse gas emissions (GHGs), sub-divide the cap into smaller parts (or emissions allowances similar to rationing coupons), and distribute the emissions allowances, either by auction or a no-cost basis to businesses that emit greenhouse gases. Businesses wishing to emit GHGs beyond their specific allowances would be able to purchase rights to do so from owners of surplus emission allowances. GHGs include carbon dioxide from combustion of fossil fuels and methane and nitrous oxide from agriculture and food production activities.

These policies are commonly referred to as "cap-and-trade" regulations. The costs of reducing GHGs through cap-and-trade regulations are not trivial. If implemented, cap-and-trade policies would add significant costs to production and would likely have a severe negative impact on the long-term U.S. growth. We review the economics behind cap-and-trade policies, and illustrate the adverse economic impacts that can be expected from the implementation of cap-and-trade regulations.

#### Proponents of Cap-and-Trade Misunderstand the Dynamic Marketplace

Already implemented in the European Union through the Kyoto Protocol, advocated by numerous states, and the subject of several legislative proposals in Congress, cap-and-trade is billed as a market-based approach for managing GHGs. Cap-and-trade establishes an aggregate constraint – that is, "the cap" – on GHGs. This constraint is typically benchmarked to the GHGs from a certain year – the Kyoto Protocol, for instance, established a cap that is 7 percent below 1990 levels for the years 2008-2012. Some cap-and-trade proponents advocate GHG cuts of up to 80 percent below 1990 levels by 2050.

The aggregate constraint is sub-divided into emission allowances that are then sold or allocated to businesses that emit greenhouse gases. Businesses constrained by their available allowances face a choice – either comply with their GHG allocations by changing their production levels or production technologies; or purchase more GHG allowances from owners of surplus GHG allowances. *The Economist* (2007) has described the theoretical workings of cap-and-trade by stating,

*The basic idea is that power plants and manufacturers will be allowed to emit a certain number of tons of carbon. If they exceed that amount, they must buy "credits" from companies that pollute less than their allowance. One day the price of a ton of carbon may be as widely quoted as that of a barrel of oil.<sup>1</sup>*

Several cap-and-trade proposals also incorporate a means to store or "bank" current GHG allowances for use later allowing for an inter-temporal transfer of emissions.

Advocates claim cap-and-trade is superior to other alternatives for reducing GHGs, such as a so-called "carbon tax," because of its supposed flexibility and "market-based" approach to the problem. Proponents hypothesize that cap-and-trade represents an efficient division of labor – that is, the government establishes emissions levels while the market sorts out who has the right to produce them. Goods and services that are in greater demand will be able to pay a higher price for GHGs associated with their production. Consequently, producers of good and services in high

demand will outbid other users for the right to emit greenhouse gases, while the manufacturers of the less-valued products will either have an incentive to sell these rights or will not be able to purchase these rights in the first place. Either way, only the producers of good and services that consumers value the most will end up with GHG allowances. In this manner, the market is allocating the scarce right to emit greenhouse gases based on their most valued use.

Cap-and-trade advocates are correct only in a static world where market supply-and-demand curves are known with certainty. Appendix I illustrates the theoretical benefits from a cap-and-trade policy, or what is known as a quantity constraint in economics, under these hypothetical and unrealistic conditions.

Markets are dynamic, and people change their actions in response to the changing dynamics of the marketplace. Appendix II illustrates this economic logic in a realistic scenario where the supply-and-demand curves vary compared to levels expected by the government after establishment of a GHG cap. Once market dynamics are incorporated, the efficacy of the cap-and-trade solution disappears.

Significant price volatility emerges in the market because the supply-and-demand curves are not known to policymakers when initial cap-and-trade policies are established. Furthermore, the supply-and-demand curves will shift over time, and oftentimes in unpredictable ways. By definition of the cap-and-trade quantity constraint, the quantity of the GHGs allowances cannot change and may become substantially stricter in subsequent years. Changes in supply-and-demand, then, can only be accommodated through changes in prices (see Appendix II). This process may lead to extreme price volatility in the emissions allowance market and the markets for good and services produced under emissions caps.

The European experience with cap-and-trade exemplifies these fundamental flaws. The value of the GHG allowances in Europe nose-dived in April 2006 due to a mismatch between the allowances granted and actual market demand. While some observers try to explain these variations as a result of poor planning on the part of governments, such extreme price volatility is a natural consequence of policies that arbitrarily cap quantities. As shown in Appendix II, this price volatility is what should have been predicted prior to Europe's implementation of cap-and-trade. The European experience supports the contention that cap-and-trade is not the appropriate policy response for addressing the issues related to GHG emissions.

A recent Congressional Budget Office analysis echoes these precise concerns:

*When costs and benefits are uncertain, as they are in the case of climate change, a system that raises the price of emissions – for example, a tax or a permit system with a set permit price – can have significant advantages over one that establishes an emissions quota. Tightening restrictions on emissions is likely to raise the incremental cost of mitigation much more quickly than it lowers the incremental benefit. As a result, the cost of guessing wrong and imposing an overly restrictive quota could be relatively high. In contrast, the cost of guessing wrong about the appropriate tax level—and perhaps failing to reduce emissions enough in any given year—will probably be relatively low.<sup>2</sup>*

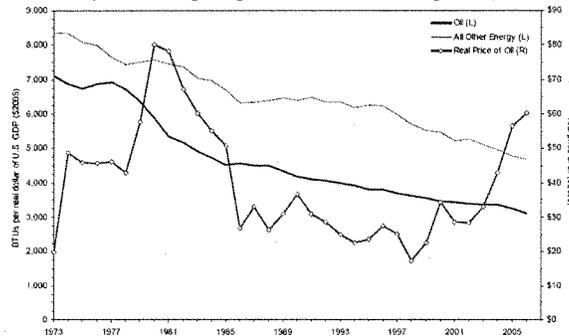
The results are the exact opposite of what cap-and-trade proponents argue – cap-and-trade regulations create overly restrictive policies that increase price uncertainty in the marketplace. The market loses efficiency because of cap-and-trade regulations.

#### Carbon Restrictions Impact Economic Growth

Energy use creates externalities – that is costs (or benefits) imposed on others who are neither the seller nor the purchaser of the products and services in question. Pollution emitted from energy use is a negative externality. Economic growth, wealth creation, and poverty reduction created from using energy are positive externalities.

Global warming policies geared toward economizing our use of fossil fuels impose tremendous economic costs, especially when the positive externalities of economic growth and poverty reduction are not given appropriate consideration. Economic growth and pollution are intertwined in complex ways. As countries become wealthier, heavy industries develop creating industrial wastes that increase pollution. However, there is ample evidence from recent history that greater economic growth, at least past a certain threshold, actually reduces the pollution a society creates. The U.S., for example, has been consistently using less energy per dollar of economic output in times of both rising and falling oil prices (see Figure 1).

**Figure 1**  
U.S. Physical Consumption of Oil and Non-Oil Energy and the Real Price of Oil  
(Actual through August 2006, estimated through 2006)



At a February 2003 Harvard Business School Conference on Asia Business, the Executive Secretary of the United Nations Economic and Social Commission for Asia and the Pacific concurred with these sentiments, stating:

*Deterioration of environment could turn to improvement as economic development progresses and income increases to a certain level. Sustained high economic growth for a long period is a pre-condition for this to happen. In this regard, both Japan and the Republic of Korea have performed extremely well in the decades of 70's, 80's and most part of 90's in the last century. Per capita income of Japan increased from US\$4,481 in 1975 to US\$37,600 in 2000. For the Republic of Korea, the increase has been from US\$599 in 1975 to US\$9,762 in 2000. Poverty in the absolute sense is virtually non-existent in Japan and very low in the Republic of Korea. Improvements in environmental conditions are equally impressive. They have excelled in improving*

*energy efficiency and resource conservation and were successful in reducing pollution. For example, Japan was able to reduce SO<sub>2</sub> emission by 40 per cent during the mid seventies to mid eighties.<sup>3</sup>*

Appropriately incorporating externalities into a coherent comprehensive global plan is no simple affair. Rigid requirements to force nations and companies to focus exclusively on reducing negative externalities, while politically popular, may cause more harm than necessary.

Carbon-based energy – i.e., coal, natural gas and oil – supplies the vast majority of global energy needs. Restricting energy options by significantly capping the amount of GHGs the U.S. emits will raise the country's energy costs, at least in the short-run. Artificial reductions in the supply of energy – akin to a “supply shock” – impose significant economic costs on the U.S. economy. According to the Federal Energy Information Agency (EIA), imposing the restrictions mandated by the United Nation's Kyoto Global Warming Treaty would reduce total U.S. economic growth significantly.<sup>4</sup> The actual forecast varied depending upon what the government was assumed to do with any windfall revenues it would raise. The EIA assumed that the government would raise revenues through an initial sale of the right to emit carbon into the air. Depending upon the assumptions and amount of carbon restrictions imposed, these revenues are estimated to be between \$128 billion and \$585 billion.

The EIA considered two scenarios regarding the revenues raised:<sup>5</sup>

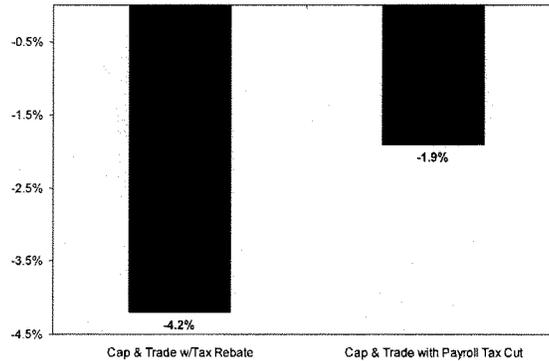
*...first, returning collected revenues to consumers through a personal income tax lump sum rebate and, second, lowering social security tax rates as they apply to both employers and employees. The two policies are meant only to be representative of a set of possible fiscal policies that might accompany an initial carbon mitigation policy.*

The EIA study forecasted that implementing cap-and-trade regulations with a tax offset via a personal income tax rebate would reduce economic growth by 4.2 percent, or \$565 billion of 2006 QIV GDP (see Figure 2). Implementing the cap-and-trade proposal with a payroll tax rebate would reduce economic growth by 1.9 percent, which is \$256 billion of 2006 QIV GDP.

There are a few important caveats regarding the EIA's economic impact estimates. The EIA study examined the potential economic impacts from reducing GHGs to a level that is 7 percent below 1990 levels. Current discussions regarding the target for GHGs have become more aggressive – some as high as 80 percent. Since such carbon reductions are many times more restrictive than the scenario's considered by the EIA, it is not unreasonable to assume that the potential economic impacts could be significantly greater. Consequently, the economic impacts discussed above may significantly under-estimate the potential economic impacts from the significantly more restrictive GHG policies currently under consideration.

The economic impacts may also be higher because, although the EIA assumed that the initial distribution of GHG allowances was achieved through a government auction, this allocation mechanism has not been generally used.

Figure 2  
 EIA Forecasted Impact on GDP Growth from Kyoto Protocol  
 Forecast Growth Compared to Baseline Growth  
 Assumes Carbon Levels 7 percent Below 1990 Levels



As implemented in Europe, and now under consideration in the U.S., the initial GHG allowances would be freely allocated to different private entities. Under this "grandfathering" system, the initial the right to emit GHGs are given away to certain emitters free-of-charge based on some formula involving current emissions and designated emissions goals. Another way to describe the cap-and-trade system is that the government arbitrarily designates winners and losers – a process that would most likely devolve into competition between lobbyists.

In order to effectively limit GHGs, the regulatory cap must reduce GHGs below current market levels. But reducing the quantity of carbon emissions raises the price of energy. Because the companies received the rights to pollute without paying for them, the revenues from the higher prices are transferred from the consumer to the producer – which may be an undesirable outcome from an equity perspective. A recent *Financial Times* article documented this impact in the United Kingdom:

*...profits are created because of the way the emissions trading scheme works, rather than because of sharp practice by the companies. Electricity prices are higher as a result of the scheme. But generators' costs do not rise to the same extent, as they are given most of their permits for free.*

*In phase two of the scheme, which runs from 2008 to 2012, the price of permits is about €23 a tonne of carbon dioxide, and UK electricity companies have been allocated permits for 104m tonnes of carbon dioxide a year. In the first phase of the scheme, 2005-07, it is thought the total windfall profit for the generators was about £2bn.<sup>6</sup>*

The adverse impacts on consumers are not equitably distributed either. Energy taxes, such as gasoline taxes, are generally viewed to be regressive because the dollar value of the tax imposes a larger burden on people of lesser means compared to wealthier individuals. The same holds true for cap-and-trade regulations. Energy price increases operate as an additional "tax" on lower income people. As a consequence, it is likely that the costs of the cap-and-trade regulations will be felt most acutely by those least able to afford these costs.

The Congressional Budget Office raised these equity concerns as a significant problem with most cap-and-trade regulations.<sup>7</sup> Additionally, a cap-and-trade system implemented with a grandfathering distribution of emission allowances limits the government's options to offset the impact on the economy from the carbon reduction policy. Consequently, the adverse economic impact from cap-and-trade regulations are amplified when the right to emit carbon is given away as opposed to auctioned off to its most valued purchaser.

#### **Lessons from previous Supply-shocks**

Fossil fuels, the energy sources that produce the most GHGs, currently account for 86 percent of total energy consumption.<sup>8</sup> Alternative low GHG sources currently account for only 6.1 percent of total energy consumption. Importantly, renewable fuels are not in a position to replace the lost energy output from fossil fuels.

According to the EIA,<sup>9</sup>

*[solar power]...is still in the early stages of development, with relatively high costs and uncertain performance, and inadequate solar conditions east of the Mississippi River limit its potential market [while] wind resources are often far from electricity customers, and if the wind is not blowing the resources may not be available during peak daily or seasonal loads.*

Wind power has other problems. Wind farms can only be placed in certain locations and these locations often interfere with the migratory paths of birds. They are also unsightly and localities resist their construction. These barriers limit the viability of wind power in the near term. Similar barriers exist for other renewable energy sources. Due to these constraints, limiting GHGs emissions in the short-term can only be achieved by limiting the supply of energy produced. Disrupting the country's energy supplies, whether by domestic regulation or foreign oil embargo, is an energy supply shock.

It is not necessary to forecast impacts on the U.S. economy from a significant energy supply shock. The U.S. economy has endured several supply-induced energy crises over the last 40 years. These real world examples clearly illustrate the adverse economic impacts in the short-run from supply-induced energy shocks. Figure 3 traces the spot commodity prices of oil on a monthly basis from January 1946 through April 2007. Figure 3 shows four significant oil price spikes:

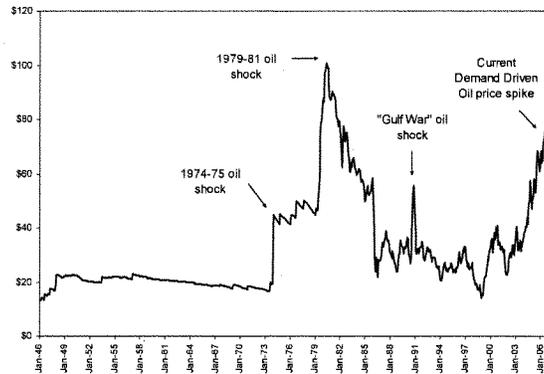
- 1974 – 75;
- 1979 – 81;
- 1990 – 91; and
- 2005-present.

The first three oil price spikes resulted from an "energy shock" or supply-disruption. The current price spike, in contrast, has resulted from increased demand.

Currently, the supply of oil has never been greater. World daily crude production averaged over 73 million barrels in early 2006, averaged 63+ million in 1996, and averaged about 56 million back in 1986. Moreover, known reserves

are also in abundant supply. Proved crude oil reserves, estimated at 51 billion barrels in 1944, grew to 1.3 trillion barrels by the end of 2003.<sup>10</sup>

**Figure 3**  
West Texas Intermediate Spot Oil Price  
January 1946 – April 2007



The cause of the current price spike is a global economic boom of unbelievable breadth and depth. Even with huge augmented supplies of oil pouring on the world economy, demand growth has led to a price spike. Without this spike in the price of oil, the world economy would be in precarious shape. The rise in the price of oil is doing just what it is supposed to do—allocating a scarce commodity amongst alternative users. Today's rise in the price of oil is a direct consequence of the efficient positive functioning of global markets whereas earlier spikes in the price of oil were a consequence of hostile anti-growth interventions in the oil market. Consequently, it is the first three price spikes that are of interest with respect to the economic effects of a supply-side energy shock.

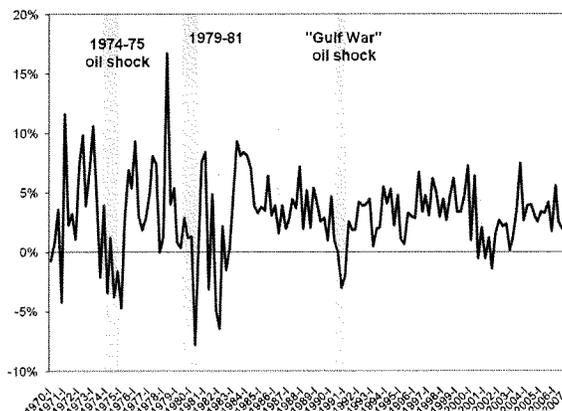
Oil prices increased dramatically during 1974-75 as a direct result of an interdiction in the oil supply initiated by OPEC countries. The period of 1974-75 is best described as a leftward shift in the supply curve for oil. The price of oil rose as a result of the deprivation of oil supply. The U.S. economy and stock market declined precipitously.

The 1979-81 price shock reflected another Mid-East-related interdiction in supply, U.S. wellhead price controls, excess profits taxes on oil companies, and gas rationing – all causing another leftward shift in the supply curve for oil. The price of oil again rose, the stock market weakened and the economy faltered. While by no means the sole cause of the U.S. recession of 1981-82, the high price of oil surely contributed.

When Iraq invaded Kuwait in 1990, the U.S. responded with "Desert Storm." Again, oil supplies were greatly reduced, shifting the supply curve for oil leftward once again. Oil prices rose and the world experienced an economic slowdown, albeit not entirely due to rising energy prices. The culprit was yet another Middle East-induced interdiction of supply. The interdiction of supply was a major contributor to the high price of oil and the subsequent collapse of the U.S. stock market and economy.

Figures 4 – 6 detail the results. Figure 4 reviews the impact on real GDP growth following each of the three energy supply shocks. In each episode, the U.S. economy entered a recession, the severity of which was linked to the severity of the supply shock, see Table 1.

**Figure 4**  
Percent Change in Real GDP  
1970 Q1 – 2007 Q1



**Table 1**  
Percent Change in Real GDP

	1974 - 75	1979 - 81	1990 - 91
Percent Increase in Oil Price*	+134.1%	+117.2%	+88.3%
Percent Change GDP (peak to trough)	-2.70%	-2.18%	-1.26%

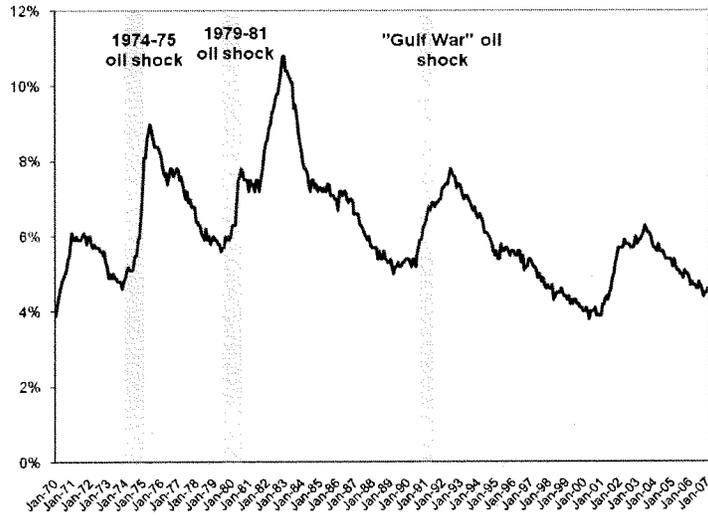
\* Measured as peak price to price prior to price spike

Consistent with a recession, the unemployment rate surged following each oil supply shock (see Figure 5). The oil supply shocks with the largest percentage increase in oil prices were also associated with those periods with the largest increase in the nation's unemployment rate (see Table 2).

As a final measure of the adverse economic impacts caused by energy supply shocks, Figure 6 compares changes in inflation adjusted stock prices and inflation adjusted oil prices; it shows that when inflation adjusted oil prices rise, inflation adjusted stock prices fall.

Taken together, the previous energy supply shocks all tell the same story – an energy supply interdiction causes the U.S. economy to slow, unemployment to rise, and the value of the stock market to fall.

**Figure 5**  
**U.S. Unemployment Rate**  
**January 1970 – May 2007**

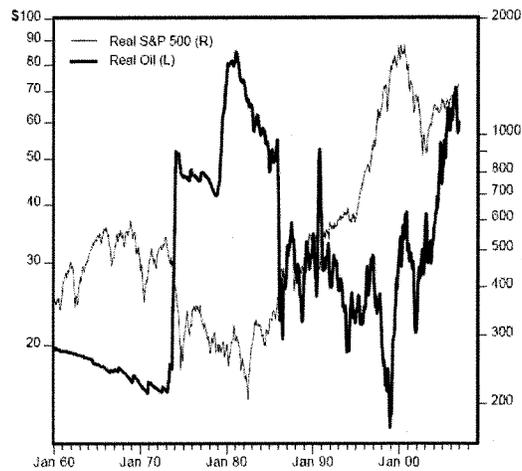


**Table 2**  
**Increase in National Unemployment Rate**

	1974 – 75	1979 - 81	1990 - 91
Percent Increase in Oil Price*	+134.10%	+117.21%	+88.26%
Increase in Unemployment Rate	+3.90 p.p.	+2.20 p.p.	+1.70 p.p.

\* Measured as peak price to price prior to price spike  
 p.p. denotes percentage point

**Figure 6**  
**Inflation Adjusted Oil Prices vs. Inflation Adjusted Stock Prices**  
**1970 Q1 – 2007 Q1**



**Table 3**  
**Summary of GDP and Employment Effects from Previous Oil Supply Shocks**

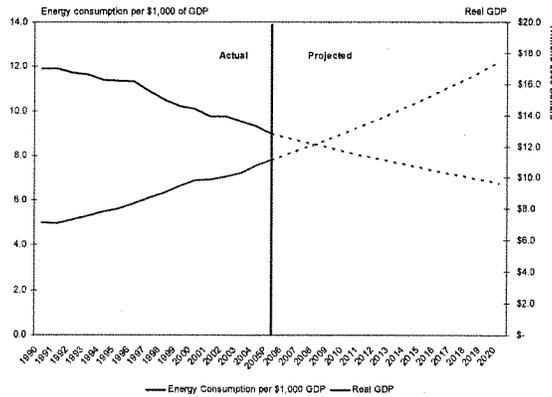
	Average Change
Percent Increase in Oil Price*	+113.2%
Percent Change GDP (peak to trough)	-2.1%
Increase in Unemployment Rate	+2.6 percentage points

Because current technological constraints limit the viability of alternative energy sources, a GHG cap will have the effect of lowering the amount of fossil fuel-derived energy that can be used; while it is unclear how the lost energy output will be replaced. Additionally, GHGs are not simply carbon emissions. For instance methane emissions from dairy farms and nitrous oxide emissions from fertilizers are also GHGs. A comprehensive GHG cap will, consequently, impact agricultural production GHGs as well. The economic impact from a full GHG cap could be larger than the values estimated below as these impacts are driven primarily by constraints on fossil fuel use.

As of 2005, each dollar of GDP is generated by 8,970 British Thermal Units (BTUs) of energy, or a total of 99.9 quadrillion BTUs.<sup>11</sup> The U.S. Department of Energy EIA study has estimated that a GHG emissions cap consistent with the Kyoto Protocol would require total energy output to be reduced to 98.8 quadrillion BTUs.<sup>12</sup>

On average, the U.S. economy becomes more energy efficient each year, where increased energy efficiency is defined as the ability to produce the same level of economic output (or GDP) with less energy input (BTUs). Since 1949 energy efficiency has improved by about 1.4 percent per year. Since 1990, the pace of energy efficiency has increased to 1.9 percent per year. Based on the rate of energy efficiency growth since 1990, and average total GDP growth since 1990, by 2020 each dollar of GDP will be generated by 6,756 BTUs, and total real economic output will be \$17.4 trillion. These values imply total energy usage of 117.8 quadrillion BTUs.

**Figure 7**  
**Real GDP Compared to Energy Consumption per \$1 of GDP**  
**1990 – 2005 (actual)**  
**2006 – 2020 (projected)**



Compliance with the Kyoto Protocol would require an actual reduction of total energy usage to 98.8 quadrillion BTUs. If energy efficiency did not improve compared to this baseline, such a disruption in energy supply would lead to total economic activity being 16.1 percent lower in 2020 than the baseline scenario.

The actual economic impact will likely be less than the 16.1 percent figure as growth in energy efficiency will likely accelerate and partially offset the impact of the lower energy usage on GDP. During the period around the energy supply shocks of the 1970's, the rate of growth in energy efficiency accelerated to 2.7 percent per year. Such economizing behavior is a natural response of individuals to higher energy prices, and results from changing driving habits, car purchase choices, home temperature settings and other energy efficiency activities.

Assuming that consumers respond to the higher energy costs from cap-and-trade regulations so that our energy efficiency growth accelerates to an average of 2.7 percent per year, total economic activity would be 5.2 percent lower in 2020 than the baseline scenario.

The implications of such a discrepancy are significant. Due to the reduction in economic growth, by 2020 every man, woman, and child would be about \$2,700 poorer than the baseline scenario – or about \$10,800 for a family of 4.<sup>13</sup> Furthermore, the lack of current technological alternatives limits the ability to offset these impacts. To the extent that GHG emissions constraints are more binding, the overall adverse economic impact could be slightly larger. This analysis, along with the EIA study, and the prior episodes of drastic oil reduction illustrate the types of economic consequences that would likely occur in the U.S. from ill-conceived cap-and-trade policies.

#### Cap & Trade Fraud

Financial instruments representing GHG emissions allowances are not like future or spot market contracts for traditional commodities such as agricultural, energy or mining products – all of which contemplate that their underlying physical commodities be delivered to a specific place at a precise time and in pre-determined quantities of sufficient quality.

GHG emissions are invisible, are not easily measurable, and there is currently no uniform or standard way to measure GHG emissions. Additionally, because GHG emissions are global in scope, there is no single regulatory or enforcement organization responsible for measurement of all GHG emissions. Because of these concerns, the financial instruments based on GHG emissions will be subject to fraud and manipulation that will be difficult, if not impossible, to detect or guard against.

Schmalensee (1996) has previously described some of the issues associated with international treaty compliance:

*It is first argued that widespread noncompliance with the reporting requirements of the Montreal Protocol have arisen not from bad intentions, "but rather because [countries] did not have the resources and technical know-how needed to carry out their obligations." As even non-economists know, "I don't have the money," almost always means, "I have better things to do with the money." If half the signatories to the Montreal Protocol are willing to claim in public that they couldn't afford to meet the Protocol's reporting requirements, it does not take much imagination or cynicism to predict near-universal non-compliance with a climate protocol involving costs that are orders of magnitude larger. A history of partial compliance with low-cost environmental treaty*

*obligations argues that compliance with any burdensome future climate-related agreements is likely to be very spotty indeed.*

*Second, it is noted that noncompliance with certain oil pollution treaties was solved when an equipment standard was adopted that made monitoring easy, and it is asserted in passing that "monitoring of international agreements may be the more important problem." This assertion is hard to dispute; one can only wish its implications had been explored. Most international environmental agreements rely on self-reporting, and almost none are well-monitored. And, as I noted above, it is at least arguable that for technical reasons only CO2 emissions from fossil fuels can be reliably monitored today.<sup>14</sup>*

The argument developed by Schmalensee raise important concerns regarding carbon emissions trading. Based on experience with the Montreal Protocol and the experiences of many countries that are currently trying to comply with the Kyoto Protocol, it is likely that industries in many countries will not be complying with the emissions cap. Furthermore, a global carbon emission cap-and-trade system requires that all allowances, including the allowances from countries with less stringent controls, to be tradable in the global marketplace.

As a result, the carbon emissions allowance marketplace will be subject to game-playing by emitters from countries where strict enforcement may not be pursued; and uncertainty due to lack of compliance in many countries. These uncertainties will make it difficult for a company that purchased a carbon emissions allowance from the global trading system to verify that the person or company who sold the allowance has not either used the allowance or sold the same allowance to another company. Because the person selling an allowance does not need to be the original allowance holder, uncertainty will exist regarding the true validity of any emissions allowance purchased on the market. While uncertainty is inherent in all financial markets, uncertainty regarding the validity of ownership (or the property right over the good or service purchased) is not. History has shown that when property rights are not well enforced, market participants lose confidence and in the extreme causes all market transactions to cease.

#### **Other Inefficiencies with Cap & Trade**

All markets face uncertainties. Will consumers want the product? Is production, especially agricultural, sufficient? Will new competitors or competitive products enter the market? What about the myriad transportation and distribution issues that must be managed? Creating a market for trading GHG allowances adds an extra layer of uncertainty to the typical uncertainty inherent in all markets.

Under cap-and-trade, the government must continually set the number of GHG allowances (the level of the cap) into the future. Many assumptions must be made in order to establish the correct quantity cap due to environmental and economic uncertainties. Just a few of these uncertainties include:

- The expected environmental impact from the emissions constraint (will the quantity constraint actually impact global warming);
- The cost for businesses to effectively replace their current GHG-emitting technology; and,
- The costs that emissions constraints will impose on the economy.

Errors in any of these calculations will cause the actual emissions caps to vary, perhaps significantly, from the efficient GHG level. Additionally, current Kyoto Protocol GHG caps are not set past 2012, thereby creating an arbitrary endpoint that disrupts business planning and that impacts the ability to properly price the value of the caps.

Urban experiences with taxi cab medallions exemplify the difficulties of the cap-and-trade regulations. Many cities constrain the number of taxis by requiring all taxi drivers to acquire a "taxi medallion". The supply of taxi medallions are constrained with the purpose of capping the total number of taxis operating within the city. The constrained quantity leads to higher prices; supply shortages during peak usage times (especially during rush hour or rainstorms); and, inflated and volatile values for taxi medallions depending upon the changing market dynamics and the regulatory response.<sup>15</sup> Ultimately, taxi services are compromised as the taxi medallions reduce the taxi market's efficiency.

What holds true for taxi medallions will likely hold true for cap- and-trade regulations on GHG emissions. By imposing a quantity constraint, cap-and-trade regulations could create price volatility with respect to emission allowances and increase overall uncertainty in the market. As implemented, cap-and-trade regimes may also limit the government's options for implementing policies that can offset the adverse economic impacts caused by creating an energy shortage.

The U.S. experience with implementing an income tax is also illustrative. The current U.S. income tax was implemented in 1913. The income tax was applied only to those people earning \$500,000 or more a year, which was the top 1 percent of income earners. Within 10 years, the top marginal tax rate went from 7 percent to 73 percent, and the number of people responsible for paying income taxes exploded. The adverse economic impact from income tax uncertainty has been well documented since. Imposing a new government regulation can be expected to create new uncertainties with respect to corporate planning and investment.

Some have tried to liken the EPA's acid-rain-emissions-trading program to GHG cap-and-trade. The two programs are not comparable on any level. Importantly, the transactions costs with respect to the acid rain program were significantly lower. In terms of scale, the acid rain program involved hundreds of emitters within the U.S., whereas GHG cap-and-trade would involve millions of emitters (if not hundreds of millions) around the world. The technical feasibility of measuring and reducing acid rain-related emissions (sulphur dioxide and nitrogen oxide) from power plant smokestacks is technically much simpler and cheaper than measuring and reducing GHG emissions from a much wider variety of sources. Finally, no one has comprehensively studied the costs and benefits of the EPA's acid rain program in great detail, so it is premature to conclude that it can serve as a model for GHG cap-and-trade. However, the use of quantity constraints implies that the costs with respect to the amount of sulphur dioxide and nitrogen oxide reduction may have been higher than necessary.

#### **A Comment on Universality**

The efficacy of environmental policies is increasingly dependent on the degree to which they are applied universally. If only one-half of the earth implements pollution reducing environmental policies, total pollution emitted would decline but by far less than one-half of the decline if the whole earth implemented the same pollution reducing environmental policies. Pollution of the environment is truly as global as the earth's stratosphere. Chinese pollution affects global warming from Santiago Chile to Vladivostok Russia, from polar ice cap to polar ice cap. An environmental policy imposed on one specific location will only push polluting industries out of that location and into other locations more

polluting tolerant. While the earth's atmosphere could be little impacted, production in the specific location could be devastated. From our perspective, policies such as those adopted recently in California will not be very effective in controlling global warming, but could be quite harmful to California's economy. The failure to achieve universality in a global warming policy will greatly reduce its effectiveness and yet will not significantly reduce its costs.

If the U.S. were to increase its gasoline tax, gasoline consumption in the U.S. would decline for sure. But, simultaneously, gasoline and other oil products would become cheaper and more plentiful to other nations such as China, India and Brazil. In advocating a carbon tax, economist Greg Mankiw observed, "...as a higher gas tax discouraged oil consumption, the price of oil would fall in world markets."<sup>16</sup> The net effect from the gas tax is in part a relocation of carbon emissions that could ironically increase overall carbon emissions because China, India and Brazil are gallon-for-gallon far more serious polluters of the world's environment.

What is true for California and the U.S. is true for Europe, Japan or any individual country or region. Without universal commitment to a carbon reduction regime, people will have the incentive to move businesses that emit carbon from the countries or regions with restrictive carbon policies to the countries or regions without restrictive carbon policies. The net impact on carbon reduction will be diminished, while the net economic impacts can be potentially quite large. Universality is a key precondition for an effective carbon emissions reduction regime.

#### **Conclusion**

As currently conceived, cap-and-trade regulations are an economically harmful and ineffective policy for addressing global warming concerns. Because the regulations would constrain GHG emissions, significant price volatility for emissions allowances, such as the volatility that has been evident in the European Union's emissions market, are a natural consequence. Citing the price volatility issue, the Congressional Budget Office has concluded that cap-and-trade regulations are not a sound policy for addressing global warming issues.

Cap-and-trade regulations would likely impose large economic costs on the U.S. economy. The EIA estimates that overall economic growth could decline by as much as 4.2 percent for just the initial cap of 7%. These estimates assume, however, that the government will auction off the rights to emit GHGs as opposed to simply giving them away at no cost – the approach most commonly discussed in the U.S. and the approach actually implemented in Europe. When coupled with the lack of feasible technological alternatives, the economic impact from a cap-and-trade regulation could be even larger.

The EIA's forecasted economic impacts are substantiated by the real world impacts from previous energy supply shocks. Over the past 40 years, the three supply shocks on the oil market, one of the primary energy sources for the U.S. economy, were all followed by a significant downturn in the economy, an increase in unemployment, and a decline in the stock market.

Technical difficulties in measuring and verifying the validity of traded GHG emissions allowances imply that the global market for GHG emissions will likely be inefficient. Government regulations that fail to define the precise levels of GHG emissions far into the future add another layer of uncertainty, disrupting the ability of businesses to effectively plan and grow their businesses in the future. These uncertainties raise further questions regarding the efficacy of the cap-and-trade regulations.

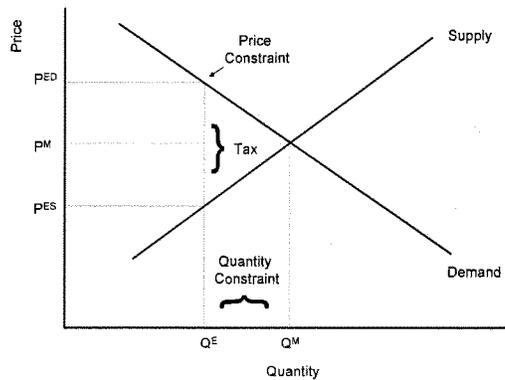
When evaluated as a whole, cap-and-trade regulations would likely impose significant economic impacts on the U.S. economy. These costs argue against implementing cap-and-trade regulations as a response to current concerns over global warming.

**APPENDIX I: Cap-and-trade Regulations, a Chalkboard Example**

Government policies can affect a market by impacting the price of the product, setting the quantity of the product, or setting the price of the product. A tax increase, such as a carbon tax, impacts the price of a product, or is a "price add-on" policy. Regulations, such as cap-and-trade, constrain the quantity of the product. A price constraint establishes a minimum price that must be paid for the product. Economic theory illustrates that with full information, there is no difference between any of these policies.

Figure A1 details the chalkboard illustration of a market whose production creates an externality such as excessive carbon emissions. In this market, supply represents the production of the good that emits GHGs during its production process. Demand represents the consumers' desires for this product. Given the production costs of the product and consumer desires, the market will naturally establish an output level of  $Q^M$  and a market price of  $P^M$  – basic market supply and demand analysis.

**Figure A1**  
**Chalkboard Example**  
**Tax, Quantity Constraint and Price Constraint Equivalency**



However, by assumption, the market-determined level of output is not the correct level. We have established that production of this good emits GHGs, which we will assume is causing global warming. The costs of global warming are real, but neither the producers' nor the consumers' are incorporating these costs into their current decision making processes. Because the market determined output level is not incorporating the costs of GHG emissions on the environment into the price of the product, too much consumption of this product is occurring.

The government's optimal policy response is to ensure that the market properly considers the "full" costs of the product thereby ensuring that the correct production level is established. For the chalkboard illustration, we assume that with the full costs of greenhouse gasses included, the optimal amount of output is reduced from  $Q^M$  to  $Q^E$ . At output level  $Q^E$ , consumers must pay a price of  $P^{ED}$  and producers receive a price of  $P^{ES}$ . This outcome is efficient

because the full costs (including the cost of GHG emissions on global warming) are now being incorporated by both the producers and consumers in the market.

In the chalkboard example we are empowered with great deal of knowledge in this market. We know: the exact supply curve; the exact demand curve; and, the efficient level of output or alternatively the efficient level of GHG emissions. With such knowledge, Figure A1 illustrates that it does not matter whether the government uses a carbon tax, a quantity constraint, or a price constraint.

If the government wanted to impose a carbon tax, it would know for sure that the correct tax is equal to  $P^{ED}$  minus  $P^{ES}$ . Similarly, if the government were to impose a quantity constraint, the quantity of carbon emissions created with a production level of  $Q^E$  is the correct quantity constraint. Lastly, if the government were to impose a price constraint, the price of the product should be established at  $P^{ED}$ . Given what we know about this market, all three policies create the exact same outcome. Total output is reduced to the efficient level and carbon emissions are now optimal.

Policymakers do not have the knowledge contained in the chalkboard example, however. As a consequence, inefficiencies arise, especially with respect to the quantity constraint policies such as cap-and-trade – see Appendix II.

**APPENDIX II: The Inefficiency of Cap-and-trade, a Supply and Demand Analysis**

"Cap-and-trade" regulations are an example of what economists call a quantity constraint. A quantity constraint establishes a fixed quantity of the product that can be produced or consumed. With quantity fixed, all market variations can only impact the price of the product: the greater the quantity restriction, the larger the regulation's impact on price. The greater the amount of variation in market supply and demand, the greater price variability will be evident in the marketplace.

With respect to the cap-and-trade regulations, the cap sets the quantity of GHG emissions allowances in the market. Depending upon the quantity level set, the price of the GHG emissions allowance could be cheap or expensive. If the quantity cap creates a significant production constraint, then the price for a GHG emissions allowance will skyrocket. On the other hand, if the cap is a minor constraint, prices will plummet.

These effects can be clearly seen in Figures A2. Figure A2 details the supply and demand curves for GHG emissions – or more precisely the products whose production and consumption emits GHGs.

**Figure A2**  
**The Economics of Cap & Trade**

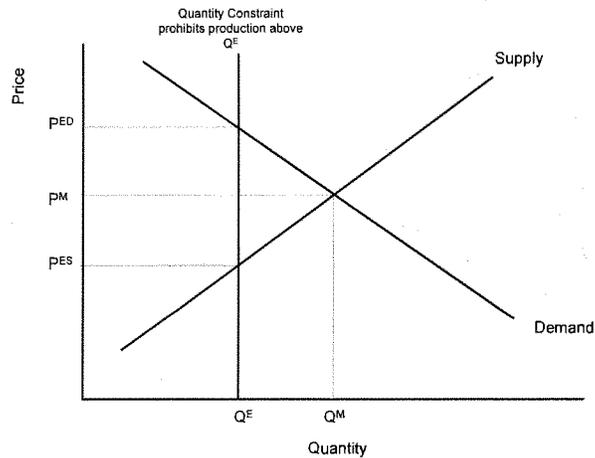
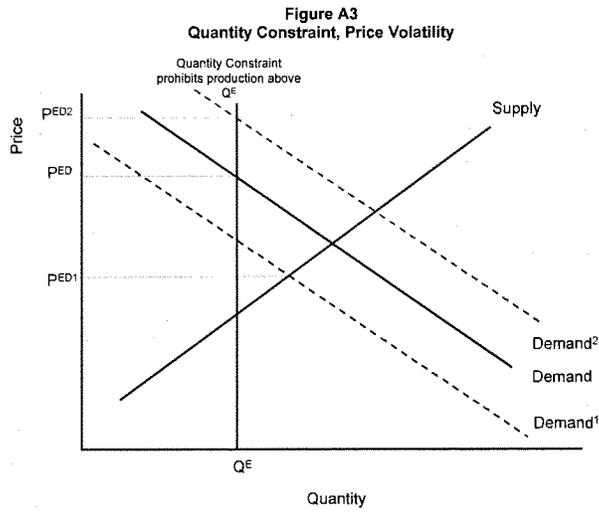


Figure A2 begins with a reproduction of Figure A1, focusing on the quantity constraint scenario. The solid black line at  $Q^F$  represents the quantity constraint that is determined based on the assumed supply and demand curve. By definition of the cap, this is the maximum amount of carbon emissions that can be created. In Figure A3 demand curves fluctuate or otherwise differ from the demand curve assumed by the government to exist when the cap-and-trade policy was established – although we have chosen to focus on the demand curve, the same analysis would hold for the supply curve. As Figure A3 illustrates, the actual prices in the market ( $P^{ED1}$  and  $P^{ED2}$ ) will fluctuate significantly from the expected price ( $P^{ED}$ ) when either demand curves shift or the government based its initial

quantity cap on an inaccurate assessment of the actual market demand curve. The same arguments hold for the supply curves as well. Because the original positioning of the supply and demand curves are not known with certainty and due to changing market dynamics the supply and demand curves will change over time, price volatility arises in a market with a quantity constraint such as the cap-and-trade regulations.



### Acknowledgement & References

Funding support for this study was provided by the Free Enterprise Education Institute.

<sup>1</sup> "How an American carbon-trading system should work". (2007) Economist.com, Jan 22<sup>nd</sup>.

<sup>2</sup> (2003) Addressing the Uncertain Prospect of Climate Change. *Congressional Budget Office: Economic and Budget Issue Brief* April 25.

<sup>3</sup> Kim, Hak-su (2003) Poverty and sustainable development in Asia Pacific region: Issues and policy options. *Harvard Business School 2003 Asia Business Conference* 14-15 February.

<sup>4</sup> (1998) Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity. *Energy Information Administration* October (SR/OIAF/98-03).

<sup>5</sup> Ibid.

<sup>6</sup> Crooks Ed (2007) Electricity generators emissions trading gain, *Financial Times*, June 17.

<sup>7</sup> Dinan Terry and Lim Diane (2000) Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs. *Congressional Budget Office* June. The CBO considered 4 possible implementation scenarios. Under 3 of the 4 scenarios, lower-income individuals faced a larger burden from the cap-and-trade regulations than higher income individuals.

<sup>8</sup> Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.1.

<sup>9</sup> See the Energy Information Agency, <http://www.eia.doe.gov/fuelrenewable.html>.

<sup>10</sup> Bradley, Robert L. and Richard W. Fulmer. (2004) Energy, the Master Resource. Dubuque, Iowa: Kendall/Hunt Publishing Company, p. 88. Available at [http://instituteforenergyresearch.org/MR\\_All\\_Chapters.htm](http://instituteforenergyresearch.org/MR_All_Chapters.htm).

<sup>11</sup> Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.5.

<sup>12</sup> Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.5.

<sup>13</sup> Per capita numbers are calculated based on projected population in 2020 from the U.S. Census, [www.census.gov/populations/projections](http://www.census.gov/populations/projections).

<sup>14</sup> Schmalensee, R. (1996) Greenhouse Policy Architectures and Institutions, *Publications of the MIT Global Change Joint Program*, November.

<sup>15</sup> See for instance, Cervero Robert (1985) "Deregulating Urban Transportation" *The Cato Journal* Vol. 5, No. 1 (Spring/Summer).

<sup>16</sup> N. Gregory Mankiw, "Raise the Gas Tax," *The Wall Street Journal*, October 20, 2006.

Senator SANDERS. Thank you very much, Wayne.

Carol Berrigan is the Director of Industry Infrastructure with the Nuclear Energy Institute. Carol, thanks very much for being with us.

**STATEMENT OF CAROL BERRIGAN, DIRECTOR OF INDUSTRY  
INFRASTRUCTURE, NUCLEAR ENERGY INSTITUTE**

Ms. BERRIGAN. Thank you, Mr. Chairman.

Mr. Chairman and members of the Committee, I am Carol Berrigan, Director of Industry Infrastructure at the Nuclear Energy Institute. I appreciate this opportunity to express the industry's views on the potential for global warming initiatives to produce green jobs.

Let me begin by thanking members of this Committee for their longstanding oversight of the U.S. nuclear industry and the NRC. The 104 reactors operating in the U.S. today are among our Nation's safest and most secure industrial facilities due to the oversight of this Committee, which is to be commended. They are the Nation's lowest cost producers of baseload electricity and represent over 70 percent of the Nation's emissions-free generation portfolio, avoiding nearly 700 million tons of carbon dioxide annually.

Did you know that on a life cycle basis, nuclear's emissions footprint is comparable to renewables? Carbon mitigation strategies from Princeton, Columbia, Harvard and the Pew Center for Global Climate Change have concluded a clear path for meeting the global challenge of reducing greenhouse gases relies in part on an expanded portfolio of low emission sources of electricity, including nuclear power.

Responsible climate change legislation must address the connection between energy costs, trade, and employment. A carbon-constrained economy may lead to the use of readily deployable lower CO<sub>2</sub> -emitting technologies such as natural, that can have a perverse impact on manufacturing and agricultural sectors. Nuclear power must play a role in a carbon-capped economy to alleviate price pressures on natural gas supplies and to maintain a competitive trade balance in a global economy.

A September 8th resolution adopted by the AFL—CIO's Building and Construction Trades Department and submitted as an attachment to my written testimony, states: "If America wants to seriously address greenhouse gases and global warming, then we must be serious about expanding our nuclear power generating capacity. The technology to build zero-carbon nuclear reactors is already available. Pricing on new reactors is no longer unreliable and they will fit into existing electrical grids seamlessly. America needs the power and the jobs that new nuclear generation will provide."

Nuclear energy clearly links to creating those green jobs. Today, the average nuclear plant employs between 400 and 700 people, and pays substantially more than average salaries in the local community. The median salary for an electrical technician is over \$67,000 a year; for a mechanical technician, over \$66,000; and for a reactor operator, over \$77,000 per year. These jobs often do not require a 4-year degree and include medical benefits, pensions and generous incentive compensation plans. These are wonderful jobs.

Regardless of the carbon control policy selected, credible analyses indicate an increasing role for nuclear energy. The technology-based EPRI prism scenario indicates roughly 64 gigawatts of new nuclear capacity by 2030, translating to roughly 46 new nuclear power plants. Forty-six additional plants will generate over 64,000 to over 82,000 construction jobs, with peak employment over 128,000, including skilled trades, engineers, project managers, and construction supervisors. Once built, these 46 plants can permanently employ over 18,000 to 32,000 workers and generate over 18,000 to 32,000 additional jobs in the local community; nearly \$20 billion in annual expenditures, \$920 million in State and local tax revenues, and \$3.45 billion in Federal taxes.

Beyond the jobs in construction, new nuclear plants will require components and commodities including pumps, valves, piping, tubing, cement and steel rebar.

What can this Congress do to help ensure that Americans get as many of these new green jobs as possible? This Congress has demonstrated leadership in addressing work force challenges from the American Competes Act to support for nuclear engineering education, and we thank you for this. But there is more work to be done in developing the technical and skilled trade work force that our Nation will need. We must raise awareness about the impending skilled craft labor shortages and its potential impacts; elevate the image and prestige of skilled craft careers; attract, recruit and train workers, particularly from untapped and under-represented labor pools; align investments in work force development initiatives; and implement performance-based education and training through vocational and technical programs at the secondary and post-secondary level.

Congress should consider policies to encourage investment in energy sector manufacturing, and also pass implementing legislation for the Convention on Supplementary Compensation.

In conclusion, Mr. Chairman, it has been shown that any credible program to reduce GHG emissions must include nuclear energy. In doing so, the industry will hire and retain tens of thousands of skilled and well paid workers. Those jobs will be based in the United States and will contribute to two of our highest national priorities: the climate and energy security.

Scanning 63-84

Thank you.

[The prepared statement of Ms. Berrigan follows:]

STATEMENT OF CAROL BERRIGAN, DIRECTOR OF INDUSTRY INFRASTRUCTURE,  
NUCLEAR ENERGY INSTITUTE

Madam Chairman, Ranking Member Inhofe and members of the Committee, I am Carol Berrigan, Director of Industry Infrastructure at the Nuclear Energy Institute. I appreciate this opportunity to express the industry's views on the potential for global warming initiatives to produce green jobs.

Let me begin by thanking the Members of this Committee for their long-standing oversight of the U.S. nuclear industry and the Nuclear Regulatory Commission. The 104 reactors operating in the United States today are among the safest and most secure industrial facilities in the United States in part due to the oversight of this Committee for which the Committee is to be commended. In addition, they are the nation's lowest cost producer of base-load electricity, averaging just 1.72 cents per kilowatt-hour.

Those 104 nuclear power plants produce one-fifth of America's electricity, and U.S. utilities are preparing to build advanced-design nuclear power plants to meet our nation's growing electricity demand.

Today, nuclear energy represents over 70 percent of the nation's emission-free generation portfolio, avoiding 3.12 million short tons of Sulfur Dioxide, .99 million short tons of Nitrogen Oxide and 681 million metric tons of Carbon Dioxide compared to the fossil fuels that would have been burned in the absence of nuclear energy.

On a life-cycle basis, all energy-generation technologies emit some amount of CO<sub>2</sub> during the manufacture of components (whether it be pressure vessels, wind turbines, or photovoltaic cells) and other activities not directly associated with the production of electricity at the power plant, a number of studies by organizations such as the Organization for Economic Co-Operation and Development have concluded that nuclear energy's emissions "footprint" is comparable to renewables.

Nuclear energy holds 'great potential' for meeting our nation's future climate related goals. Climate change is increasingly important as Federal, State and local policymakers consider energy supply and greenhouse gas mitigation. Given those concerns and the need for affordable and reliable base-load electricity production, policymakers and energy industry leaders are evaluating an expanded role for nuclear power. Just this morning, NRG announced that it has taken concrete steps toward this expanding role with the submission of a Combined Operating License Application for new nuclear reactors to be built in Texas.

Carbon mitigation strategies from Princeton University, Columbia University's Earth Institute, Harvard University and the Pew Center on Global Climate Change have reached a similar conclusion: A clear path toward meeting the global challenge of reducing greenhouse gases relies in part on an expanded portfolio of low-emission sources of electricity, including nuclear power.

A 2006 report by the Progressive Policy Institute states that expanding nuclear power should be part of a plan that would help avert a dangerous long-term energy crisis and address air-quality issues. The Institute's "Progressive Energy Platform" states that nuclear energy "holds a great potential to be an integral part of the diversified energy portfolio for America."

At a 2004 State of the Planet Conference at Columbia University, scientists, academics and government officials identified four essential elements for human well-being: energy, food, water and health. Maintaining access to energy, conferees said, "will require new technologies, in some combination of renewable and nuclear energy; energy conservation; and industrial carbon sequestration."

Nuclear energy also is part of the strategy for combating climate change in an energy security plan released by the Center for American Progress, a progressive think tank. The center recommends that the United States establish a "renewable portfolio standard" mandating that 10 percent to 25 percent of electricity be produced from renewable resources and nuclear energy by 2025.

The linkage between nuclear energy and the creation of green jobs was forcefully expressed on September 8th in a resolution adopted by the AFL-CIO's Building and Construction Trades Department. Let me quote "if America wants to seriously address greenhouse gasses and global warming, then we must be serious about expanding our nuclear power generating capacity. The technology to build zero-carbon nuclear reactors is already available. Pricing new reactors is no longer unreliable. And they will fit into existing electrical grids seamlessly. America needs the power and the jobs that new nuclear generation will provide."

In a carbon controlled environment, nuclear energy offers substantial additional benefits. We all recognize that responsible climate change legislation must address the interconnection between energy costs, trade, and employment. The imposition of emission controls by some, but not all, major emitting nations may disrupt the competitive trade balance between nations and inappropriately shifts jobs to countries without emissions controls, where manufacturing costs will be less. A carbon constrained economy may lead to the use of readily deployable lower CO<sub>2</sub> emitting technologies, such as natural gas, that can have a perverse impact on our manufacturing and agricultural sectors. Nuclear power must play a role in a carbon capped economy to alleviate price pressures on natural gas supplies, and to maintain a competitive trade balance in the global economy.

Studies have generated varying estimates of the amount of new nuclear generation that will be deployed under a variety of climate change initiatives. If you refer to Chart 1, you will see a number of the different analyses depicted. Regardless of the carbon control policy selected, the preponderance of the credible analyses indicate an increasing role for nuclear energy.

I draw your attention to the EPRI analysis on the bottom of the chart. This analysis is a technology-based assessment. It indicates roughly 64 GW of new nuclear generating capacity deployment by 2030.

Since the interest of this Committee is job creation, I will describe what this 64 GW of new nuclear capacity means in terms of employment. Let me first preface my remarks by stating that for the purpose of this discussion, each new nuclear plant will be referenced at roughly a 1.4 GW. In reality, the nuclear plant designs under consideration by U.S. utilities range in size from 1.1 GW to 1.7 GW in generating capacity. The 64 GW in additional nuclear capacity translates to roughly 46 new nuclear plants.

Today, the average operating nuclear plant employs 400 to 700 people and jobs at these plants pay substantially more than the average salaries in the local area. For example, the median salary for an electrical technician at a nuclear power plant is \$67,517, for a mechanical technician, it is \$66,581 and for a reactor operator, it is \$77,782. A senior reactor operator's median income is \$85,426. Jobs in the nuclear industry are great jobs to have, they commonly include family medical benefits, pensions and generous incentive compensation plans. And, jobs in the nuclear industry are safe with fewer reported accidents than numerous other industries, including banking and other white-collar occupations.

In addition to direct employment, each plant creates economic activity that generates 400 to 700 additional jobs within the local community and produces approximately \$430 million annually in expenditures for goods, services and labor, and through subsequent spending because of the presence of the plant and its employees. The average nuclear plants also contributes more than \$20 million annually to State and local tax revenue, benefiting schools, roads and other State and local infrastructure and provides annual Federal tax payments of \$75 million.

In addition to the ongoing employment at the nation's nuclear fleet, each new nuclear plant that is constructed will employ between 1,400 and 1,800 people during construction with peak employment of up to 2,800 individuals. These jobs include skilled trades such as welders, pipefitters, masons, carpenters, millwrights, sheet metal workers, electricians, ironworkers, heavy equipment operators, insulators, engineers, project managers, and construction supervisors.

These 46 additional plants will generate 64,400 to 82,800 construction jobs (with peak employment at 128,800). Once built, these 46 plants can generate 18,400 to 32,200 permanent fulltime jobs operating each plant, 18,400 to 32,200 in additional jobs in the local community, \$19.78 billion in annual expenditures for goods, services, labor and through subsequent spending, \$920 million in local State and local tax revenue and \$3.45 billion in Federal tax revenues.

Beyond the jobs in construction, new nuclear plants will require components including pumps, valves, piping, tubing, insulation, reactor pressure vessels, pressurizers, heat exchangers, and moisture separators to name a few, and commodities like cement, structural steel, steel reinforcing bar, stainless steel, cable tray and cabling.

What can this Congress do to help ensure that Americans gets as many of these green jobs as possible?

The first area in which Congress can provide leadership is in the development of the work force. As you may already be aware, the nuclear industry, like many other parts of the energy sector, is seeing the leading edge of a wave of attrition due in large part to demographics. We project that as many as 35 percent of our incumbent work force may be eligible to retire within 5 years. Further, there are few work force training programs focused on the skills needed for successful employment in the nuclear energy industry and there has been an overall decline in high quality career and technical education.

I encourage you to develop and support work force development policies that 1) address the science, technology, engineering, and math (STEM) workforce challenges identified in the National Science Foundation's "Gathering Storm" report, and 2) address the challenges of developing a high quality technical work force with a focus on the skilled trades.

This Congress has demonstrated significant leadership in addressing some of these work force challenges. The recently enacted America Competes Act establishes a solid policy framework for addressing the challenges in the STEM workforce and we look forward to this Act's implementation. This Congress has long supported the nuclear engineering education and university programs and we thank you for your continuing support.

But there is work to be done in developing the technical and skilled trades workforce that our nation will need to deploy additional generating capacity, including nuclear. Specifically we must:

- raise awareness of the impending skilled craft labor shortage and its impact on the energy sector

- elevate the image, status and prestige of skilled craft careers in the energy sector
- attract, recruit and train workers, particularly from untapped and under-represented labor pools
- align investments and work force development initiatives to ensure collaboration and coordination of government, industry and labor efforts in the develop the energy skilled trades work force
- build partnerships that promote talent and economic development
- implement performance-based education and training programs for skilled craft workers through vocational and technical education programs in secondary and post-secondary educational environments.

The second area in which this Congress can provide leadership is in the development of nuclear manufacturing infrastructure in the U.S. When the current fleet of nuclear power plants were built from the 1960's to the 1980's, there was a substantial nuclear manufacturing infrastructure in the U.S. As new nuclear construction declined from the late 1980's through the turn of the century, the domestic nuclear industry contracted.

Congress should consider policies that will encourage investment in energy sector manufacturing to provide components to the nuclear industry, as well as other energy technologies the Nation will need. The United States has long been a leader in innovation and advanced manufacturing. I encourage you to promote policies that take advantage of the growth of our energy sector, and American ingenuity, productivity and entrepreneurship by encouraging the manufacturing industries that will support future energy development to produce their products in the U.S.

This can be achieved though a number of initiatives. First, Congress should support the export of U.S. nuclear products and services by passing implementing legislation for the Convention on Supplementary Compensation. We commend this Committee for leadership on this issue.. Second, Congress should consider financial incentives for investment in manufacturing through a number of instruments including tax credits or accelerated depreciation of capital investments.

Madam Chairman, in conclusion, nuclear energy can make a significant contribution to the reduced GHG emissions goals of any global warming initiative. In fact, any credible program to reduce greenhouse gas emissions must include nuclear energy. In doing so, the industry will hire and retain tens of thousands of skilled and well-paid workers. Those jobs will be based in the United States and will contribute to two of our highest national priorities; the climate, and energy security.

---

RESPONSE BY CAROL BERRIGAN TO AN ADDITIONAL QUESTION FROM SENATOR BOXER

*Question.* Were you aware of the Center for American Progress's relationship to this report and their stance on nuclear power?

*Response.* When I presented my testimony, I was unaware of the Center for American Progress's relationship to this report and their stance on nuclear power as expressed in the letter from Mr. Podesta. Thank you for drawing this issue to my attention and forwarding a copy of the letter expressing their concern.

As it appears, the correct citation for the report is "The National Security Task Force on Energy" whose members included: Madeleine K. Albright, Samuel R. Berger, Rand Beers, Carol Browner, William Danvers, Tom Daschle, John Deutch, Thomas J. Downey, Michle A. Flournoy, Leon Fuerth, Suzanne George, Denis McDonough, James C. O'Brien, Peter Ogden, John Podesta, Susan E. Rice, Wendy R. Sherman, Gayle Smith, Tara Sonenshine, Jim Steinberg and Timothy E. Wirth.

Upon researching the correct citation for this report and review of the CAP letter, I noticed that the July 26, 2006 press release for this report that is posted on the CAP website, clearly marked with a copyright notice for CAP states that "The Center for American Progress today hosts a morning conference to unveil a new report, "Energy Security in the 21st Century," which presents a comprehensive strategy for sharply reducing our dependence on foreign oil, confronting the threat posed by climate change, eliminating key proliferation threats, and building a more secure international energy environment."

The same press release goes on "There is widespread agreement across the political spectrum that America's addiction to oil leaves it dangerously dependent on unstable or hostile regimes for its energy supply. This vulnerability is growing as new conflicts flare up in oil-rich regions and gas prices skyrocket to record highs. The Bush administration has demonstrated a willingness to acknowledge the existence of such energy security challenges, but has failed to implement a plan to meet them. By following this report's recommendations, however, the United States can chart a

new course toward increased energy independence and enhanced national, economic, and environmental security.”

The bolded sentence above can easily be interpreted as an unqualified endorsement of the report’s recommendations by the organization that issued the press release. I would encourage CAP to qualify their press statement so it does not appear as though CAP is affiliated with or endorses the report.

Further, I agree with Mr. Podesta’s statement that the report does not provide an unqualified endorsement of the use of nuclear power for energy generation, nor does my testimony. As in my testimony, the report specifies support for nuclear power for inclusion in a national renewable portfolio standard. Mr. Podesta notes that the report recommendation states “responsibly generated nuclear power”. The U.S. commercial nuclear industry has an impeccable track record of generating safe, affordable and clean nuclear power. The commercial nuclear industry also has an excellent record of responsibility managing its used fuel. In my view, my testimony and the recommendation are consistent.

#### RESPONSES BY CAROL BERRIGAN TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

*Question 1.* Can you explain what the barriers are to siting new nuclear plants?

Response. Most of the new nuclear power plants announced to date would be built on “brownfield” sites, which already include one or more operating nuclear power plants. Many of these sites were originally scheduled for more reactors than were actually built and, in general, and have the infrastructure and attributes (e.g., available land, cooling water, transmission access, strong local public support) to support new nuclear plant construction. There is substantial capacity in the United States to build new nuclear plants on existing sites.

The barriers to siting new nuclear plants include the physical characteristics of the site and the permits necessary from State and local authorities.

The physical characteristics of the site include specific criteria such as geology, hydrology, meteorology, demographics, environmental sensitivity, and land use. In addition, the location must meet the physical needs (e.g., for cooling water supply) of the intended plant design and the business needs of the project sponsor (e.g., proximity to large electrical load centers and transmission corridors.)

In order to receive a combined construction permit and operating license (COL) from the Nuclear Regulatory Commission, a company planning to build a new nuclear plant must demonstrate that the site meets all applicable standards necessary to protect public health and safety and the environment. NRC reviews, and additional reviews by State and local agencies, include examination of such issues as environmental impacts, effluent discharges, hazardous materials controls, water use, sewer hook ups, road use and traffic controls, property taxes, building codes and inspections.

*Question 2.* What are the consequences if we had carbon caps and did not aggressively build new reactors?

Response. Analyses by the Energy Information Administration (EIA), the Electric Power Research Institute (EPRI), and others indicate that new nuclear plants are essential to achieve reductions in carbon emissions from the electricity sector needed to meet the proposed carbon caps now under consideration. In one such analysis, “The Power to Reduce CO<sub>2</sub> Emissions”, EPRI concluded that “CO<sub>2</sub> emissions reductions policies will create a cost to the U.S. economy” (p. 4–3). The cost to the economy depends on whether a full portfolio of technology advancements and deployment can occur. These significant technology advancements include coal with carbon capture and sequestration, nuclear, renewables and aggressive end-use efficiency. If these technologies (including substantial numbers of new nuclear plants) are not deployed, the net cost to the nation’s economy will be much greater because the alternative is a heavier reliance on natural gas plants.

Increasing demand for natural gas in the electricity sector would put greater upward pressure on natural gas prices. Natural gas prices have already more than doubled in the U.S. since the 1990’s, creating a large economic burden for industries like chemicals, plastics and others that use natural gas as a fuel and a feedstock. Not only do high natural gas prices affect the industrial and electrical sectors, but the residential sector will also see higher prices for the natural gas needed for heating. Relying on more natural gas for power generation would only exacerbate this problem.

The EIA has analyzed several legislative proposals to mitigate greenhouse gas emissions. For instance, Senators Lieberman and McCain proposed S. 280, the Climate Stewardship and Innovation Act of 2007, which would establish caps on greenhouse gas emissions starting in 2012 with increasingly stringent caps in 2020, 2030 and 2050. The EIA analysis estimated an increase of 145 gigawatts (GW) of new

nuclear capacity (equal to more than 100 new nuclear plants) would be needed by 2030 to meet the S. 280 caps.

The EIA also analyzed a proposal by Senators Bingaman, Landrieu, Murkowski, Specter, Salazar, and Lugar which would establish annual emissions caps based on targeted reductions in greenhouse gas intensity, defined as emissions per dollar of Gross Domestic Product (GDP). This proposal is not as drastic a greenhouse gas reduction as proposed by Senators Lieberman and McCain, but still requires a 47 GW increase in new nuclear capacity by 2030.

*Question 3.* What is the importance of providing baseload energy to the grid versus variable energy?

Response. Baseload power plants—typically nuclear plants or coal-fired power plants—and intermittent or variable resources—often renewable resources—both have their place in America’s electric supply system.

Baseload power plants provide the electricity required on a 24 hour per day, 7 day per week, 365 day per year basis. Baseload power plants produce large amounts of electricity with high reliability. Their large capacity helps the electric transmission system adjust to normal variations in electricity demand (e.g., as industrial facilities ramp up and down). They are also typically the lowest-cost generating plants on the system.

Intermittent or variable energy resources include many renewable energy sources, such as wind and solar. Wind farms, for example, typically have capacity factors in the 30–35 percent range due in large part to the intermittent or variable nature of the wind. This attribute represents a challenge for operators of the transmission system, because they must have back-up resources on standby to manage the fluctuations in output associated with intermittent or variable resources. Nonetheless, the transmission system has demonstrated that it can manage this challenge. Renewables can and must play a significant role in America’s electricity supply, because they (like nuclear power plants) are emission-free and carbon-free when generating electricity.

Baseload sources of electricity (like nuclear and coal-fired power plants) and intermittent sources like many renewable resources thus serve different needs. Intermittent or variable resources alone cannot supply the large volumes of around the clock electricity required by our \$11 trillion, 4-trillion-kilowatt-hour-a year economy.

Senator SANDERS. Thank you very much.

Let me take a few minutes to ask some questions, then we will go to Senator Alexander and then Senator Lautenberg.

Mr. Gabriel, thank you again very much for being with us today. It is generally recognized that Germany has been perhaps the leader in the world in moving toward solar technology and solar energy. Can you explain what the feed-in program is? I know my friend Dick Armev likes to create a whole lot of capitalists. My impression is that you are creating many, many small business people in Germany who are making money by selling solar energy into the system.

Would you talk a little bit about that in particular, and what Germany is doing with regard to solar energy?

Mr. GABRIEL. Thank you, Mr. Chair. We not only created small businesses, but also some American companies came to Germany to produce solar wafers. In the east part of Germany we had some areas where we lost thousands of jobs after the reunification. Nobody wanted to go there, and now this is the area where we get thousands of new jobs, all in the solar industry. In Saxony-Anhalt, for example, we have around about 2,000 new jobs and some of them, half of them are created by American companies.

Senator SANDERS. Are they producing photovoltaics?

Mr. GABRIEL. They are producing photovoltaics, from the beginning, from the wafers, up to the cells. These are big companies—Q-cells, for example, and some others—with United States owners of these companies. So what we did in the past is that we set a clear and stable and a long-term political framework for this new

industry. The framework is a feed-in tariff which starts relatively high and then over the time of 15 or 20 years, every year decreases.

You can say, to be very honest, that every German adult has to pay by his electricity bill at the end of the month, one Euro per month for this feed-in tariff. You can say, OK, one Euro is one Euro and it is 12 Euros a year. Maybe for some people this is a lot of money, but we thought for creating a new industry, and for creating hundreds and thousands of jobs, it is not very much.

Senator SANDERS. Let me ask you how it works. I own a house in Germany, right? And I install a photovoltaic unit.

Mr. GABRIEL. And you have the right to feed in your produced electricity in the German grid.

Senator SANDERS. And if I produce more than I consume, I make money on that?

Mr. GABRIEL. Yes. You are a power producer.

Senator SANDERS. I am a power company.

Mr. GABRIEL. Yes, you are a power company and you can feed in your electricity in the German grid and you get money, a stable amount of money. But every year it goes down and decreases over the period of years.

Senator SANDERS. Let me ask you, how many homes in Germany now have these units and this arrangement and what is your hope for the future?

Mr. GABRIEL. Some 100,000. I don't know exactly.

Senator SANDERS. Is that a growing number?

Mr. GABRIEL. Yes, of course, of course.

Senator SANDERS. And people like that idea?

Mr. GABRIEL. People like this idea, and they like the idea to use the special form of renewable energy which is the best form for their house. Some of them use geothermal power. Some of them use photovoltaics. Some others use wind.

Senator SANDERS. OK, in my limited time let me go to Mr. Khosla. You made the point that your concern in this issue was not just environmental and global warming, but was very economic and profit-making and job growth. Could you amplify on that a little bit please?

Mr. KHOSLA. Absolutely. I believe that even for people who don't believe in global warming, climate change legislation is warranted, mostly because it will create competitors for traditional energy sources. All the indications are that in the relatively short term, being three to 5 years, we will have cheaper sources of energy than oil when it comes to transportation, and coal-based IGCC power when it comes to power generation.

So I am making strictly an economic argument by giving choice in the marketplace and creating competition, and frankly leveling the playing field. Because traditional industries have had huge subsidies, and in fact continue to have subsidies, which makes it very difficult for newcomers to compete, especially since they are not at scale.

Senator SANDERS. When you are talking about sustainable energy, what are you talking about? Solar, wind, geothermal?

Mr. KHOSLA. Yes. I am mostly talking about solar and geothermal energy for power generation, and biofuels competing with oil.

Senator SANDERS. What do you see, in my remaining minute here, what do you see as the potential of solar? Will prices go down, do you believe?

Mr. KHOSLA. I believe that today we can be below 10 cents a kilowatt hour for solar thermal, not solar photovoltaic technologies, which are newer technologies getting recent attention. At the request of Senator Alexander, in an area that is not friendly to solar like Tennessee, we made a computation of the cost of solar thermal power in Tennessee at TVA's cost of capital. The answer was below 6 cents a kilowatt hour.

Senator Alexander was kind enough to spend 6 hours looking at the issues.

Senator SANDERS. OK. Thank you very much.

Senator Inhofe?

Senator INHOFE. Thank you, Mr. Chairman.

I would have to say that Senator Alexander might be the only one who would spend 6 hours on such a subject. He is famous for that and he is a very thoughtful person.

Let me address something to Mr. Armey. Dick, our friend Dingell over in the House has proposed a carbon tax, higher tax as a way of reducing carbon emissions, such as 50 cents per gallon of gasoline in tax and so forth.

Now, I am not for that, but I am also not for a carbon tax. I think as I look at this, and I say, you know, recently you have seen such changes in the science and all this, but the one thing that seems to be a certainty, even though the science is not, is the cost of this thing. The only response I have to Dingell is, I think that is a more honest way of doing it. To me, a cap and trade thing is the way of going in the back door and not letting people know how much this is costing.

What do you think?

Mr. ARMEY. I have to agree with that. I mean, you could take the proposition as advanced by Congressman Dingell and take it all the way back to Arthur Cecil Pigou and the early research on what is called economic externalities and trespass against the environment that really was a consequence of the government's failure to define the proprietorship of the environment and therefore charge for its use.

The one thing about the Dingell approach that I like is it simply sets the cost out there and it tells business, if you want to find a way to stay in business, produce for a good return for your investors, then innovate, create.

What I would argue is that the history of innovation, invention and creation is such that the best of it has come in pursuit of a profit by private innovators and creators, and the worst of it has come from government-inspired decisionmakers. I happen to be, for example, a big fan of wind. I think it is a great opportunity. I would argue that it is only by virtue of government action that we do not today see cheap wind off the Nantucket coast. It is clearly a politically defined NIMBY problem of people in high places getting the government to stop it. So the fact of the matter is again

if it were left to a free market, you would be generating wind energy off cape wind today.

Why do we not have better nuclear? I would argue that if French engineers can be depended upon, American engineers can do the job. And yet we have government barriers to it. I would argue that it is because of government regulation that we have never fully developed the marvelous low sulfur coal resources we have, indeed have even put some of them in State parks while we continue to try, without much success, to scrub dirty coal, again because of government regulations.

The market is fluid. The market encourages the genius of the private sector, what my daddy used to call the practical American genius to find the solution.

Now, the problem with the cap and trade is the first thing I always ask about cap and trade, and I have a recommendation for this committee should you pursue cap and trade, is where do you make the initial allocation of the allotments? I say, give them to Medicare. Let Medicare peddle them to the private sector. We can solve another problem of a badly mismanaged government program's liquidity crisis.

Where else are you going to get them? My guess is politicians will make decisions about who are our best friends, and on that basis the initial allocations of carbon allotments will be made, apparently politically defined distribution and redistribution of wealth.

Then from that the market can probably make some allocative decisions. But what waste and inefficiencies will be borne from that in the outset is hard to measure.

Senator INHOFE. I think you have actually answered about three more questions I was going to ask you. So I appreciate that very much.

Mr. Winegarden, you heard what I said about it. Isn't that a more honest way of doing it than cap and trade? What do you think?

Mr. WINEGARDEN. It is absolutely a more honest way because you are putting the cost explicitly out there. You have a measure of the economic costs that you are imposing. What we would emphasize, and we have written a paper on this, is the importance of taxes are a negative incentive. So if we are going to impose a very large negative incentive on the economy, what we want to do is we want to offset that with a positive incentive by cutting marginal tax rates elsewhere so that we have a complete balancing out of the negative effects from the tax.

Senator INHOFE. Yes. I am not sure if that is what Congressman Dingell has in mind.

Let me just ask one other thing. I think we will get a chance to go 1 minute over here. One of the things that has bothered me is all these things—you know, we went 15 years up until about 1995 without one additional coal-fired generating plant. The Chinese are cranking them out about once a week.

Now, would you buy the argument that somehow we could pass something that should apply to developed countries, and then all of a sudden because of the good example that we have set that China will follow. What do you think about that, Dick?

Mr. ARMEY. Well, I mean, I laugh. Now, I hear a lot of people who complain in America that we are exporting all our manufacturing jobs. If we put such stiff costly environmental regulations in this Country that are prohibitive, we might very well likely see manufacturing done in China or other nations with lesser standards that has a greater global impact on the environment than what would happen had these manufacturing facilities been kept in this Country under a less rigorous standard.

Senator INHOFE. So if we are going to export our jobs, they are going to be in a place where they are going to pollute more than if they were staying here. That is a good point.

Thank you, Mr. Chairman.

Senator SANDERS. Thank you.

Senator Lautenberg.

Senator LAUTENBERG. Thanks very much, Mr. Chairman. I am sorry that I wasn't here to hear all of the testimony expertly given with slightly different points of view in some cases.

One of the things is, I come out of the computer business. I ran a company called ADP. One of the things that we used to do in our search for air conditioning and better air quality for the staff working was to recirculate our air. When I went back after being here several years and saw the reduction in the size of the computer facility, I thought we had lost all our business, but in fact what had happened is the computer manufacturers got with the drill and got more information processed with a lot less requirement for heat and cooling and so forth.

So Mr. Khosla, we are pleased to see you here. Some of the legislative proposals include a safety valve to permit companies to emit more than they cap if the cost to those companies goes above a certain price. Well, you are an investor. Do such provisions as a safety valve undermine the use of new cleaner technology? And what effect might such a provision have on the investment side of things?

Mr. KHOSLA. Sir, I am a fan of safety valves. I do believe consumers deserve low prices, and I am not a huge fan of the German system of feed-in tariffs, which unnecessarily raises prices and is market-inefficient. There are technologies that could supply power in Germany at under 10 cents, yet solar power is under 10 cents, yet the feed-in tariff rates are at 40 cents.

So I do believe we should have something like the renewable popelier standard where the price of electricity goes to the most competitive technology. But if that price is too high, we should have some safety valves. It is a balancing act. Is it too high or too low? I first believe that no technology should be subsidized for more than 7 years after it is introduced in the marketplace. That is sufficient time for a technology to mature scale and get to market. Most technologies will make it in that timeframe.

So really I differ from most of the panel in saying green technologies will succeed because they are cheaper, because they are subject to the same kind of innovation. I was one of the founders of Sun Microsystems back in 1982 and I know what happens to costs when you start innovating. We have gone through it in the telecom business. Ten years ago, I said long distance calls would be free. AT&T didn't believe it. They were sold for a song.

There are many, many examples of costs coming down. But if technologies get long-term subsidies, then inefficient technologies will make it to market. So my answer is, we do need safety valves to protect consumers and industry, but in fact we do need legislation to get these alternatives started and to compete in the marketplace and create more targets.

Today, the problem is not that cheaper technologies are not available, it is lack of competition. Competition will drive down costs.

Senator LAUTENBERG. Thank you.

Mr. Gabriel, welcome here. In Germany, you have set targets for carbon emission reductions. They are much stronger than the European Union's target. Having set a stronger target, has that been of help to the clean energy industry in Germany?

Mr. GABRIEL. First of all, would you allow me one remark? Ten years ago when we started with wind energy, everybody said that it would be too high, and result in a high price for electricity, but the electricity sector today in the field of renewable energy is competitive with the rest of the electricity sector. And 70 percent of the windmills we produce are going to the export.

We think that to invest in solar for the next 7 years or 8 years will be the next chance, the next opportunity for Germany to export solar and thermal technologies and photovoltaics. So our strategy is not only to reduce carbon dioxide, not only to be more independent from energy resources from Russia and other countries. It is also an industry strategy for the export of our technologies. I only want to explain that this is the reason why we are able to explain to our population that they have to pay subsidies, it is because we want to create new jobs.

Your question was, whether they helped, the ambitious targets for our industry. Of course, we have the same struggle you have in your discussions with your industry. But the interesting thing is that yesterday the German industry association presented a new study made by McKinsey about the energy and climate targets of the German government. And what they said—they were our hardest strugglers in the industry—they said that the ambitious targets of the German government will help the industry to become more efficient and here we are only discussing about 5 percent or 6 percent of our program for climate and energy, the majority of the issues are already being accepted by the industry.

Senator LAUTENBERG. Thank you.

Senator SANDERS. Thank you very much, Senator Lautenberg.

Senator Klobuchar.

**STATEMENT OF HON. AMY KLOBUCHAR, U.S SENATOR  
FROM THE STATE OF MINNESOTA**

Senator KLOBUCHAR. Thank you, Mr. Chairman.

I am from Minnesota and we have a very aggressive renewable energy standard for electricity: 25 percent by 2025; 30 percent for Xcel. It is a bipartisan effort supported by a Republican Governor. Because of that and our strong work in the ethanol area, we have just seen revitalization of a lot of our rural communities. I have seen it firsthand.

My first questions were about wind energy. I think it was in your testimony, Mr. Khosla. You talked about how, according to some studies, an extra 30,000 jobs could be created in agriculture alone with an aggressive renewable electricity standard. Could you talk a little bit about where those jobs are coming from? I look at that only because I was in a tiny town in Minnesota where half the population was working at a wind tower manufacturing company. There was a recent article in *The Wall Street Journal* about how these wind turbines take 8,000 parts and there are delays. Where will these jobs come from, and what do you think we should be doing so that these jobs are home-grown jobs in our own Country?

Mr. KHOSLA. Senator, I can speak to both the study level and the individual level. At the various levels, econometric studies by various institutions, the Union of Concerned Scientists, even the NRDC and others, have proven that renewable energy generates twice as many jobs. The fallacy, of course, is in the assumptions. You can make one set of assumptions and come up with one answer; make another set of assumptions, and come up with a different answer. In fact, I wrote one of the first computer courses in 1977 for the School of Public Affairs to teach econometrics. So I am very familiar with the topic and the sensitivity of the assumptions.

What I can tell you is at the specific level, when we take a company we have invested in, like AUSRA, and compare its job creation to that of coal, IGCC plants or pulverized coal plants, there are twice as many jobs. I haven't looked at the wind industry directly. When I compare somebody like Range Biofuels, which is producing cellulosic ethanol, to oil, for dollar of investment, you create far more jobs.

So whether it is at the study level, but more important to me at the specific example level of replacement technologies for oil and coal, we see more job creation.

But equally importantly, we will see lower prices, and because of that we will see larger economic growth, and that is where I believe the econometric models you have heard about are wrong. They don't assume a role for technology. That is where I think the discrepancy comes.

Senator KLOBUCHAR. Other ideas from other panelists? One of the things we have talked about is having the tax credit last for a longer time. It has been like a game of red light/green light. Going off and on is harder for people to invest in wind because of that.

Any other thoughts from the panelists on what we can do? In Germany, could you talk a little bit about how you built such a big industry?

Mr. GABRIEL. I can only give the same answer, because of the feed-in tariff and the stable framework. We started with wind energy maybe 10 or 15 years ago. When we asked our economists, they said that it was impossible to get more than 4 percent of the electricity out of the wind energy sector. "You will create too high costs. It is not competitive."

Today, we see that it is one of the biggest parts of our exports. The steel industry in Germany gets a lot of incentives out of the wind industry. Of course, they have to produce a lot of windmills, but again, 70 percent of the windmills which are produced in Ger-

many today, they are going to the export. The biggest German wind companies, they get into discussion with a French company who wanted to buy them, and there is also an Indian company who wants to buy them.

So at the beginning, there was a stable framework where the investments in the industry are secure, this was the beginning of this success story. Today, of course the industry is competitive.

Senator KLOBUCHAR. Thank you.

Senator SANDERS. OK. Well, let me just take this opportunity to thank this panel for your very thoughtful presentation on an issue of enormous consequence. Thank you very much.

OK, if we could bring up the second panel please.

I want to thank our panelists for being here. Two panelists that were intending to be here are unable to be here. That is Paul Renfrow, who is the Vice President of Public Affairs at OGE Energy Corporation, and Dorothy Rothrock, who is the Vice President for Government Relations of California Manufacturers and Technology Association. Their remarks will become part of the record.

[The referenced documents can be found on pages 209-213.]

Senator SANDERS. Thank you all very much for being here. Let's start with Daniel Kammen, who is Professor of Energy and Society, Professor of Public Policy in the Goldman School, Professor of Nuclear Energy and Director of the Renewable and Appropriate Energy Laboratory, University of California in Berkeley.

Senator INHOFE. Mr. Chairman.

Senator SANDERS. Yes?

Senator INHOFE. I think it might be worth mentioning, since there is media here, that the two that were not able to be here for very good reasons were both our witnesses. So it might be a little skewed the other direction this way.

Senator SANDERS. OK. Thank you.

Senator INHOFE. Which is fine.

Senator SANDERS. Mr. Kammen.

**STATEMENT OF DANIEL KAMMEN, PROFESSOR OF ENERGY AND SOCIETY, PROFESSOR OF PUBLIC POLICY IN THE GOLDMAN SCHOOL, PROFESSOR OF NUCLEAR ENGINEERING, AND DIRECTOR OF THE RENEWABLE AND APPROPRIATE ENERGY LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY**

Mr. KAMMEN. I thank you for the chance to speak and I really appreciate the opportunity to address the Committee. But the ground rules, as we speak right now, are going to be critical for shaping this green economic environment for the future. A key concern of mine is not how innovative our economy can be—it can be incredibly innovative—but it is setting the ground rules that we are here to discuss so that the benefits of a green economy can accrue across the entire socioeconomic spectrum.

Several things here to note. One is that in our 2004 study that Vinod Khosla cited as well, called Putting Renewables to Work, we found that a key finding across a wide range of methodologies. We surveyed studies of the green economy done by groups that are considered left and right, libertarian, liberal, et cetera. They were consistent in their findings that there was significant job growth in

the clean energy space. In fact, those job growth numbers were anywhere from three to ten times as many jobs generated in the clean tech area than in traditional fossil fuel areas.

That is not an either/or, that is not that one should fully supplant the other, but that in growing a new industry there are significant opportunities to buildup that new economic environment by investing in the clean tech area, diversifying our economy, and critically bringing down the strong volatility in prices that we see in oil and natural gas in particular. In fact, if any thing affects businesses and the poor significantly, it is high volatility in the cost of fossil fuels.

Diversifying the economy to renewables can significantly and positively impact that. If you look at a map of the United States right now, as I placed in my testimony, it is a patchwork. It is a mosaic of a number of States that have strong renewable standards—Minnesota, New Jersey, California, Texas, Nevada. All have very significant standards in place to diversify their economies. We are seeing increasing job growth in those areas where we have chosen to invest. The mechanism that the U.S. has embraced, the so-called renewable portfolio standard is a little bit different than the German feed-in tariffs, has been a critical driver for helping to solidify and diversify that growth.

In fact, what we have seen out of that process is a very important lesson. If you look at what is taking place in Silicon Valley, California, in Route 128 in Boston, in the Oak Ridge area in Tennessee, in the Austin, Texas area, we are seeing clusters of green tech.

A critical part of the process has been to let entrepreneurs and elected officials, municipalities, citizens groups, all work together to find the best ways to diversify the economy. That has been a strong driver toward getting low cost clean energy systems in place, and to learn. These groups learn from each other. Entrepreneurs, business installers all need that environment where the lessons are passed back and forth. The more that we support those clusters by developing the right sorts of tax incentives, by getting expertise in public office, and in the hands of entrepreneurs has been a critical part of the process.

So in my testimony, I highlight the job growth expected in those States that have adopted these renewable standards and looked at what we think will happen if we move this toward the Federal level. The standard number being discussed right now is roughly a 20 percent renewable obligation at the Federal level. That is estimated to produce hundreds of thousands, if not millions of new jobs. That is just jobs in the growth of the green part of the economy, the new green techs: solar, wind, biofuels. When you also look at what we expect from the growth in energy efficiency, it is an even larger number.

Again, the critical part of the process, whether you are doing this because of concerns about global warming or business diversity, is that the larger the renewable energy sector becomes, the more strength we will have against the price fluctuations that we have seen in natural gas and oil. So it is a major driver of action. In fact, Nevada and a number of States have looked at that and have seen

those benefits, and have observed the price stability that you get in the process.

Areas of economic growth that are untouched in this area right now are plug-in hybrid vehicles, areas to make batteries better, areas to make the grid smarter by diversifying and essentially making our grid based around the smart technology in our cell phones, not the old technology that we have in our rotary meters, to allow individuals and businesses and cities to sell power back and forth, to again make our economy more diverse and strengthened on an economic front as it becomes greener.

A critical thing that California has done is to work through a low carbon fuel standard that I am very pleased to have been one of the authors of. That essentially sets a carbon content of fuels and allows us to legislate that number down and to let the market then find out what combination of greener biofuels, cellulosic fuels, plug-in hybrid vehicles, or mass transit help to meet those needs.

So a critical aspect for this Committee to do is to find and standardize those rules and to do what we can to make sure that those job benefits, those green jobs, are not just white collar jobs, but are blue collar, so-called green collar jobs, as the testimony from Van Jones highlights. These are all areas where this strengthening of the economy can be broadly seen by all Americans, and not just by the top.

Thank you very much for the chance to speak today.

[The prepared statement of Mr. Kammen follows:]

DANIEL M. KAMMEN, PROFESSOR OF ENERGY AND SOCIETY, PROFESSOR OF PUBLIC POLICY IN THE GOLDMAN SCHOOL OF PUBLIC POLICY IN THE GOLDMAN SCHOOL, PROFESSOR OF NUCLEAR ENGINEERING, AND DIRECTOR OF THE RENEWABLE AND APPROPRIATE ENERGY LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY

#### INTRODUCTION & SUMMARY

Chairman Barbara Boxer, Senator Barrie Sanders, Hearing Chair, and other members of the Senate Environment and Public Works Committee, I appreciate your invitation to appear before you today. I am particularly appreciative your inspiring efforts to develop a comprehensive approach to environmental quality, human health protection, and economic development for the Nation. I am grateful for the opportunity today to speak with you on the energy, climate, and security issues that face our nation and the planet.

In this testimony I highlight the key finding that while a continuation of business as usual energy choices will result in socially, politically, and environmentally costly and destructive climate change, the motivation to invest in solutions to climate change can be simply that a green economy can also be exceedingly vibrant. In fact, an economy built around a suite of low-carbon technologies can be resistant to price shocks as well as secure against supply disruptions as well as inclusive of diverse socioeconomic groups. A new wave of job growth ? both 'high technology' and ones that transform 'blue collar labor' into 'green collar' opportunities. The combination of economic competitiveness and environmental protection is a clear result from a systematic approach to investing in climate solutions.

Clean energy systems and energy efficiency investments also contribute directly to energy security and to domestic job growth versus off-shore migration. Renewable energy systems are more often local than imported due to the weight of biomass resources and the need for operations and maintenance.

A growing number of state, regional, and national economies are assuming leadership positions for a clean, low carbon, energy economy. These 'early actors' are reaping the economic benefits of their actions. Among the global leaders are Brazil, Denmark, Iceland Germany, Japan, Spain, all of which have made significant commitments to a green economy, and all are seeing job growth and rapidly expanding export opportunities. In the United States several states have embarked on significant

climate protection efforts, and half of U. S. states have taken the vital step of adopting minimum levels of renewable energy requirements.

On the vitally important issue of transportation a set of European nations have followed the lead of California, Illinois and other U. S. states in adopting a Low Carbon Fuel Standard (Kammen, 2007). The goal of a Low Carbon Fuel Standard is to reduce the greenhouse impact of fossil fuel emissions, and to begin to move toward a diverse set of economically and environmentally sustainable transportation choices.

#### JOB GROWTH IN A GREEN ECONOMY—EMPIRICAL LESSONS

Expanding the use of renewable energy is not only good for our energy self-sufficiency and the environment; it also has a significant positive impact on employment. My students and I have examined the observed job growth in a number of technology sectors (Kammen, Kapadia and Fripp, 2004).

We reviewed 13 independent reports and studies that analyzed the economic and employment impacts of the clean energy industry in the United States and Europe. These studies employ a wide range of methods, which adds credence to the findings. In addition to reviewing and comparing these studies, we have examined the assumptions used in each case, and developed a job creation model which shows their implications for employment under several future energy scenarios.

Energy Technology	Source of Estimate	Average Employment Over Life of Facility (jobs/MW <sub>a</sub> )		
		Construction, Manufacturing, Installation	O&M and fuel processing	Total Employment
PV 1	REPP, 2001	6.21	1.20	7.41
PV 2	Greenpeace, 2001	5.76	4.80	10.56
Wind 1	REPP, 2001	0.43	0.27	0.71
Wind 2	EWEA/Greenpeace, 2003	2.51	0.27	2.79
Biomass $\bar{G}$ high estimate	REPP, 2001	0.40	2.44	2.84
Biomass $\bar{G}$ low estimate	REPP, 2001	0.40	0.38	0.78
Coal	REPP, 2001	0.27	0.74	1.01
Gas	Kammen, from REPP, 2001; CALPIRG, 2003; BLS, 2004	0.25	0.70	0.95

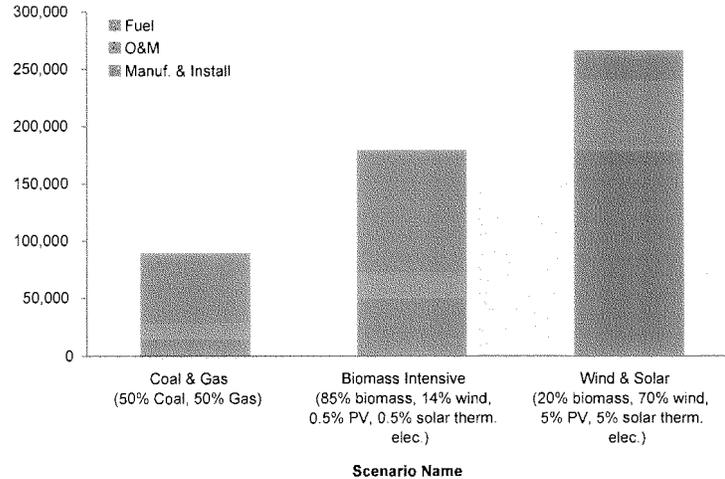
**Table 1: Average employment for different energy technologies. “MW<sub>a</sub>” refers to average installed megawatts de-rated by the capacity factor of the technology; thus, for a 1 MW solar facility operating on average 21% of the time, the power output would be 0.21 MW<sub>a</sub>. References in parentheses and sources refer to the studies reviewed in the text. The biomass energy studies are a proxy for jobs that could derive from an expansion of biofuels (e.g. ethanol use) in regional or the national energy mix.**

#### ECONOMIC BENEFITS—FOCUS ON BIOFUELS

Forecasts of job creation can, in fact be far higher. A recent U. S. Department of Energy report *Breaking the barriers to cellulosic ethanol* concluded that:

A biofuel industry would create jobs and ensure growing energy supplies to support national and global prosperity. In 2004, the ethanol industry created 147,000 jobs in all sectors of the economy and provided more than \$2 billion of additional tax revenue to Federal, state, and local governments (RFA 2005). Conservative projections of future growth estimate the addition of 10,000 to 20,000 jobs for every billion gallons of ethanol production (Petrulis 1993). In 2005 the United States spent more than \$250 billion on oil imports, and the total trade deficit has grown to more than \$725 billion (U.S. Commerce Dept. 2006). Oil imports, which make up 35 percent of the total, could rise to 70 percent over the next 20 years (Ethanol Across America 2005). Among national economic benefits, a biofuel industry could revitalize struggling rural economies. Bioenergy crops and agricultural residues can provide farmers with an important new source of revenue and reduce reliance on government funds for agricultural support. An economic analysis jointly sponsored by USDA and DOE found that the conversion of some cropland to bioenergy crops could raise depressed traditional crop prices by up to 14 percent. Higher prices for tradi-

tional crops and new revenue from bioenergy crops could increase net farm income by \$6 billion annually (De La Torre Ugarte 2003).



**Figure 1: Comparison of the estimated employment created by meeting the equivalent of 20 percent of current U.S. electricity demand via and expansion of fossil or renewables-based electricity generation. These totals use the jobs per megawatt numbers from Table 1. These scenarios are for different fuel mixtures that could comprise a federal Renewable Energy Portfolio Standard.**

A key result emerges from our work, and can be seen in Table 1. Across a broad range of scenarios, the renewable energy sector generates more jobs than the fossil fuel-based energy sector per unit of energy delivered (i.e., per average megawatt). In addition, we find that supporting renewables within a comprehensive and coordinated energy policy that also supports energy efficiency and sustainable transportation will yield far greater employment benefits than supporting one or two of these sectors separately. Further, generating local employment—including that in inner-cities, rural communities, and in areas in need of economic stimulus—through the deployment of local and sustainable energy technologies is an important and underutilized way to enhance national security and international stability. Conversely, we find that the employment rate in fossil fuel-related industries has been declining steadily for reasons that have little to do with environmental regulation.

The U.S. Government Accounting Office conducted its own study of the job creation potential of a clean energy economy (GAO, 2004). While focusing on rural employment and income they found that:

... a farmer who leases land for a wind project can expect to receive \$2,000 to \$5,000 per turbine per year in lease payments. In addition, large wind power projects in some of the nation's poorest rural counties have added much needed tax revenues and employment opportunities.

#### MOVING TO FEDERAL ACTION—A GREEN JOBS/RENEWABLE ENERGY PORTFOLIO

Twenty-three states and the District of Columbia have now enacted Renewable Energy Portfolio Standards, which each call for a specific percentage of electricity generated to come from renewable energy. Federal legislation should, at minimum, solidify State action with Federal support. A great deal would be achieved if Congress took the logical step and instituted a Federal standard. A 20 percent Federal RPS enacted today and required by 2020 is reasonable and achievable.

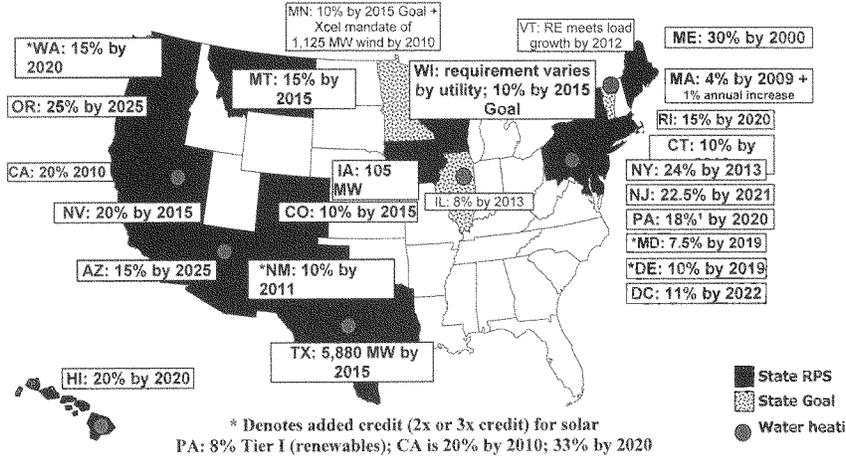


Figure 2. Map of States with Renewable Energy Portfolio Standards As of January 2007, 23 states and the District of Columbia have enacted or voted to adopt renewable energy standards. These plans represent a diversity of approaches and levels, but each reflect a commitment to clean and secure energy that could be emulated at the federal level. In addition 13 states have specific measures to increase the amount of solar photovoltaic power in use. These range from specific solar energy targets, to double (MD) or up to triple credit (DE, MN, & NV) for solar.

Figure 2. Map of States with Renewable Energy Portfolio Standards As of January 2007, 23 states and the District of Columbia have enacted or voted to adopt renewable energy standards. These plans represent a diversity of approaches and levels, but each reflect a commitment to clean and secure energy that could be emulated at the Federal level. In addition 13 states have specific measures to increase the amount of solar photovoltaic power in use. These range from specific solar energy targets, to double (MD) or up to triple credit (DE, MN, & NV) for solar.

## Green job creation

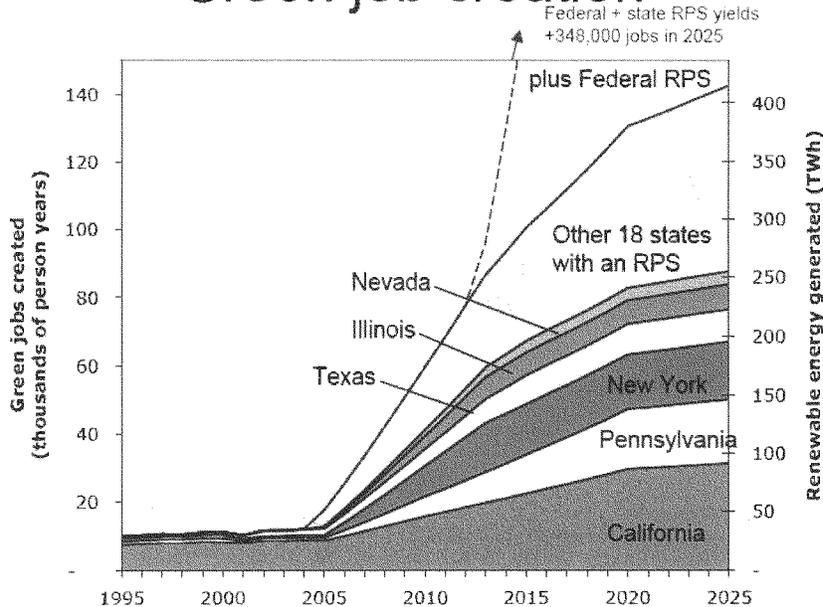


Figure 3: Green job creation totals for selected states, and for the nation as a whole if a 20% RPS were adopted for 2020.

It is clear that developing a clean energy economy is not only good for the environment, but it is good for job creation as well.

### RECOMMENDATIONS

There are a number of measures that the committee should consider, and the Nation as a whole would be well-served to include in a clearly articulated plan for the development of a national energy vision and green jobs strategy. These include:

#### RAISE CLEAN ENERGY RESEARCH, DEVELOPMENT, AND DEPLOYMENT SPENDING TO REASONABLE LEVELS

The U. S. has under-invested in energy research, development, and deployment for decades (Kammen and Nemet, 2005), and sadly the fiscal year budget request is no exception. Federal energy research and development investment is today back at pre-OPEC levels despite a panoply of reasons why energy dependence and insecurity, and climatic impact from our energy economy are dominating local economics, geopolitics, and environmental degradation.

At \$2.7 billion, the overall energy RD&D fiscal year request is \$685 million higher than the fiscal year appropriated budget. Half of that increased request is accounted for by increases in fission, and the rest is in moderate increases in funding for biofuels, solar, FutureGen, and \$147 million increase for fusion research. However, the National Renewable Energy Laboratory's (NREL) budget is to be cut precisely at a time when concerns over energy security and climate change are at their highest level, and level of need. The fact that a plan exists to cut assistance to low-income families by 41 percent from fiscal year levels for weatherization to improve the energy efficiency of their homes is startling.

The larger issue, however, is that as a nation we invest less in energy research, development, and deployment than do a few large biotechnology firms in their own, private R&D budgets. This is unacceptable on many fronts. The least of which is

that we know that investments in energy research pay off at both the national and private sector levels.

In a series of papers (Margolis and Kammen, 1999; Kammen and Nemet, 2005) my students and I have documented a disturbing trend away from investment in energy technology—both by the Federal Government and the private sector, which largely follows the Federal lead. The U.S. invests about \$1 billion less in energy R&D today than it did a decade ago. This trend is remarkable, first because the levels in the mid-1990's had already been identified as dangerously low, and second because, as our analysis indicates, the decline is pervasive—across almost every energy technology category, in both the public and private sectors, and at multiple stages in the innovation process. In each of these areas investment has been either been stagnant or declining. Moreover, the decline in investment in energy has occurred while overall U.S. R&D has grown by 6 percent per year, and Federal R&D investments in health and defense have grown by 10 to 15 percent per year, respectively.

One of the clearest findings from tracking actual investment histories, is that there is a direct and strong correlation between investment in innovation and demonstrated changes in performance and cost of technologies available in the market.

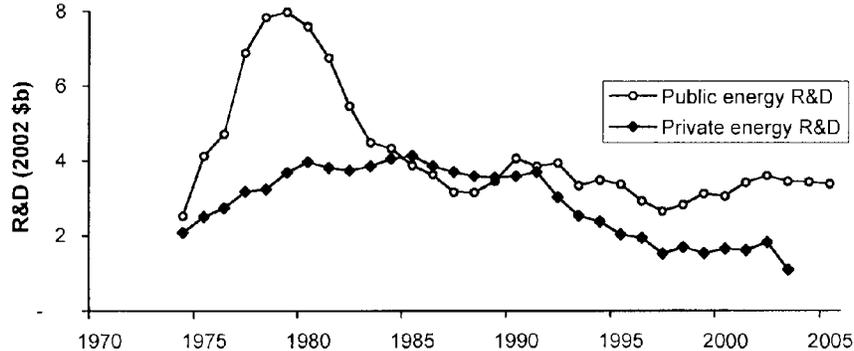
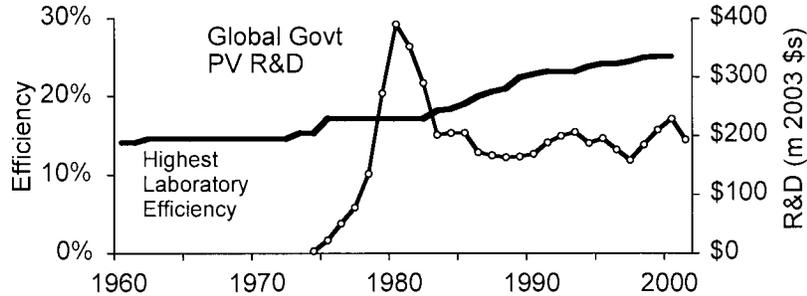


Figure 4. The history of declining energy R&D investment by both public and private sectors

Source: Kammen and Nemet (2005) *Issues in Science and Technology*.

In the case of solar photovoltaics, a 50 percent increase in PV efficiency occurred immediately after unprecedented \$1 billion global investment in PV R&D (1978–85). From there, we observed significant efficiency improvements, which accounts for fully 30 percent of the cost reductions in PV over the past two decades. (Increased plant size, also related to the economic viability of PV accounts for the largest segment, 40 percent of the cost decline over the same period of time.)



**Figure 5: Benefits of R&D Investments in Improving Products in the Market.**

Directly after a significant increase in federal funding for solar photovoltaics, a 50% rise in cell efficiency occurred. This increase in efficiency has been shown to be the second largest single contributor to the cost effectiveness of solar cells. Source: Nemet, G. F. (2006). "Beyond the learning curve: factors influencing cost reductions in photovoltaics, *Energy Policy* 34(17), 3218 - 3232.

The U.S. experience is not at all unique. A world-leading solar energy program was initiated in Japan almost 20 years ago. The results have been dramatic.

The Japanese program integrated both research and development efforts. The result of the Japanese program was striking: the cost of installed solar PV systems fell by over 8 percent per year for a decade. A smaller effort in California, but without significant R&D spending, resulted in one-half that level of innovation and cost improvement. California has now embarked on a much larger (10 years, \$320 million/year) commercialization

The case of solar photovoltaics is not at all unique. By looking at individual energy technologies, we have found that in case after case, R&D investment spurs invention and job creation. In a set of recent reports we (Kammen and Nemet, 2005) report on the strong correlation between investment and innovation and job creation for the solar, wind, biomass, and nuclear industries.

We also see steady cost declines in solar and wind technologies, although the bulk of the manufacturing for each technology has been outside the U. S. for many years.

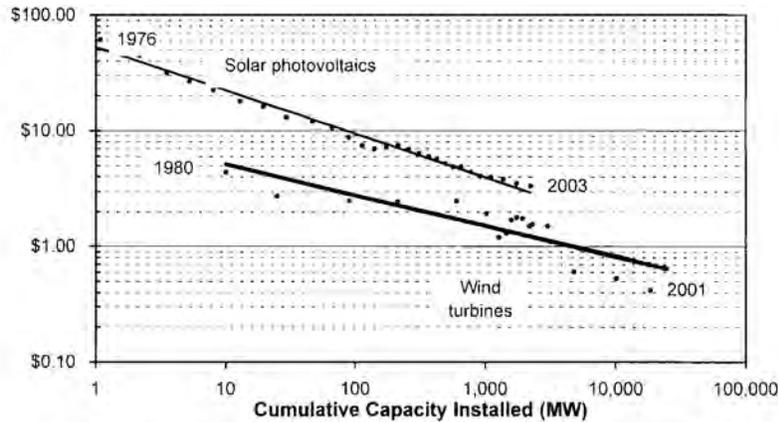


Figure 6: Capital costs of photovoltaics and wind turbines (constant 2004\$/Watt.) The horizontal axis shows cumulative worldwide installations of each technology (Duke and Kammen, 1999). Expanding production, driven by research, development, and deployment directly pays off in cost declines for the technology, and larger domestic markets further result in greater economic activity and job creation (Kammen, Kapadia, and Fripp, 2004).

PROVIDE RESEARCH SUPPORT JOINTLY TO THE DEPARTMENTS OF ENERGY AND AGRICULTURE, AND THE ENVIRONMENTAL PROTECTION AGENCY TO STUDY A FEDERAL LOW CARBON FUEL STANDARD

The recent explosion of interest in biofuels, including ethanol and biodiesel, has been a major advance in diversifying our transportation fuels markets. On January 27, 2006, our research group at the University of California, Berkeley, published a paper in *Science*, the magazine of the American Association for the Advancement of Science, and an accompanying website (<http://rael.berkeley.edu/ebamm>) that provided a calculator to compare the greenhouse gas benefits of ethanol derived from a range of input biofuels, and produced in distilleries powered by different fuels (e.g. coal, natural gas, or through the use of renewables).

The conclusion of that work was simple: not all biofuels are created equal in terms of their carbon content. The next logical step was to rank, and then regulate fuels, based on their carbon content.

In January 2007 California Governor Arnold Schwarzenegger signed Executive Order 1-07 to establish a greenhouse gas standard for fuels sold in the state. The new Low Carbon Fuel Standard (LCFS) requires a 10 percent decrease in the carbon intensity of California's transportation fuels by 2020. The State expects the standard to more than triple the size of the state's renewable fuels market while placing an additional seven million hybrid and alternative fuel vehicles on the road. The standard will help the State meet its greenhouse gas reduction goals set by State Assembly Bill 32, which the Governor signed last year.

On February 21, 2007 California Governor Schwarzenegger and Senator McCain called for a Federal LCFS. An important piece of the LCFS should be the inclusion of electricity as a fuel to support the development and use of plug-in hybrid vehicles in areas where the average grid power is sufficiently low-carbon to result in a net reduction in greenhouse gas emissions. A low carbon fuel standard will promote the development of at least two important industries: a sustainable biofuels sector; and the evolution of the plug-in hybrid sector. Both of these are areas of potentially strong and sustained job growth. At present, however, Detroit automakers have expressed concerns about the job benefits of a clean energy economy. A study conducted by the University of Michigan found, in fact, that job losses could occur if Detroit does not become more innovative and competitive. Integration of bioenergy/ethanol resources and work to develop the commercially successful plug-in hybrid industries could both become major areas of new job growth.

Significantly, bioenergy work—agriculture and distilling ? and battery construction and vehicle construction are areas where high wages can be expected.

Build Jobs Across Socioeconomic Groups—the Green Jobs Program in the U. S. and Overseas

Green jobs can accrue across the entire economy, from laboratory research and development positions, to traditionally unionized work in plumbing, electrical wiring, and civil engineering. The Green Jobs Act (initially Solis and Tierny, H.R. 2847, now part of the H.R. 3221, the Renewable Energy and Energy Conservation Act of 2007) invests in worker training and career opportunities for low-income Americans, and could be the model for expanded job access and development efforts.

In addition to supporting domestic job creation, clean energy is an important and fastest growing international sector, and one where overseas policy can be used to support poor developing regions ? such as Africa (Jacobsen and Kammen, 2007) and Central America ? as well as regaining market share in solar, fuel cell and wind technologies, where European nations and Japan have invested heavily and are reaping the benefits of month to year backlogs in clean energy orders. Some of those orders are for U.S. installations.

#### BRIEF BIOGRAPHY—DANIEL M. KAMMEN

I hold the Class of 1935 Distinguished Chair in Energy at the University of California, Berkeley, where I am a professor in the Energy and Resources Group, the Goldman School of Public Policy, and the Department of Nuclear Engineering. I am the founding director of the Renewable and Appropriate Energy Laboratory (<http://rael.berkeley.edu>), an interdisciplinary research unit that explores a diverse set of energy technologies through scientific, engineering, economic and policy issues. I am also the Co-Director of the University of California, Berkeley Institute of the Environment. I have served on the Intergovernmental Panel on Climate Change (IPCC), and have testified before both U.S. House and Senate Committees on the science of regional and global climate change, and on the technical and economic status and the potential of a wide range of energy systems, notably renewable and energy efficiency technologies for use in both developed and developing nations. I am the author of over 200 research papers, and five books, most of which can be found online at <http://rael.berkeley.edu>

In July of last year the Honorable R. John Efford, the then Minister of Natural Resources Canada, announced my appointment, as the only U. S. citizen, to serve on the Canadian National Advisory Panel on the Sustainable Energy Science and Technology (S&T) Strategy.

Recently I played a leadership role in developing and now in managing the successful \$500 million Energy Biosciences Institute award from BP.

#### ACKNOWLEDGMENTS

This work was supported by a grant from the Energy Foundation, the Karsten Family Foundation endowment of the Renewable and Appropriate Energy Laboratory, and the support of the University of California Class of 1935. I am delighted to thank John Stanley and Joe Kantner, graduate students in the Energy and Resources Group at UC Berkeley for their assistance in developing this testimony.

Senator SANDERS. Thank you very much.

Dr. Kenneth Green is a Resident Scholar with the American Enterprise Institute for Public Policy Research. Thanks very much for being here.

#### STATEMENT OF KENNETH GREEN, VISITING FELLOW, AMERICAN ENTERPRISE INSTITUTE FOR PUBLIC POLICY RESEARCH

Mr. GREEN. Good afternoon, Senator Sanders, Senator Inhofe, members of the Committee. I would like to thank you for inviting me to speak to you today.

Before I get to today's topic, I think a few words about my background and core beliefs regarding global warming may be in order and help to understand everything in context.

As an environmental scientist by training, I have studied the data myself, including reading the IPCC reports, several of them in their entirety as a reviewer. I am convinced the climate has indeed warmed since about the 1850's. I believe that human greenhouse gas emissions have caused and will cause some degree of that warming. Exactly how much is still a matter of active inquiry. I believe extensive warming could well pose significant risks to future generations.

By philosophy, I am a classical liberal, so I actually believe the government has a responsibility to protect people from harming each other through the environment, and to protect environments held in common for the people. So I think it is perfectly fit that Congress be taking up this important subject.

Finally, as an environmental policy analyst who has worked with economists for about 15 years, I have tended to argue in favor of adaptation mostly in the past, but as our understanding of climate change and the public policy discussion has matured, I recently embraced the idea of mitigating greenhouse gas emissions with a modest revenue neutral carbon tax as being the most efficient option and superior policy approach to achieving that goal.

I submitted a recent article on this subject for the record, published as an AEI Environmental Policy Outlook called Carbon Tax versus Trade, and I recommend that to you.

Now, to the question of the day: Do global warming initiatives create new green jobs? This is a fringe benefit of my surname that I am constantly mentioned in environmental discussions. I thank my father for that, and his father before him.

The answer, I would say is that global warming initiatives can create some jobs, but only at the expense of other jobs. Further, I would suggest the end result would be less new jobs on net, less economic growth, and most likely the loss of existing capital as a byproduct.

The question of government job creation actually has been debated since the 1850's, at least when Frederic Bastiat, a French journalist and politician wrote, *What is Seen and What is Not Seen*, an essay in which he refutes the fallacy that somehow one can turn a public bad such as breaking a window into a public good by claiming it creates jobs for glaziers or glassmakers.

The analogy holds just as well when the government is the one that breaks the window of a company selling goods and services into the market and favors another company selling a different good into the market. Let's put this in global warming context and be a bit more specific.

Assume the Congress bans the sale of incandescent light bulbs, and approach favored by many regulatory advocates, and a part of the energy bill that has been considered recently. As Bastiat would ask, what is seen, of course, will be the creation of new jobs making fluorescent light bulbs. It is inarguable. If you are going to replace everything with fluorescents, you will make new jobs. What is not seen is the loss of jobs in the incandescent bulb sector and in face the consequences of being successful. If you are really successful and you have fluorescent bulbs that use less energy, the energy sector will have to produce less energy, there will be less bulbs used because they last longer, therefore less will be shipped, less

will be packaged, less will be disposed of and handled and sold. There will be a general downturn in jobs, in accordance. That is what will not be seen.

If you raise CAFE standards, what will be seen is indeed more high fuel economy small cars. It is inarguable. What will not be seen are the lost jobs making the larger vehicles, sport utility vehicles, the supply and the energy that goes into them, the profits that come from such high-end vehicles, the mid-range vehicles which become unprofitable in terms of their mileage. This is, by the way, what happened to the station wagon we grew up with, when the CAFE standards the first time around made that market niche virtually unprofitable for automakers and they ceased making them. That also opened the door for sport utility vehicles and minivans which now are an environmental problem.

Finally, let's look at the question of cap and trade. Would cap and trade create jobs if it is successful? By definition the only thing that is going to reduce carbon emissions is higher energy prices. That is what a carbon tax does and that is what cap and trade does, simply in an inefficient way compared to a carbon tax. If that happens, the cost of goods and services goes up. If costs go up, demand goes down, competitiveness goes down, and productivity and jobs will be not seen. A lot of jobs will be lost and they will not be seen.

Bastiat made this analogy in the 1850's and he made it very well, in which he pointed out that at first blush we see a broken window as bad. Someone comes along and says, well, no, it is not really that bad because after all it makes work for the glaziers. That is true, but the person who had the whole window in the first place is now out the cost of a new window and out the business opportunity that would have come with that cost, and society as a whole is poorer. That will be the case with global warming initiatives, just the same as with Bastiat's broken windows.

I, of course, will be glad to take your questions. Thank you for having me here today.

[The prepared statement of Mr. Green follows:]

STATEMENT OF KENNETH GREEN VISITING FELLOW, AMERICAN ENTERPRISE  
INSTITUTION FOR PUBLIC POLICY RESEARCH

Good afternoon, Senator Boxer, Senator Inhofe, Members of the Committee ? thank you for inviting me to speak today on a very interesting question: whether or not governmental activities ? in this case, global warming initiatives, create jobs. The question of government job creation has been debated since at least the 1850's, when Frederic Bastiat, a French journalist and politician wrote "What is Seen, and What is Not Seen," an essay that is, or certainly should be required reading for anyone interested in economics and government.

But before I get to today's topic, I would like to say a few words about my background and core beliefs regarding global warming policy so my comments can be understood in proper context.

As an environmental scientist by training, my reading of the scientific literature (including the synthesis reports of the United Nations Intergovernmental Panel on Climate Change) has persuaded me that we have observed a real warming of the climate since measurements started in the 1850's. Further, I believe that the basic physics and chemistry of our planet and its atmosphere make it highly likely that humanity's addition of greenhouse gases to the atmosphere has caused, and will cause some degree of warming of the climate. How much is still a matter of active inquiry. And I believe if warming turns out to be extensive, it could well pose significant risks to future generations.

As a classical liberal, I believe that government has an obligation to prevent people from harming each other via environmental contamination, as well as an obligation to protect the health of environmental resources held in common for the public by Federal, state, and local governments. So yes, I think it appropriate that the government considers how it might best address the potential harms of global warming.

Finally as an environmental policy analyst by avocation, I have argued that while we should focus mostly on adaptation, the most efficient policy to mitigate the risk of manmade climate change would be a modest, revenue-neutral carbon tax. I'll be glad to discuss any of that during the question period, and would like to submit to the record a recent article I co-authored on the question of a carbon tax for AEL, entitled "Climate Change: Caps vs. Taxes."

Now, to the question of the day: do global warming initiatives "create" "new green" jobs? The short answer, I would say, is that they might do so, but only at the expense of other jobs that would otherwise have been produced by the free market. Further, I'd suggest that the end result would be significantly less jobs on net, less overall economic growth on net, and most likely, the loss of existing capital as a by-product.

The fallacious idea that one can make jobs by destroying others is a variation of Bastiat's Broken Window fallacy. As Bastiat explained, imagine some shopkeepers get their windows broken by a rock-throwing child. At first, people sympathize with the shopkeepers, until someone suggests that the broken windows really aren't that bad. After all, they "create work" for the glazier, who might buy food, benefiting the grocer, or clothes, benefiting the tailor. If enough windows are broken, the glazier might even hire an assistant, creating a new job.

Did the child then do a public service by breaking the windows? Would it be good public policy to simply break windows at random? No, because what's not seen in this scenario is what the shopkeepers would have done with the money that they've had to use to fix their windows. If they hadn't needed to fix the windows, the shopkeepers would have put the money to work in their shops, buying more stock from their suppliers, or perhaps adding a coffee-bar, or hiring new stock-people.

Before the child's action, the shopkeepers had the economic value of their windows and the money to hire a new assistant or buy more goods. After the child's action, the shopkeepers have their new windows but no new assistant or new goods, and society, as a whole, has lost the value of the old set of windows.

The analogy holds just as well when it is the government that comes, and by regulatory fiat "breaks the window" of a company successfully goods and services into a free market. When the government establishes a regulation favoring product A over product B, what is seen is the new sales of product A, and the jobs associated with such sales.

What is not seen is the lost sales of product B, and the lost jobs that go with it. Because the market is superior at efficiently identifying and providing what people want than are planners, it is virtually certain that the lost jobs in any regulatory scenario will outnumber the created jobs in a regulatory scenario.

Let's put this in a global warming context. Assume that Congress bans the sale of incandescent light bulbs, an approach some regulatory advocates favor for reducing greenhouse gases. Has Congress then "created" new jobs making fluorescent light bulbs?

Certainly, some jobs will be made in the fluorescent bulb industry. That, as Bastiat would say, is what is seen as a result of the action. What is not seen? First, one will have eradicated the jobs making incandescent bulbs. But that is only the beginning: after all, the very reason fluorescent light bulbs are theoretically desirable is that they use less energy, and last longer, using fewer materials. Thus, there will be less of them made, less of them shipped, less of them packaged, and less of them disposed of, and jobs in all of those areas will be reduced, not increased. True, some jobs will remain, but there will be less of them, and they won't necessarily be the same jobs, or jobs in the same part of the country, or, necessarily, even jobs in the same country.

Or let's consider raising CAFE standards. This is another popular regulatory approach to control greenhouse gas emissions. Would raising CAFE standards make "new green jobs"?

Let's examine what happens under new CAFE standards. In essence, automakers are required to sell more low-profit compact/fuel-efficient cars, and less high-profit luxury cars and SUVs. Thus, the first effect is to terminate jobs in the more-profitable luxury car market, some of which will be replaced by jobs in the lower-profit fuel-efficient vehicle market. But again, that is only the beginning of the losses. To offset the loss of profit, the automakers will have to raise costs on luxury cars somewhat (reducing sales on net, but increasing profit per sale) or terminate lines of little profitability, even if they are popular. This is what the first CAFE standards did

to the station wagon, paving the way for SUVs and mini-vans. And again, the purpose of the exercise is to reduce gasoline use, and hence, jobs in the gasoline production and distribution pipeline.

So what is unseen? Fewer vehicles sold over all, with industry wide job losses, additional losses of jobs producing SUVs, loss of jobs producing mid-range vehicles of limited profit potential, loss of jobs in the gasoline sector, and so on. Congress can throw subsidies at hybrids and such to try to stimulate sales and thus offset some of the harm but they must take money away from some other business in order to do it.

Finally, let's consider the poster-child of global warming initiatives, cap-and-trade. Would enacting a cap-and-trade scheme create more green jobs, on net, than the non-green jobs it would extinguish?

The first thing to consider is what the effect of capping carbon emissions will be: higher prices for energy, a fundamental input to production and to the provision of services across the entire economy. This is, actually, the entire point of the enterprise, since the only way to suppress greenhouse gas emissions is to raise energy prices.

What do we know from the law of supply and demand? Higher energy prices will lead to reduced sales of goods and services, on net. Thus, lost jobs in energy-intensive sectors of the economy will be seen first, and job losses on those who use the product of such goods will follow. That's a rather large component of the economy, since energy is a primary input to pretty much all goods and services in the market today.

Will some green jobs be created? Certainly, at least among government credit auditors, market regulators, and among brokers arranging carbon trades. Since technologies to reduce carbon emissions from fossil fuel burning do not actually exist, one can't argue that new jobs will appear in the carbon-dioxide catalytic converter sector, or the carbon dioxide bag-house producers. Carbon emission reductions come only by turning down output, or increasing efficiency, which raises costs. Nor can one argue that sequestration, whether agricultural or otherwise will produce jobs, because the entire idea is to stick something carbonaceous in the ground and leave it there.

In conclusion, it has been my privilege to speak to you today about whether or not climate change initiatives can create new, green jobs. It seems obvious to me that the answer is no. I hope you'll hold another hearing soon to discuss whether or not a revenue-neutral carbon tax could avoid the pitfalls of other global warming initiatives, so that I can come back with a happy story to tell, rather than one of such negativity.

I will, of course, be glad to take your questions.

---

#### RESPONSES BY KENNETH GREEN TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

*Question 1.* Does it make sense to devote enormous economic resources toward reducing greenhouse gas emissions as compared to other possible activities such as eradication of disease or clean drinking water?

Response. This question actually subsumes two separate questions. The first subsumed question is "does it make economic sense to spend money first on mitigating distant, uncertain risks of potentially high cost versus spending money to mitigate better known, more proximal risks, such as the control of water borne illness." The second subsumed question is "does it make political sense to do so."

I would argue that it does not make economic sense to devote enormous economic resources toward reducing greenhouse gas (GHG) emissions at the expense of mitigating better known risks that either exist now, or will exist on short time-horizons. This argument was made exceptionally clear by the Copenhagen Consensus project led by Bjørn Lomborg in 2004, in which a group of leading economists from around the world (including several Nobel laureates) were brought together to prioritize where resources should be focused from a standpoint of getting the best economic return on investment: that is, the most risk averted at the least cost. What emerged from that process was the consensus that mitigating climate change was too costly, and benefits too uncertain, to rank as a good investment compared to a number of other investments, such as disease control; ending malnutrition; trade liberalization; clean drinking water; adequate sanitation; and so forth. Investments in climate change mitigation came in last on the list of priorities determined through the Copenhagen Consensus.

Whether it makes political sense is a separate question. A large segment of the electorate has become convinced that global warming is the largest crisis humanity will face, and studies show that our children now live in fear for their future, due

to unrelenting waves of alarmist climate change projections. To a great extent, the question of climate policy has become a values issue, a political issue, and even a moral/religious issue far more than a scientific or economic issue. Only our nation's politicians can make the calculation about whether it makes political sense to pander to what are likely exaggerated fears based on faulty computer models of future climate and risk the wrath of voters who are denied the opportunity to "feel good" by seeing money spent on climate change, whether that spending does any good or not; whether that spending is actually to their own detriment on net; and whether that spending is at the expense of efforts to stop suffering through more prosaic means in the world today.

*Question 2.* Which is more damaging economically, a carbon cap, or a carbon tax? Response. While both a carbon cap and a carbon tax would raise energy prices, a carbon cap would almost certainly be far more economically damaging than a revenue-neutral carbon tax (there would be little difference between the two approaches if the carbon tax raised were not revenue neutral). I would refer you to an AEI Environmental Policy outlook I co-authored with two colleagues in June 2007 that considers this question at length, which was submitted to the original record of the hearing on September 25, 2007.

Both theory and practice tell us that cap-and-trade would:

- Be generally ineffective at reducing GHG emissions (as we've seen in Europe)
  - Increase energy prices
  - Increase prices of goods and services
  - Increase energy price volatility
  - Be highly prone to fraud ? all parties have incentive to cheat and look-aside
  - Be largely opaque to validation (particularly internationally)
  - Be massively redistributionist & regressive
  - Be negated by safety-valves if effective
  - Create massive new national (and international bureaucracies)
  - Self-entrenching
  - Self-tightening; and importantly
  - Irreversible ? Ending the program would mean buying out permit holders
  - Create no revenue for enforcement or to offset economic damage
- Auctioning, the favored answer to this has never, and will never happen in a meaningful way.

A revenue neutral carbon tax, by contrast, would:

- Be generally effective at reducing GHG emissions
- Increase energy prices
- Increase prices of goods and services
- Create incentives for energy conservation throughout the economy
- Create incentives for entrepreneurialism
- Price stabilizing
- Be less redistributionist
- Be less prone to corruption (Gov't has incentive to enforce)
- Use existing collection mechanisms
- Allow regulatory streamlining: a vast number of existing regulations become redundant with a carbon tax, and most important
- Create a revenue stream to offset economic damage
- Be adjustable: tax reform happens on election cycles ? compare that with Kyoto.
- We modeled that a tax of \$15.00 per ton of CO<sub>2</sub> emitted would:
  - Increase the price of coal by 83 percent
  - Increase the price of oil by 11 percent
  - Increase the price of natural gas by 9.6 percent; and
  - Add about \$0.14 to a gallon of gasoline
  - Raise about \$80 billion annually
  - Could be used to reduce income taxes by 13 percent or
  - Could be used to reduce corporate taxes by 29 percent, or
  - Could be used to reduce payroll taxes by 10 percent

In virtually all respects, a revenue-neutral carbon tax is a superior policy to carbon cap-and-trade.

*Question 3.* With environmentalists opposing coal, nuclear, hydroelectric dams, natural gas, and often wind farms, can you discuss what the effects of constraining energy would be?

Response. Energy (along with capital and labor) is a fundamental input into our economy, and, the costs of energy are reflected in all of the goods and services we produce.

The fundamental economic law of supply and demand tells us unequivocally that driving up the price of energy would drive up energy prices, reduce demand, and thus constrain economic growth. This would be true regardless of the exact mechanism that constrains energy use, be it higher prices, supply restrictions, use restrictions based on GHG output, or so forth. This theoretical relationship is supported by a number of studies which have shown that energy consumption and GDP growth are co-dependent: that is, reducing one invariably reduces the other.

Higher energy prices would in turn result in higher costs for goods and services domestically, which would reduce consumption, slowing economic growth still further. Higher energy prices would also result in higher priced goods and services in the export market, leading to reduced competitiveness internationally, as well as increased outsourcing as labor and capital seek areas with less expensive energy in which they can be more competitive.

*Question 4.* What would you say is the biggest fallacy of the argument made by those who say government mandates are the engine of the economy?

Response. With all due respect to the government, it is a fundamental truth that economic activity is driven not by governmental fiat, but by the consensual exchange of value between buyers and sellers in a free market. One can, by regulatory fiat, demand that a massive quantity of widgets be produced, but if there is no market demand for them, there will be no economic activity, and thus, no economic productivity. One need look no farther than the track record of the former Soviet Union with its endless parade of failed 5-year plans to see the results of such fatal conceit.

The idea that a relative handful of government planners can make decisions more rationally than the distributed intelligence of millions or billions of people is, as Frederick Hayek pointed out the fatal conceit of planners and is by far the biggest fallacy of those arguing that government mandates are the engine of the economy.

In fact, the situation is exactly reversed: government mandates are drags on the engine of the economy, which is the exchange of value through the free market. Economic activity stems from the consensual exchange of goods in a free market. Those exchanges, in turn, depend on the myriad decisions that must be made regarding whether a good is worth selling at a given price, or buying at a given price. Such decisions are made by what one might call the ultimate in distributed computing: millions of buyers and sellers, make those decisions in billions, or trillions of individual decisions and transactions determined based on highly specific circumstances of time and place. Maximum efficiency at matching supply with demand happens when these decisions are made free of government interference, save for the enforcement of contracts between buyer and seller.

Government mandates cannot create true markets. They can, on occasion, create false markets in any number of ways that force consumers to make less economic choices by limiting their options, or that foist off hidden costs on the public by requiring producers to use overpriced or inferior materials in production. Thus, governments can create a false market recycled glass by requiring builders to use insulation made from recycled glass. That the false market created is inherently less efficient than the market that it replaces (the market in fiberglass insulation made from scratch) is obvious, since if it were actually cheaper to use recycled glass to make fiberglass, there would be profit potential in doing so, and no government intervention would be needed.

Likewise, the government can create false markets in certain technologies, such as fluorescent light bulbs by banning the sale of incandescent bulbs. But again, this market will be inherently less efficient and less economically productive because the costs of the equivalent good have been forced up by government fiat. Higher prices must inevitably suppress demand compared to the status quo ante: a free market in incandescent bulbs. Further, as I testified, job losses follow the economic losses of government mandates.

The idea that governments, not individuals engaged in consensual transactions through a free market is the eternal fallacy of planners and big-government advocates. Government mandates can no more make jobs or drive the economy than government regulations could set  $\pi$  equal to 3.0, or control the future climate of the Earth.

American Enterprise Institute for Public Policy Research



No. 2 • June 2007

## Climate Change: Caps vs. Taxes

By Kenneth P. Green, Steven F. Hayward, and Kevin A. Hassett

*As the Kyoto Protocol's 2012 expiration date draws near, a general theme dominates the global conversation: leadership and participation by the United States are critical to the success of whatever climate policy regime succeeds the Kyoto Protocol. Two general policy approaches stand out in the current discussion. The first is national and international greenhouse gas (GHG) emissions trading, often referred to as "cap-and-trade." Cap-and-trade is the most popular idea at present, with several bills circulating in Congress to begin a cap-and-trade program of some kind. The second idea is a program of carbon-centered tax reform—for example, the imposition of an excise tax based on the carbon emissions of energy sources (such as coal, oil, and gasoline), offset by reductions in other taxes. In this paper we will address the strengths and weaknesses of both ideas and the framework by which legislators should evaluate them.*

The framing of a global climate regime presents a classic chicken-and-egg problem: the United States does not wish to enter into a regime of economically costly emission caps or taxes that would have the effect of driving industry and jobs to nations such as China and India that do not participate in such caps. China and India, however, are unlikely to enter into a restrictive regime unless the United States goes first, and even then, only so long as the policy regime does not threaten serious constriction of their economies. It is often assumed that if the United States goes first, developing nations will eventually follow, but this is by no means assured. Both China and India have repeatedly declared that they are not prepared to make even a delayed commitment at this time.

Given these policy uncertainties—and other uncertainties about the eventual impacts of climate change in terms of severity, distribution, and timing—there are two guideposts policymakers

Kenneth P. Green is a resident scholar, Steven F. Hayward is the F. K. Weyerhaeuser Fellow, and Kevin A. Hassett is a senior fellow and director of economic policy studies at AEI. This *Environmental Policy Outlook* is available online at [www.aei.org/publication26286/](http://www.aei.org/publication26286/).

should keep in mind. The first is that the United States can only effectively impose a national regulatory regime (though such a regime could eventually be harmonized with international efforts). The second is that, given the current uncertainty, policy should conform as much as possible to a "no regrets" principle by which actions undertaken can be justified separately from their GHG emissions effects in the fullness of time, such that nonparticipation by developing nations will disadvantage the United States in the global marketplace as little as possible.

While the United States may wish to join with other nations in setting a post-Kyoto emissions goal, it should be wary of joining an international emissions-trading or other regulatory regime. One of the less-remarked-upon aspects of the Kyoto Protocol, and any prospective successor treaty on that same model, is that it represents an unprecedented kind of treaty obligation for the United States. Most treaties involve direct actions and policies of governments themselves, such as trade treaties that bind nations' tariff levels and affect the private sector of the economy only indirectly. Kyoto and its kin go beyond government policy to affect the private sector directly or require the

government to control the private sector and the investment decisions of the private sector to an unprecedented degree. It is not governments that emit GHGs, after all. Between the asymmetries of legal and regulatory regimes across nations, the United States should think hard about the dilution of sovereignty that a hindering GHG treaty represents, even if the United States agrees with the basic objective of reducing carbon emissions.

### Problems with Emissions Trading for GHG

Some economists favor the idea of emissions trading for its elegance in achieving least-cost emissions reductions while avoiding the manifold difficulties of prescriptive “command-and-control” regulation from a centralized bureaucracy. But this is something of a false choice, as such regulation is a deeply troubled policy option. While trading may be superior to command-and-control, it is not necessarily superior to other alternatives, such as carbon-centered tax reform.

There are a number of emissions-trading success stories that, upon inspection, suggest significant limitations to the applicability of emissions trading for GHG emissions. Enthusiasts for cap-and-trade point first to our sulfur dioxide (SO<sub>2</sub>) trading experience under the 1990 Clean Air Act Amendments. It is claimed that the costs of SO<sub>2</sub> abatement through trading turned out to be dramatically lower than economists had forecast for a prescriptive regime, wherein the Environmental Protection Agency (EPA) would have mandated control technologies on individual coal-fired power plants. But a closer look shows this success to have been uneven. There has been significant volatility in emission permit prices, ranging from a low of \$66 per ton in 1997 to \$860 per ton in 2006, as the overall emissions cap has been tightened, with the price moving up and down as much as 43 percent in a year.<sup>1</sup> Over the last three years, SO<sub>2</sub> permit prices have risen 80 percent a year, despite the EPA’s authority to auction additional permits as a “safety valve” to smooth out this severe price volatility.

Several other aspects of the SO<sub>2</sub>-trading program are of doubtful applicability to GHGs. First, SO<sub>2</sub> trading was only applied to a single sector: initially, only 110 coal-fired power plants were included in the system, but it subsequently expanded to 445 plants. While

coal-fired power plants account for roughly one third of U.S. carbon dioxide (CO<sub>2</sub>) emissions and will therefore be central to a GHG cap-and-trade program, a comprehensive GHG emissions-trading program will have to apply across many sectors beyond electric utilities, vastly complicating a trading system.

Second, SO<sub>2</sub> and CO<sub>2</sub> are not comparable targets for emissions reduction. Reducing SO<sub>2</sub> emissions did not require any constraint on end-use energy production or consumption. Coal-fired power plants had many low-cost options to reduce SO<sub>2</sub> emissions without reducing electricity production. Some switched to low-sulfur coal (abetted in large part by railroad deregulation in the 1980s, which made transport of Western low-sulfur coal more economical than previously).

The cost of “scrubbers”—industrial devices which capture SO<sub>2</sub> and sequester it—turned out to be lower than predicted. Other utilities emphasized more use of natural gas. The impact on ratepayers and consumers was modest.

CO<sub>2</sub> is different: it is the product of complete fuel combustion. There is no “low-CO<sub>2</sub> coal,” and the equivalent of SO<sub>2</sub> scrubbers does not yet exist in economical form.<sup>2</sup> At the margin there is some opportunity for GHG emissions reductions through substitution—

increased use of natural gas (which emits less CO<sub>2</sub> per unit of energy than coal) and possibly nuclear power—but the inescapable fact is that any serious reduction in CO<sub>2</sub> emissions will require a suppression of fuel combustion. This is going to mean lower energy consumption and higher prices, at least in the intermediate term.

Even though confined to a segment of a single sector of energy use, the SO<sub>2</sub> emissions-trading regime was far from simple. There were complicated allocation formulas to distribute the initial emissions permits. Despite the best efforts to create objective criteria, at the end of the day, the allocation of emission permits involves some arbitrary discretion. For political reasons there were special subsidies and extra allowances for the benefit of high-sulfur coal interests. Most trading in the early years took place between power plants within the same company.

Establishing allowances and accounting systems for GHG emissions across industries is going to be vastly more difficult and highly politicized. The forest products industry, for example, will reasonably want credits for creating carbon sinks in the trees it plants and

While trading may be superior to command-and-control, it is not necessarily superior to other alternatives, such as carbon-centered tax reform.

harvests, but the manufacturing sector that uses these wood products as a raw material will want credit for sequestering carbon. The difference will have to be split in some arbitrary manner that will surely introduce economic distortions in the marketplace. The auto industry will want credits for GHG innovations, while industries and businesses of all kinds will lobby for credits for reducing mobile source emissions from changes to their auto and truck fleets. There are going to be winners and losers in this allocation process. Multiply this problem across sectors and industries and it becomes evident that a GHG emissions-trading system is going to be highly complex and unwieldy, and too susceptible to rent-seeking influence in Washington. The problem of politically adjusting competing interests will be compounded on the international scale. The long-running diplomatic conflicts that can be observed over purported subsidies for aircraft (i.e., Boeing versus Airbus) and the European Union's agricultural subsidies and trade barriers are examples of the kinds of conflicts that will be endemic to any international emissions-trading scheme.

The favored solution to these problems is to over-allocate the number of initial permits both to ease the cost and to encourage the rapid start-up of a market for trades. This was the course the European Union took with its Emissions Trading System (ETS), and it has very nearly led to the collapse of the system. Because emissions permits were over-allocated, the price of emissions permits plummeted, and little—if any—emissions reductions have taken place because of the ETS. The over-allocation of initial permits merely postpones both emissions cuts and the economic pain involved. Economist Robert J. Shapiro notes:

As a result of all of these factors and deficiencies, the ETS is failing to reduce European CO<sub>2</sub> emissions. . . . [T]he European Environmental Agency has projected that the EU is likely to achieve no more than one-quarter of its Kyoto-targeted reductions by 2012, and much of those "reductions" will simply reflect credits purchased from Russia or non-Annex-1 countries [developing countries], with no net environmental benefits.<sup>3</sup>

As economist William Nordhaus observes:

We have preliminary indications that European trading prices for CO<sub>2</sub> are highly volatile, fluctuating in a band and [changing] +/- 50 percent over

the last year. More extensive evidence comes from the history of the U.S. sulfur-emissions trading program. SO<sub>2</sub> trading prices have varied from a low of \$70 per ton in 1996 to \$1500 per ton in late 2005. SO<sub>2</sub> allowances have a monthly volatility of 10 percent and an annual volatility of 43 percent over the last decade.<sup>4</sup>

Nordhaus points out the ramifications of such volatility, observing that "[s]uch rapid fluctuations would be extremely undesirable, particularly for an input (carbon) whose aggregate costs might be as great as petroleum in the coming decades," and that "experience suggests that a regime of strict quantity limits might become extremely unpopular with market participants and economic policymakers if carbon price variability caused significant changes in inflation rates, energy prices, and import and export values."<sup>5</sup>

Nordhaus is not alone in this concern about price volatility. Shapiro similarly observes:

Under a cap-and-trade program strict enough to affect climate change, this increased volatility in all energy prices will affect business investment and consumption, especially in major CO<sub>2</sub> producing economies such as the United States, Germany, Britain, China and other major developing countries.<sup>6</sup>

Additional pitfalls and dilemmas of emissions trading can be seen through a review of the spectacular trading failure of the RECLAIM (Regional Clean Air Incentives Market) emissions-trading program in Southern California. Launched in 1994 after three years of development, RECLAIM set in motion an emissions-trading program targeting SO<sub>2</sub> and nitrogen oxides (NO<sub>x</sub>) emissions, and eventually hoped to expand to include volatile organic compound (VOC) emissions. All three types of emissions are important precursors to ozone formation in the greater Los Angeles air basin. RECLAIM, for the first time, offered swaps between stationary and mobile sources: stationary sources such as oil refineries could help reach their emissions reduction targets by purchasing old, high-polluting automobiles and trucks and taking them off the road—a cost-effective measure in a voluntary demonstration program. The South Coast Air Quality Management District (SCAQMD) estimated that SO<sub>2</sub> and NO<sub>x</sub> would be reduced by fourteen and eighty tons per day, respectively, by the

year 2003, at half the cost of the usual prescriptive method of regulation.<sup>7</sup> There was great public support and enthusiasm for the program at the outset.

RECLAIM never came close to operating as predicted, and was substantially abandoned in 2001.

Between 1994 and 1999, NO<sub>x</sub> levels fell only 3 percent, compared to a 13 percent reduction in the five-year period before RECLAIM. There was extreme price volatility aggravated by California's electricity crisis of 2000. NO<sub>x</sub> permit prices ranged from \$1,000 to \$4,000 per ton between 1994 and 1999, but soared to an average price of \$45,000 per ton in 2000, with some individual trades over \$100,000 per ton. Such high prices were not sustainable, and SCAQMD removed electric utilities from RECLAIM in 2001. SCAQMD also dropped its plan to expand RECLAIM to VOCs. Despite the hope that RECLAIM would be simple and transparent, there were serious allegations of fraud and market manipulation, followed by the inevitable lawsuits and criminal investigations.

One particular problem with RECLAIM that is likely to plague any international GHG emissions-trading regime is the lack of definite property rights to the emissions allowances the program creates. A cliché of the moment is that industry would like some clarity and certainty about any prospective GHG regulatory regime. A cap-and-trade program, however, cannot provide certainty precisely because emissions allowances are not accorded real property rights by law.<sup>8</sup> The government can change the rules at any time, making emissions allowances worthless. This is exactly what happened to electric utilities in Los Angeles: their allowances were terminated, and the utilities were subsequently required to install specified emissions-control technologies and to pay fines for excess emissions. In effect, some Los Angeles firms had to pay three times over for emissions reductions.

A GHG emissions-trading scheme on an international level will be even more vulnerable to these kinds of unpredictable outcomes. To the extent that a GHG emissions-trading program results in international cross-subsidization of the economies of trading partners, it is

going to be politically unsustainable in the long run. An international emissions-trading program is also unlikely to survive noncompliance by some of its members.

There are two final, overriding reasons to be doubtful about global emissions trading. It is possible that the defects of previous emissions-trading programs could be

overcome with more careful design and extended to an international level, though this would require an extraordinary feat of diplomacy and substantial refinements of international law. Even if such improvement could be accomplished, it would not provide assurance against the prospect that the cost of such a system might erode the competitiveness of the U.S. economy against developing nations that do not join the system.

The second reason for skepticism about global emissions trading is that it fails the "no regrets" test. It is considered bad form nowadays to express doubt or skepticism about the scientific case for rapid and dangerous global warming in the twenty-first century. If warming is either less pronounced than some current forecasts predict or if emissions reductions have limited effect in moderating future temperature rise . . . a severe global emissions-reduction policy through emissions trading could turn out to be the costliest public policy mistake in human history, with the costs vastly exceeding the benefits.

overcome with more careful design and extended to an international level, though this would require an extraordinary feat of diplomacy and substantial refinements of international law. Even if such improvement could be accomplished, it would not provide assurance against the prospect that the cost of such a system might erode the competitiveness of the U.S. economy against developing nations that do not join the system.

The second reason for skepticism about global emissions trading is that it fails the "no regrets" test. It is considered bad form nowadays to express doubt or skepticism about the scientific case for rapid and dangerous global warming in the twenty-first century. If warming is either less pronounced than some current forecasts predict or if emissions reductions have limited effect in moderating future temperature rise, however, a severe global emissions-reduction policy through emissions trading (on the order of a minimum 50 percent cut by 2050) could turn out to be the costliest public policy mistake in human history, with the costs vastly exceeding the benefits.

Could instituting a tax on the carbon emissions released by fuel use, as part of a revenue-neutral tax reform package, pass these two tests? We believe it could.

### Advantages of a Revenue-Neutral, Carbon-Centered Tax Reform

Most economists believe a carbon tax (a tax on the quantity of CO<sub>2</sub> emitted when using energy) would be a superior policy alternative to an emissions-trading regime. In fact, the irony is that there is a broad consensus in favor of a carbon tax everywhere except on Capitol Hill, where the "T word" is anathema. Former vice president Al Gore supports the concept, as does James Connaughton, head of the White House Council on

Environmental Quality during the George W. Bush administration. Lester Brown of the Earth Policy Institute supports such an initiative, but so does Paul Anderson, the CEO of Duke Energy. Crossing the two disciplines most relevant to the discussion of climate policy—science and economics—both NASA scientist James Hansen and Harvard University economist N. Gregory Mankiw give the thumbs up to a carbon tax swap.<sup>9</sup>

There are many reasons for preferring a revenue-neutral carbon tax regime (in which taxes are placed on the carbon emissions of fuel use, with revenues used to reduce other taxes) to emissions trading. Among them are:

- **Effectiveness and Efficiency.** A revenue-neutral carbon tax shift is almost certain to reduce GHG emissions efficiently. As economist William Pizer observes, “Specifically, a carbon tax equal to the damage per ton of CO<sub>2</sub> will lead to exactly the right balance between the cost of reducing emissions and the resulting benefits of less global warming.”<sup>10</sup> Despite the popular assumption that a cap-and-trade regime is more certain because it is a quantity control rather than a price control, such a scheme only works in very limited circumstances that do not apply to GHG control. The great potential for fraud attendant on such a system creates significant doubt about its effectiveness, as experience has shown in both theory and practice in the gyrations of the European ETS.

The likelihood of effectiveness also cannot be said for regulations such as increased vehicle fuel economy standards. In fact, such regulations can have perverse effects that actually lead to increased emissions. By making vehicles more efficient, one reduces the cost of a unit of fuel, which would actually stimulate more driving, and, combined with increasing traffic congestion, could lead to an increase in GHG emissions rather than a decrease.

As Harvard researchers Louis Kaplow and Steven Shavell point out, “The traditional view of economists has been that corrective taxes are superior to direct regulation of harmful externalities when the state’s information about control costs is incomplete,” which, in the case of carbon emissions reductions, it most definitely is.<sup>11</sup> And when it comes to quantity controls (as a cap-and-trade system would impose), Pizer found that

My own analysis of the two approaches [carbon taxes vs. emission trading] indicates that

price-based greenhouse gas (GHG) controls are much more desirable than quantity targets, taking into account both the potential long-term damages of climate change, and the costs of GHG control. This can be argued on the basis of both theory and numerical simulations.

Pizer found, in fact, that a carbon-pricing mechanism would produce expected net gains five times higher than even the best-designed quantity control (i.e., cap-and-trade) regime.<sup>12</sup>

- **Incentive Creation.** Putting a price on the carbon emissions attendant on fuel use would create numerous incentives to reduce the use of carbon-intensive energy. The increased costs of energy would flow through the economy, ultimately giving consumers incentives to reduce their use of electricity, transportation fuels, home heating oil, and so forth. Consumers, motivated by the tax, would have incentives to buy more efficient appliances, to buy and drive more efficient cars, and to better insulate their homes or construct them with more attention to energy conservation. A carbon tax would also create incentives for consumers to demand lower-carbon power sources from their local utilities. A carbon tax, as its cost flowed down the chains of production into consumer products, would lead manufacturers to become more efficient and consumers to economize in consumption. At all levels in the economy, a carbon tax would create a profit niche for environmental entrepreneurs to find ways to deliver lower-carbon energy at competitive prices. Finally, a carbon tax would also serve to level (somewhat) the playing field among solar power, wind power, nuclear power, and carbon-based fuels by internalizing the cost of carbon emission into the price of the various forms of energy.
- **Less Corruption.** Unlike carbon cap-and-trade initiatives, a carbon tax would create little incentive or opportunity for rent-seeking or cheating. As William Nordhaus explains:

A price approach gives less room for corruption because it does not create artificial scarcities, monopolies, or rents. There are no permits transferred to countries or leaders of countries, so they cannot be sold abroad for

wine or guns. . . . In fact, a carbon tax would add absolutely nothing to the instruments that countries have today.<sup>13</sup>

Without the profit potential of amassing tradable carbon permits, industry groups would have less incentive to try to get credits for their favored but non-competitive energy sources. That is not to say that tax-based approaches are immune from corruption, for they certainly are not. If set too far down the chain of production or set unevenly among energy sources, carbon taxes could well lead to rent-seeking, political favoritism, economic distortions, and so on. Foreign governments might have an incentive to undermine a trading scheme by offering incentives to allow their manufacturers to avoid the cost of carbon trading. A tax on fuels proportionate to their carbon content, levied at the point of first sale, should be less susceptible to corruption, and by delivering revenue to the government rather than to private entities, should create incentives more aligned with the government's objective.

- **Elimination of Superfluous Regulations.** Because a carbon tax would cause carbon emissions to be reduced efficiently across the entire market, other measures that are less efficient—and sometimes even perverse in their impacts—could be eliminated. With the proper federal carbon tax in place, there would be no need for corporate average fuel economy standards, for example. California's emissions-trading scheme, likewise, would be superfluous, and its retention only harmful to the Golden State. As regulations impose significant costs and distort markets, the potential to displace a fairly broad swath of environmental regulations with a carbon tax offers benefits beyond GHG reductions.
- **Price-Stabilization.** As the experiences of the European ETS and California's RECLAIM show us, pollution-trading schemes can be easily gamed, resulting in significant price volatility for permits. Imagine one's energy bill jumping around as permits become more or less available due to small changes in economic conditions. A carbon tax would be predictable, and

by raising the overall price of energy to include the tax, the portion of energy cost per unit that stems from fluctuation in market rates for fossil fuels shrinks as a percentage of the whole. That shrinkage makes the price of a given form of energy less susceptible to volatility every time there is a movement in the underlying production costs.

---

A carbon tax, as its cost flowed down the chains of production into consumer products, would lead manufacturers to become more efficient and consumers to economize in consumption.

---

- **Adjustability and Certainty.** A carbon tax, if found to be too stringent, could be relaxed relatively easily over a time-frame, allowing for markets to react with certainty. If found too low to produce results, a carbon tax could easily be increased. In either event, such changes could be phased in over time, creating predictability and allowing an ongoing reassessment of effectiveness via observations about changes in the consumption of various forms of energy. A cap-and-trade system, by contrast, is more difficult to adjust because permits, whether one is the seller or the buyer, reflect significant monetary value. Permit traders would demand—and rightly so—compensation if what they purchased in good faith has been devalued by a governmental deflation of the new "carbon currency." In addition, sudden changes in economic conditions could lead to significant price volatility in a cap-and-trade program that would be less likely under a carbon-tax regime.
- **Preexisting Collection Mechanisms.** Whether at local, state, or federal levels, carbon taxes could be levied and collected through existing institutions with extensive experience in enforcing compliance, and through ready-made statutes to back up their actions. The same cannot be said for emissions-trading schemes that require the creation of new trading markets, complete with new regulations and institutions to define and enforce the value of credits.
- **Keeping Revenue In-Country.** Unlike an international cap-and-trade regime, carbon taxes—whether done domestically or as an internationally agreed-upon value—have the advantage of keeping tax payments within individual countries. This could strongly reduce the opposition to international action that has, until this point, had a strong

implication of wealth redistribution overlaid on the policy discussion.

This dynamic leads to a second reason why a carbon tax is a better fit for U.S. climate policy: it offers an international analogue to our federalist approach to public policy innovation within the United States. As we have seen, there is reason to doubt the long-run effectiveness and sustainability of the EU's emissions-trading program. If the United States adopts a carbon tax approach, we will be able to compare the effectiveness of tax versus emissions trading in short order.

- **Mitigation of General Economic Damages.** As energy is one of the three most important variable inputs to economic production (along with labor and capital), raising the cost of energy would undoubtedly result in significant economic harm. Using the revenues generated from a carbon tax to reduce other taxes on productivity (taxes on labor or capital) could mitigate the economic damage that would be produced by raising energy prices. The most likely candidates for a carbon tax tradeoff would be the corporate income tax (the U.S. rate is currently among the highest in the industrialized world) and payroll taxes, the latter of which would lower the cost of employment and help offset the possibly regressive effects of higher energy prices on lower-income households. But across-the-board income tax rate cuts and further cuts in the capital gains tax could also be considered.

Few other approaches offer this potential. Regulatory approaches such as increasing vehicle efficiency standards do not because they mandate more expensive technologies and allow the costs to be passed on to consumers without offsets (unless they are subsidized), in which case it is the general taxpayer whose wallet shrinks. Emissions-trading would allow for this if one auctioned all initial permits and used the revenue to offset other taxes. The vast majority of trading systems, however, begin with the governing entity distributing free emission credits to companies based on historical emission patterns rather than having an open auction for permits that would produce such revenue streams. Without an auction, the revenues in a trading scheme accrue only to private companies that trade in carbon permits, while the companies buying permits would pass the cost on to consumers. International emissions-trading approaches such as Kyoto's clean development mechanism are worse still: the beneficiaries of

the scheme are likely to be foreign governments or private entities that can reduce (or pretend to reduce) carbon emissions more efficiently, leaving Americans with higher energy prices and no revenue stream to offset the negative impacts on productivity.

### Exploring the Parameters of Carbon-Centered Tax Reform

Published estimates of an initial optimal carbon tax on fuels are in the range of \$10 to \$20 per ton of CO<sub>2</sub> emitted (in 2005 dollars). Nordhaus, for example, estimates the optimal rate for a tax implemented in 2010 to be \$16 per ton of carbon and rapidly rising over time.<sup>14</sup> We will focus primarily on a tax rate of \$15 per ton of CO<sub>2</sub>, while also providing enough information to allow a reader to consider the likely impact of a range of possible taxes.

- **Background on Emissions.** According to the U.S. Energy Information Administration, emissions of CO<sub>2</sub> in the United States in 2005 equaled 6,009 million metric tons (MMT) of CO<sub>2</sub>, an increase of twenty MMT over 2004.<sup>15</sup> Emissions have grown at an annual rate of 1.2 percent between 1990 and 2005. Recently, the rate has slowed, with the average annual rate between 2000 and 2005 equaling 0.5 percent.
- **Price Impacts.** Table 1, on the following page, shows the price impacts of a \$15 per ton CO<sub>2</sub> tax under the assumption that the tax is fully passed forward. The price shown for gasoline is not in addition to that on crude oil (i.e., it is not a double-tax). It is included to show how the price levied on crude oil would change the price of the refined product.<sup>16</sup> This provides a rough guide to the excise tax equivalent price impacts of a tax on CO<sub>2</sub>. We can scale the tax rates to evaluate different carbon taxes. For example, a \$10 per ton tax on CO<sub>2</sub> would raise the price of coal by \$28.55 x 0.66 = \$18.84.

A \$15 CO<sub>2</sub> tax would raise the price of gasoline by 14¢ per gallon. A similar calculation can be made for coal-fired electricity. Using the most recent data from EPA's Emissions & Generation Resource Integrated Database (eGRID), we calculate that the average emission rate for coal-fired power plants is 2,395 pounds of CO<sub>2</sub> per megawatt-hour (MWh) of electricity. A \$15 per ton CO<sub>2</sub> tax would raise the price of coal-fired electricity by 1.63¢ per kilowatt-hour (kWh), or 20 percent at an average electricity price of 8.3¢ per kWh.

Table 2 shows the impact of a \$15 per ton carbon tax on the price of major fuels used in electricity generation. Fuel prices are prices at which the carbon tax would likely be applied.<sup>17</sup> Not surprisingly, coal is most heavily impacted by a carbon tax, with coal's price rising by more than three-quarters with a tax of this magnitude.

- **Behavioral Responses and Revenue.**

The higher energy prices in table 2 should bring about a reduction in the demand for carbon-intensive fuels. A full analysis of equilibrium changes in carbon emissions requires a Computational General Equilibrium (CGE) model, an exercise that is beyond the scope of this paper. We can, however, make a rough calculation using previously published results from CGE models. Here, we extrapolate results from the analysis of Bovenberg and Goulder of a \$25 per ton tax on carbon.<sup>18</sup> Table 3 presents the price and output changes for fossil fuels following the imposition of the carbon tax in Bovenberg and Goulder's study. We compute the arc elasticity as the ratio of the percentage output change to price change.

These response elasticities are not price elasticities in the usual sense, since they are the outcome of the entire general equilibrium response to the tax. These responses, for example, include a shift in electricity production away from coal toward natural gas and oil.<sup>19</sup> They are also relatively short-run responses, on the order of three to five years following the phased-in introduction (over three years) of the carbon tax.

The elasticities from table 3 combined with the price increases in table 2 imply the reductions in fuel use and carbon emissions seen in table 4.

TABLE 1  
PRICE IMPACTS OF A \$15 CO<sub>2</sub> TAX

Energy Unit	Coal Short Ton	Crude Oil Barrel	Natural Gas mcf	Gasoline Gallon
MT C/Quad Btu	25,980,000	20,300,000	14,470,000	19,340,000
Mt CO <sub>2</sub> /Quad Btu	95,260,000	74,433,333	53,056,667	70,913,333
Btu/Energy Unit	19,980,000	5,800,000	1,027,000	124,167
Mt CO <sub>2</sub> /Energy Unit	1.903	0.432	0.054	0.009
Tax/Energy Unit	\$28.55	\$6.48	\$0.81	\$0.14

SOURCES: Carbon content of fuels from [www.eia.doe.gov/environment.html](http://www.eia.doe.gov/environment.html); energy content of fuels from U.S. Department of Energy (DOE), Energy Information Administration (EIA), *Annual Energy Review 2005*, DOE/EIA-0384(2005), Washington, DC: EIA, 2006.

TABLE 2  
SHORT-RUN PRICE EFFECTS OF A \$15 CO<sub>2</sub> TAX

Energy Source	Unit	Price Per Unit (\$)	Tax Per unit of Energy	Price Change (%)
Coal	short ton	\$34.29	28.55	83.3
Crude Oil	barrel	\$60.23	6.48	10.8
Natural Gas	thousand cubic feet	\$8.53	0.82	9.6

SOURCE: Prices are 2006 averages as reported by Energy Information Administration (EIA). Coal statistics from EIA, "Receipts, Average Cost and Quality of Fossil Fuels," available at [www.eia.doe.gov/cneaf/electricity/epm/table4\\_2.html](http://www.eia.doe.gov/cneaf/electricity/epm/table4_2.html); crude oil statistics from EIA, "Refiner Acquisition Cost of Crude Oil," available at [http://tonto.eia.doe.gov/dnav/pet/pet\\_pri\\_ric2\\_dcu\\_nus\\_a.htm](http://tonto.eia.doe.gov/dnav/pet/pet_pri_ric2_dcu_nus_a.htm); and natural gas statistics from EIA, "Natural Gas Prices," available at [http://tonto.eia.doe.gov/dnav/ng/ng\\_pri\\_sum\\_dcu\\_nus\\_m.htm](http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm). Unit taxes computed from table 1.

NOTE: Tax is assumed to be fully passed forward.

TABLE 3  
IMPLIED OUTPUT ELASTICITIES

	Price Change (%)	Output Change (%)	Output Elasticity
Coal Mining	54.50	-19.10	-0.350
Oil	13.20	-2.10	-0.159
Natural Gas	13.20	-2.10	-0.159

SOURCE: A. Lans Bovenberg and Lawrence Goulder, "Neutralizing the Adverse Industry Impacts of CO<sub>2</sub> Abatement Policies: What Does It Cost?" in *Distributional and Behavioral Effects of Environmental Policy*, eds. Carlo Carraro and Gilbert E. Metcalf (Chicago: University of Chicago Press, 2000), table 2.2.

NOTE: Output elasticity is the ratio of the percent change in quantity demanded divided by the percent change in price, multiplied by negative one.

As table 4 shows, CO<sub>2</sub> emissions are reduced by 663 million metric tons, a decline of 11 percent. Most of the reduction in emissions comes from reduced coal use. A static estimate of CO<sub>2</sub> tax revenue (ignoring the behavioral response) suggests that a \$15 tax would raise \$90.1 billion per year in the near term.<sup>20</sup> Allowing for the emissions reductions calculated in table 4, the tax would raise \$80.2 billion per year. Clearly, the tax would raise less money in future years as greater reductions in carbon emissions occurred through improvements in efficiency, fuel switching, or new technologies like carbon capture and sequestration.<sup>21</sup> The revenue estimate, however, does not factor in growth in demand for electricity nor the baseline growth in carbon emissions that would result in the absence of any carbon policy.

Applying this approach to different carbon tax rates gives the results for emissions reductions and tax revenues seen in table 5.

While these results are useful for providing a ballpark estimate of the impact of a carbon tax, more detailed modeling will be required to refine them further. Our estimates are broadly consistent with results from more detailed CGE modeling of U.S. carbon policies.<sup>22</sup>

- **Potential Uses of Revenue.** Carbon tax revenues could be used for a number of purposes, such as lowering payroll and corporate income taxes, funding tax relief to low-income earners most affected by increased energy prices, or a combination of these. Table 6 reports the carbon tax revenue from table 5 as a percentage of various tax collections in 2005, as reported in the most recent administration budget submission.

A \$15 per ton CO<sub>2</sub> tax raises enough revenue to reduce the corporate income tax by over one-quarter and income or payroll taxes by roughly 10 percent. In a policy brief for the Brookings Institution and the

TABLE 4  
EMISSIONS REDUCTIONS FOR A \$15 TAX

Energy Source	Output Change (%)	CO <sub>2</sub> Emissions (MMT)	Reduction in CO <sub>2</sub> Emissions (MMT)
Coal	-29.2	2,046	597.1
Crude Oil	-1.7	2,832	48.4
Natural Gas	-1.5	1,130	17.2
<b>Total</b>	<b>N/A</b>	<b>6,009</b>	<b>662.8</b>

SOURCE: Authors' calculations.

TABLE 5  
VARYING THE TAX RATE

Tax Rate Per Ton (\$)	Emissions Reductions (%)	Tax Revenue (\$ billions, annual rate)
10	7.40	55.7
15	11.0	80.2
20	14.7	102.5
25	18.4	122.6

SOURCE: Authors' calculations.

TABLE 6  
CARBON TAXES AS A SHARE OF OTHER TAXES

Tax Rate Per Ton (\$)	Tax Revenue (\$ billions)	Personal Income Tax (%)	Corporate Income Tax (%)	Payroll Taxes (%)
10	55.7	6.0	20.0	7.0
15	80.2	8.6	28.8	10.1
20	102.5	11.1	36.8	12.9
25	122.6	13.2	44.1	15.4

SOURCE: Authors' calculations.

World Resources Institute, economist Gilbert Metcalf estimated that a rebate of the employer and employee payroll tax contribution on the first \$3,660 of earnings per worker in 2003 would be sufficient to make the carbon tax both revenue- and distributionally neutral.<sup>23</sup>

Distributional neutrality may well impact the desirability and political feasibility of a carbon tax, but there are efficiency considerations as well. There is substantial literature on the "double dividend" that examines the economic conditions under which a

carbon tax can be paired with a reduction in other taxes in a manner that improves the overall efficiency of the economy. Where such a double dividend is available, a carbon tax swap would be desirable, even if the environmental benefit of reduced carbon emissions failed to be realized.

The concept of the double dividend stems from the observation that a tax on an environmental externality not only helps curb the externality (dividend 1), but also provides revenue with which other distorting taxes can be reduced, thereby providing efficiency gains (dividend 2).<sup>24</sup>

The double dividend comes in different levels.<sup>25</sup> The "weak" double dividend states that if one has an economically distorting tax, using environmental tax proceeds to lower it provides *greater efficiency gains* than returning the proceeds lump sum to those who pay the environmental tax. An intermediate form of the double dividend hypothesis is that there exists a distortionary tax, such that using environmental tax proceeds to lower this tax will *improve welfare*, setting aside environmental benefits.<sup>26</sup> A strong form claims that a welfare gain will occur when environmental proceeds replace those of the typical distorting tax.

The weak double dividend is uncontroversial,<sup>27</sup> while the strong double dividend is somewhat more controversial.<sup>28</sup> Criticisms notwithstanding, logic suggests that the pursuit of a strong double dividend is desirable as a matter of public policy. To that end, it would seem much more desirable in terms of efficiency to pursue capital tax reduction as a revenue feedback than other choices, as the current treatment of capital in the tax code is quite far from the optimal tax of zero, and the efficiency gains from a reduction in a payroll tax would likely be minimal if labor is, as is generally accepted, supplied relatively inelastically.

It should be noted that cap-and-trade systems and carbon-tax systems can be designed so they are quite similar. If, for example, emissions are capped and permits are auctioned off, then one could, after observing the auction price, set a carbon tax that leads to a similar emissions and revenue outcome. Cap-and-trade systems, however, generally have been pursued as an alternative to revenue-raising taxes, and often allocate

the permits according to some formula rather than through an auction. For the purposes of exposition, we compared a carbon tax to this latter form of the cap-and-trade system. One should remember that cap-and-trade proposals can be adjusted to raise revenues, and the revenues could then be used to pursue the double dividend. In that case, the relative merits of a carbon tax would be diminished.

### Achieving a More Efficient System

A cap-and-trade approach to controlling GHG emissions would be highly problematic. A lack of international binding authority would render enforcement nearly impossible, while the incentives for cheating would be extremely high. The upfront costs of creating institutions to administer trading are significant and likely to produce entrenched bureaucracies that clamor for ever-tighter controls on carbon emissions. Permit holders will see value in further tightening of caps, but will resist efforts outside the cap-and-trade system that might devalue their new carbon currency. Higher energy costs resulting from trading would lead to economic slowdown, but as revenues would flow into for-profit coffers (domestically or internationally), revenues would be unavailable for offsetting either the economic slowdown or the impacts of higher energy prices on low-income earners.

A program of carbon-centered tax reform, by contrast, lacks most of the negative attributes of cap-and-trade, and could convey significant benefits unrelated to GHG reductions or avoidance of potential climate harms, making this a no-regrets policy. A tax swap would create economy-wide incentives for energy efficiency and lower-carbon energy, and by raising the price of energy would also reduce energy use. At the same time, revenues generated would allow the mitigation of the economic impact of higher energy prices, both on the general economy and on the lower-income earners who might be disproportionately affected by such a change. Carbon taxes would be more difficult to avoid, and existing institutions quite adept at tax collection could step up immediately. Revenues would remain in-country, removing international incentives for cheating or insincere participation in carbon-reduction programs. Most of these effects would remain beneficial even if science should

---

A tax swap would create economy-wide incentives for energy efficiency and lower-carbon energy, and by raising the price of energy, would also reduce energy use.

---

determine that reducing GHG emissions has only a negligible effect on mitigating global warming.

A modest carbon tax of \$15 per ton of CO<sub>2</sub> emitted would result in an 11 percent decline in CO<sub>2</sub> emissions, while raising non-coal-based energy forms modestly. Coal-based energy prices would be affected more strongly, which is to be expected in any plan genuinely intended to reduce GHG emissions. A number of possible mechanisms are available to refund the revenues raised by this tax. On net, these tools could significantly reduce the economic costs of the tax and quite possibly provide economic benefits.

For these reasons, we conclude that if aggressive actions are to be taken to control GHG emissions, carbon-centered tax reform—not GHG emission trading—is the superior policy option.

*AEI editorial associate Nicole Passan worked with Messrs. Green, Hayward, and Hassett to edit and produce this Environmental Policy Outlook.*

## Notes

1. United States Environmental Protection Agency (EPA), "Progress Reports," available at [www.epa.gov/airmarkets/progress/progress-reports.html](http://www.epa.gov/airmarkets/progress/progress-reports.html).

2. Sequestration projects currently appear to be not only very expensive, but they also reduce net power generation by as much as 20 percent, further aggravating the cost that will be passed along to consumers and rate payers.

3. Robert J. Shapiro, "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes," February 2007, 22, available at [www.theamericancustomer.org/Shapiro.pdf](http://www.theamericancustomer.org/Shapiro.pdf).

4. William Nordhaus, "Life after Kyoto: Alternative Approaches to Global Warming Policies" (NBER working paper no. W11889, December 2005), 15.

5. *Ibid.*, 22.

6. Robert J. Shapiro, "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes."

7. RECLAIM covered 390 stationary sources of NO<sub>x</sub> and fourteen stationary sources of SO<sub>2</sub>, which represented only 17 percent of total basin-wide NO<sub>x</sub> emissions and 31 percent of basin-side SO<sub>2</sub> emissions.

8. The Clean Air Act forbids it, in fact. SCAQMD's RECLAIM regulations read: "An RTC [RECLAIM Trading

Credit] shall not constitute a security or other form of property." Section 4 of the RECLAIM regulations reiterated this point: "Nothing in District rules shall be construed to limit the District's authority to condition, limit, suspend, or terminate any RTCs or the authorization to emit which is represented by a Facility Permit." (Cited in James L. Johnston, "Pollution Trading in La-La Land," *Regulation* [Fall 1991], available at [www.cato.org/pubs/regulation/reg17n3-johnston.html](http://www.cato.org/pubs/regulation/reg17n3-johnston.html).)

9. Carbon Tax Center, "Who Supports," available at <http://carbontax.wrkng.net/who-supports/>.

10. William Pizer, "Choosing Price or Quantity Controls for Greenhouse Gases," *Resources for the Future Climate Issues Brief* 17 (July 1999).

11. Louis Kaplow and Steven Shavell, "On the Superiority of Corrective Taxes to Quantity Regulation," *American Law and Economics Review* 4, no. 1 (2002).

12. William Pizer, "Choosing Price or Quantity Controls for Greenhouse Gases."

13. William Nordhaus, "Life after Kyoto: Alternative Approaches to Global Warming Policies," 15.

14. *Ibid.*

15. U.S. Department of Energy (DOE), Energy Information Administration (EIA), *Emissions of Greenhouse Gases in the United States 2005*, DOE/EIA-0573(2005), Washington, DC: DOE, 2006. Total GHG emissions equaled 7,147 million metric tons CO<sub>2</sub> equivalent using hundred-year global warming potentials. Note that a simple conversion of other GHGs (i.e., methane, nitrous oxides, HFCs, and PFCs) does not exist. The global warming potential depends on the time horizon. We focus on CO<sub>2</sub> only in this study, though, ideally, a carbon tax would also tax these non-CO<sub>2</sub> emissions.

16. This is a standard assumption borne out by CGE modeling. See, for example, A. Lans Bovenberg and Lawrence Goulder, "Neutralizing the Adverse Industry Impacts of CO<sub>2</sub> Abatement Policies: What Does It Cost?" in *Distributional and Behavioral Effects of Environmental Policy*, eds. Carlo Carraro and Gilbert E. Metcalfe (Chicago: University of Chicago Press, 2000), 45–85.

17. We assume the tax on coal would be applied for electric utilities and major industrial coal users. Note that 91 percent of domestic and imported coal is consumed by electric utilities. (DOE, EIA, *Emissions of Greenhouse Gases in the United States 2005*.) The tax on crude oil is levied at refineries, and the tax on natural gas at the city gate.

18. A. Lans Bovenberg and Lawrence Goulder, "Neutralizing the Adverse Industry Impacts of CO<sub>2</sub> Abatement Policies: What Does It Cost?"

19. Increased coal prices could also lead to increased demand for imported oil, an important policy consideration outside the scope of this paper.

20. Carbon taxes can be reported in either units of carbon or CO<sub>2</sub>. To convert a tax rate per unit of carbon dioxide to a rate per unit of carbon, multiply the CO<sub>2</sub> rate by 44/12 (the mass difference between carbon and CO<sub>2</sub>). Thus, a tax of \$10 per ton of CO<sub>2</sub> is equivalent to a tax of \$36.67 per ton of carbon.

21. The recent coal study by researchers at the Massachusetts Institute of Technology suggests that carbon capture and sequestration is cost competitive at a carbon price of \$30 per ton of CO<sub>2</sub>. See John Deutch and Ernest Moriz, *The Future of Coal* (Massachusetts Institute of Technology, 2007), available at <http://web.mit.edu/ccal/>.

22. Sergey Palusev et al., *Assessment of U.S. Cap-and-Trade Proposals*, report 146 (Cambridge, MA: MIT Joint Program on the Science and Policy of Global Change, 2007), available through <http://mit.edu/globalchange/www/abstracts.html#top>.

23. Gilbert Metcalf, *A Green Employment Tax Swap: Using a Carbon Tax to Finance Payroll Tax Relief* (Washington, DC: Brookings Institution–World Resources Institution, 2007).

24. Don Fullerton and Gilbert E. Metcalf, "Environmental Taxes and the Double Dividend Hypothesis: Did You Really

Expect Something for Nothing?" *Chicago-Kent Law Review* 73, no. 1 (1998): 221–56.

25. See Lawrence H. Goulder, "Environmental Taxation and the 'Double Dividend': A Reader's Guide," *International Tax and Public Finance* 2 (1995): 157–83, for a thorough taxonomy of the various double dividends. Also see A. Lans Bovenberg and Lawrence Goulder, "Neutralizing the Adverse Industry Impacts of CO<sub>2</sub> Abatement Policies: What Does It Cost?"

26. The terminology of intermediate and strong double dividends is due to Goulder, "Environmental Taxation and the 'Double Dividend': A Reader's Guide."

27. Mustafa Babiker, Gilbert E. Metcalf, and John Reilly, "Tax Distortions and Global Climate Policy," *Journal of Environmental Economics and Management* 46 (2003): 269–87. Babiker et al. show that it is possible, however, to find taxes such that lump-sum replacement dominates, lowering a distortionary tax.

28. A. Lans Bovenberg and Raud de Mooij, "Environmental Levies and Distortionary Taxation," *American Economic Review* 84, no. 4 (1994): 1085–89. See also Lawrence H. Goulder, "Environmental Taxation and the 'Double Dividend': A Reader's Guide."

Senator SANDERS. Thank you very much.

David Blittersdorf is the CEO of Earth Turbines. He is the founder of NRG Systems in Hinesburg, Vermont. David, thanks for being here.

**STATEMENT OF DAVID BLITTERSDORF, CEO, EARTH  
TURBINES; FOUNDER, NRG SYSTEMS**

Mr. BLITTERSDORF. Senator Sanders and members of the Committee, thank you for allowing me to be here.

NRG is a leading manufacturer of wind measurement systems and wind turbine control sensors for the worldwide utility scale wind industry. Earth Turbines is a manufacturer of small wind turbines for home and community use in the U.S. By growing the renewable energy industry, we have a huge opportunity today, both to address global warming and to create the green jobs here in America.

I founded NRG in 1982 with only one employee. That was me. Now, its products can be found on every continent in the world and more than 120 different countries serving electric utilities, wind farm developers, research institutes, government agencies and universities.

A company such as NRG in a small rural community such as Hinesburg, Vermont that provides highly skilled, well-paid jobs, has a ripple effect on the community, State and the region. Today under the leadership of my wife, Jan Blittersdorf, NRG is experiencing sales growth of over 40 percent per year. With the twin threats of global warming and peaking of world oil production, we are implementing plans to accommodate 40 plus percent growth in the foreseeable future.

Today, NRG staff work in a 3-year old, 46,000 square foot new building. It is a world class, energy efficient, renewable energy-powered lead gold certified building. We are adding a 30,000 square foot addition right now. By the way, we are basically pre-buying most of our energy for our business for the life of the building. Over 80 percent of our energy is built in through efficiency and renewables, mainly solar and wind.

Talking about larger-scale wind, today's typical utility-scale wind turbine can generate as much as two megawatts of electricity, or enough power to meet the needs of about 540 households. That is equal to the carbon emitted from 4,800 cars.

Going forward, while wind supply is only about 1 percent of America's electricity today, even critics agree that wind could supply fully 20 percent of our electric needs in the future, further reducing our dependence on foreign oil and other energy sources. An interesting fact, the Statue of Liberty's torch is powered through the purchase of wind energy. Small wind turbines are sold in every State and exports account for almost one half of all U.S. manufacturer sales of small wind.

Then when we look at wind energy, how it displaces fossil fuels, it not only reduces associated emissions, but also conserves water and puts downward pressure on fuel prices. Every megawatt hour of wind energy that displaces fossil fuel will conserve 100 to 500 gallons of water. Wind energy often displaces natural gas and reduced demand for natural gas helps insulate customers from price

spikes. A recent report from Wood Mackenzie, a power and gas research firm, showed that an increase in renewable energy from an RPS, or renewable portfolio standard, could reduce natural gas prices by 15 percent to 20 percent over the next 20 years.

In 2005, the U.S. became the world's largest market for new wind energy, after a decade of falling behind the strong markets of Germany and Spain. Policies aimed at grabbing onto this market by building skilled workers and new supply chains could be a boon to U.S. manufacturing, which has lost over 2.5 million jobs between 2001 and 2004.

Quickly, just a couple of snapshots of the new green jobs being created in the wind industry. In the town of Pipestone, Minnesota, the 1-year old Suzlon wind turbine manufacturing plant employs 275 people after just 1 year. LM Glasfiber, a builder of wind turbine blades, is building its second plant in the U.S. and creating 1,000 new jobs in Little Rock, Arkansas. LM's existing plant in Grand Forks, North Dakota already provides 750 jobs. Tower manufacturers are adding jobs. Siemens is to add 200 in Fort Madison, Iowa, and Aerisyn with 130 jobs in Tennessee. DMI Industries is creating 450 jobs in Tulsa, Oklahoma.

With proper and clear support for renewable energy, the potential growth for the wind industry could create tens of thousands of new manufacturing jobs and hundreds of thousands of jobs across the industry. With Jan running NRG, I am building our second green business. Earth Turbines is focused on wind turbines for individual homes, farms and small businesses. We are just starting up, and after almost 30 years of wind energy experience, we hope to become the leading home wind turbine manufacturer for America.

The home wind industry is small and has been crippled in the past by the low cost of fossil fuels, lack of Federal incentives, and nonsupport of policy at the State and Federal levels. Investment to jump start this important segment of the wind industry is appearing, but strong signals in the form of incentives and supportive policy at the Federal level is an absolute necessity.

In closing here, to keep providing new green jobs, spurring rural economic development, and addressing global warming, the wind industry, both large-scale and small, needs Congress to send the kind of strong signals through the policies that I have sketched out to really address our energy and environmental problems. Legislation such as S. 309, Global Warming Pollution Reduction Act, sponsored by Senator Sanders, is necessary now.

I ask you, Congress, to act boldly and swiftly so that we can keep wind component factories humming today.

Thank you.

[The prepared statement of Mr. Blittersdorf follows:]

STATEMENT OF DAVID BLITTERSDORF, CEO, EARTH TURBINES;  
FOUNDER, NRG SYSTEMS

Senator Sanders, Chairman Boxer, Ranking Member Inhofe and members of the committee, my name is David Blittersdorf and I am the founder of NRG Systems and CEO of Earth Turbines. Both companies are based in Hinesburg, Vermont. NRG is the leading manufacturer of wind measurement systems and wind turbine control sensors for the utility-scaled wind industry worldwide, and Earth Turbines is a manufacturer of small wind turbines for home and community use in the U.S.

By growing the renewable energy industry, we have a huge opportunity today both to address global warming and to create “green” jobs here in America.

#### LARGE-SCALE WIND

I founded NRG in 1982, with only one employee?me, and now its products can be found on every continent in more than 120 countries, serving electric utilities, wind farm developers, research institutes, government agencies, and universities. A company such as NRG, in a small rural community such as Hinesburg, Vermont, that provides highly skilled well-paid jobs, has a ripple effect on the community, State and region. Today, under the leadership of my wife Jan Blittersdorf, NRG is experiencing growth of over 40 percent per year, and with the twin threats of global warming and peaking of world oil production, we are implementing plans to accommodate 40 percent or more growth in business for the foreseeable future. Today NRG’s staff work in a 3-year old, 46,000-square-foot world-class energy efficient and renewable energy powered LEED gold certified building. A 30,000 square foot addition is under construction now.

Today’s typical utility-scale wind turbine can generate as much as two megawatts of electricity, or enough power to meet the needs of about 540 households. It is also interesting to note that:

- A single utility-scale wind turbine avoids the same amount of carbon dioxide as is emitted by about 4,800 cars.
- In 1998 wind energy produced enough electricity to power about 500,000 homes. Today, turbines operating in about 30 states produce the amount of electricity needed to power about 3 million American homes ? or about that used by the entire population of the State of Virginia, reducing the need for fossil fuel electricity generation.
- While wind supplies only about 1 percent of America’s electricity today, even critics agree that wind could supply fully 20 percent of our electricity needs, further reducing our dependence on foreign oil.
  - The Statue of Liberty’s torch is powered through a purchase of wind energy.
  - Starbucks, Safeway, and Staples are all purchasing wind-generated electricity.
  - Examples of wind energy jobs include 500 workers building towers at Beard Industries in Shreveport, LA, about 1000 new jobs coming to a just announced tower manufacturing plant in Tulsa, OK, and five new wind energy businesses in Chattanooga, TN.
  - Small wind turbines are sold in every State and exports account for almost one-half of all US manufacturers’ sales.
  - Wind contributes in ways beyond creating jobs and combating global warming. Wind developers pay about \$5,000 per turbine, per year for 20 years in lease payments to hard-pressed farmers, ranchers and other landowners from Maple Ridge, NY to Abilene, TX. Wind projects also make significant contributions to the local tax base of many rural communities.
  - When wind energy displaces fossil fuel, it not only reduces the associated emissions but also conserves water and puts downward pressure on fuel prices. Every megawatt-hour of wind energy that displaces fossil fuel will conserve 100 to 500 gallons of water. Wind energy often displaces natural gas, and reduced demand for natural gas helps insulate customers from price spikes. A recent report from Wood Mackenzie, a power and gas research firm, showed that an increase in renewable energy from a Renewable Portfolio Standard could reduce natural gas prices by 15–20 percent over the next 20 years.

In 2005, the U.S. became the world’s largest market for new wind energy after a decade of falling behind the strong markets of Germany and Spain. Policies aimed at grabbing onto this market by building skilled workers and new supply chains could be a boon to U.S. manufacturing which has lost over 2.5 million jobs between 2001 and 2004.

Here is a snapshot of new “green” jobs being created by the wind industry:

Minnesota: In the town of Pipestone, the 1-year old Suzlon wind turbine manufacturing plant employs 275 people.

Iowa: Last December, the announcement of plans by Siemens Corp. to open a wind tower manufacturing facility in Fort Madison brought 2,600 people to job fairs to compete for 200 jobs.

Tennessee: Chattanooga based Aerisyn, another tower manufacturer, recently invested \$7 million and brought economic activity and 130 employees to a once empty warehouse.

Arkansas: LM Glasfiber, a builder of wind turbine blades, is building its second plant in the U.S. and creating 1000 new jobs in Little Rock. LM's existing plant in Grand Forks, ND already provides 750 jobs.

Oklahoma: This year, DMI Industries is opening a tower manufacturing plant in Tulsa, creating up to 450 jobs. This is in addition to 100 jobs already in place at Tulsa's Trinity Structural Towers plant. Bergey Windpower in Norman is a leading small wind turbine manufacturer who has recently expanded into a new facility.

Michigan: Since 2001, Michigan has lost 130,000 manufacturing jobs, many of which were in the auto industry. Earlier this month at a manufacturing conference in Lansing, Governor Jennifer Granholm told participants that renewable energy projects will help re-build Michigan's economy and create jobs. The Governor stated that "In the 20th century, Michigan was the State that put the Nation and world on wheels. In the 21st century, we want to be the State that leads our nation to sustainable energy independence."

With proper and clear support for renewable energy, the potential growth of the wind industry could create tens of thousands of new manufacturing jobs and hundreds of thousands of jobs across the industry.

#### SMALL WIND

With Jan running NRG, I am building our second "green" business, Earth Turbines focused on small wind turbines for individual homes, farms and small businesses. Earth Turbines is just starting up and after almost 30 years of our wind energy experience, we hope to become a leading home wind turbine manufacturer for North America in the near future.

The home wind energy industry is small and has been crippled in the past by the low cost of fossil fuels, lack of Federal incentives and non-supportive policy at the local, State and Federal levels. Investment to jump-start this important segment of the wind industry is appearing but strong signals in the form of incentives and supportive policy at the Federal level is an absolute necessity.

The Rural Electrification Administration (REA), created in 1935, is an example of success in bringing the benefits of grid electricity to farmers and rural communities. Before the REA, most rural residents either went without electricity or generated their own with wind power. I have met many folks who remember that Dad or Grandpa put in a wind generator to power the family radio and a few lights. Over a million wind electric generators were sold in the early to mid 1900's, but this growing industry was silenced by the mid 1950's by the success of the REA. It is time to re-power rural America with home, farm and community-scale grid connected wind energy.

The small wind turbine industry is poised for tremendous growth. The technology is "Made in the USA" and the market is asking for products. Today's home wind turbine production is measured in the hundreds of turbines per year but the market potential is in the hundreds of thousands per year. Volume production of a home size wind system could lower the cost from \$25,000 today to under \$15,000 in 5 years, making renewable energy a viable option for households across America. With effective government policies and incentives in place, the US small wind industry could grow at 40-60 percent per year compared to 14-25 percent now.

#### NEXT STEPS

To realize this opportunity we must take bold steps to invest in renewable energy through extensions of the renewable energy tax credits and bonds, specifically:

- 1) A full value, long term renewable energy Production Tax Credit (or PTC) which expires December 31, 2008
- 2) An Investment Tax Credit for small wind systems used to power homes, farms, and small businesses, and
- 3) Clean Renewable Energy Bonds for non-taxpaying, public power entities.
- 4) A nation-wide renewable energy requirement of at least 15 percent by the year 2020. (i.e., a Renewable Electricity Standard, RES or Renewable Portfolio Standard., RPS.)
- 5) A national "net metering" law so that small wind turbines can connect to the grid in a simple and fair way without roadblocks from local power companies.
- 6) Group net metering so groups of utility customers to jointly own a larger wind turbine and share its output.

I will expand a bit on the last two items because you may be unfamiliar with them. Net metering is the modern way to have our society work together in distributed wind and solar electricity generation. Power is generated at the point of use

and is shared by all customers on our electrical grid. It is time for standardized countrywide Net Metering; Thirty-two states have put net metering into law, but the rules are not consistent. We also need to facilitate Group Net Metering, which allows a group of customers of a utility to jointly own a larger wind turbine and share its output around their community homes, farms and businesses.

#### CONCLUSION

NRG and Earth Turbines represent only a piece of the growing wind industry, which is becoming a larger source of domestic energy production while producing hundreds of thousands of new jobs.

To keep providing new “green” jobs, spurring rural economic development and addressing global warming, the wind industry, both large scale and small, needs Congress to send the kind of strong signals through the policies that I have sketched out. To really address our energy and environmental problems, legislation such as S. 309 Global Warming Pollution Reduction Act sponsored by Senator Sanders is necessary.

We all ask Congress act boldly and swiftly so that we can keep wind component factories humming from Shreveport, Louisiana to Hinesburg, Vermont. Wind developers will also keep making much-needed land rental payments to farmers and ranchers, from Maple Ridge, NY to Abilene, TX, all the while producing hundreds of thousands of new “green” jobs. I have done this and my wife Jan has done it too. I know that our country can do even more.

Thank you.

---

#### RESPONSES BY DAVID BLITTERSDORF TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

*Question 1.* Wind has been experiencing significant growth in recent years in several nations around the world, such as Germany and Denmark. Could the United States experience similar growth in wind power and the associated jobs with the wind resources we have in this country?

Response. Absolutely. The United States has vast untapped wind resources with the largest amounts in the Midwest. Almost every State has viable wind energy resources both on land and off-shore. Wind energy could supply at least 20 percent of today’s electricity and probably supply over 50 percent in the future.

The United States has vast amounts of renewable resources in the wind and from the sun. We are a large country with a relative low population density and therefore we could live in a sustainable way. It would require a major shift in the way we think about, produce and use energy in this country.

Over the last 100 years we have become dependent upon the millions of years of solar energy (finite fossil fuels) that we are burning at expedient rates. We are at the peak of world oil production, within years of the peak of natural gas production and coal production MUST decrease if we are to achieve a CO<sub>2</sub> reduction of 80 percent by 2050. The safest carbon sequestration method is to not mine the coal. All other methods are either unproven or unreliable. We will have consumed most of the world’s fossil fuels by 2100. The long term answer that must be aggressively started today is the complete transition to renewable energy from finite fossil fuels and nuclear.

We must use less energy in everything we do. Huge increases in conservation (doing something differently so no energy is used), huge increases in energy efficiency (doing something differently so less energy is used) and producing energy from renewable resources is required. We cannot attempt to produce our way out of this looming energy problem with old solutions such as substituting one fossil fuel with another. Old thinking of what worked for the last 100 years must also be disregarded. The energy world is now at a tipping point and we no longer can look at our planet earth as a place of infinite resources. We must understand the finite physical world and enact practical solutions such as wind power now. We have little time before the remaining finite mineral and energy supplies are exhausted, so we must embark upon the building of the renewable energy equipment and systems so that we can live in a sustainable way.

In 10 years, Germany has grown its wind energy business to over 70,000 jobs as renewable grew from a few percent of its electricity to over 11 percent. In Denmark, wind turbines are its second largest export product. The renewable energy industry creates more jobs per energy unit than the fossil fuel and nuclear industry. This is because the renewable energy business is an on-going energy collection business and the fossil fuel and nuclear energy business are one—time mining and extraction

businesses. We can do much more wind power in the U.S. but we need strong leadership and policy at the Federal level to move the markets in the correct direction.

*Question 2.* Could this occur on its own or will it take tax incentives and a price signal from global warming legislation?

Response. It will not occur on its own. Our economic system does not recognize and discounts heavily the value of all future physical resources. The market will recognize too late the need to shift to renewable energy sources. We will have major economic and social shocks if we do not direct investments to sustainable, renewable energy technologies.

Global warming legislation that targets an 80 percent reduction in CO<sub>2</sub> by 2050 is required. That translates to a 5 percent reduction in carbon emissions per year, every year for the next 43 years. That also roughly means a 5 percent reduction in fossil fuel use every year for the next 43 years since almost all carbon emissions come from the burning of fossil fuels. This is a major undertaking and will require strong policy at all levels of government especially at the Federal level.

Strong price signals in the form of wind and solar tax incentives, feed-in-tariffs for renewable electricity, much greater Federal monetary support to re-build and expand our electricity transmission grid is required to move the market. The present Production Tax Credit (PTC) for wind is not enough as it can be used only by a small number of companies. A Renewable Portfolio Standard (RPS) is also not enough as it forces utilities to hit the minimum targets but in a slow way. Incentives must be broad-based to allow everyone to participate including homeowners, farmers, small business people and larger companies. Feed-in-Tariffs (standard contracts to buy electricity at the long term value of renewables), tax credits and a tax on carbon emissions will be necessary to actually switch how power is generated in this country in a major way. Politics and business as usual and the way we have been doing things up until now have to fundamentally change.

Senator SANDERS. Thank you very much.

Mark Culpepper is the Vice President of Strategic Marketing for SunEdison. Mark, thanks very much for being here.

**STATEMENT OF MARK CULPEPPER, VICE PRESIDENT OF  
STRATEGIC MARKETING, SUNEDISON**

Mr. CULPEPPER. Thank you. Thank you, Mr. Chairman, as well as other members of the Committee, for this opportunity to testify in front of the Senate on this important topic.

SunEdison is the Nation's largest solar energy services provider. We are based out of Beltsville, which is more or less within a stone's throw of the Capitol, but we have operations across the United States, including California, Hawaii, Colorado and New Jersey, and then of course in Maryland itself.

We offer a fairly unique perspective on solar energy. That is, we sell solar energy as a service. Specifically, we sell electricity and we do that by housing our power plants at customer sites, owning them, maintaining them, servicing them, and then selling electricity that we generate back to the client. We do so under extended contracts. That provides the customer with predictable energy costs over a very long period of time, as well as the benefits of generating their own clean electricity.

We are proud to count among our clients Kohls, Staples, Whole Foods, the city of San Diego, Wal-Mart, Xcel Energy, the Sacramento Municipal Utility District, and others. They are really driven by a desire to make their energy costs predictable and to make a positive contribution to the issues around climate change.

We created this model for this industry segment for the energy service provider for solar companies. The results really have really spoken for themselves. A short time ago, we had roughly 15 employees. Today, we have just under 400 employees. That doesn't

count, of course, manufacturing jobs that are upstream from our business and the industry as a whole.

If you look at these jobs, what you will find is a couple of unique aspects to our model and to what is happening in the solar industry. First, solar technology, specifically in photovoltaic technology, represents job opportunities in literally every county and city in the United States. It is true that in the United States there is a great abundance of solar energy. Our counterparts from Germany and Japan, who have far less solar radiance than we do, actually have much greater job coverage because they have had very robust Federal policies that support those industries.

Even upState New York receives more solar energy than leading solar markets like Japan and Germany. In fact, if you look at the Southeast and the Southwestern United States, they represent some of the best potential markets in the world.

When we put these power plants in place, these facilities, we typically hire local workers, train them to our standards of excellence and safety, and then put them to work on a continuous flow of new projects. This is energy that clients don't import from thousands of miles away. They don't extract it from the ground beneath countries that have differing views than us about the world. Our electricians can't be put on a telephone network and outsourced to the far corners of the globe. We put real technology on our customers' rooftops and that requires real jobs and real skilled labor that is American-made and American-manufactured.

In fact, when I told you about that increase in jobs, most of those are in the field out where our key markets live. We like to build our solar rooftops at a steady pace in those markets, and that means hiring local foremen, warehouse managers, logistics managers, inspectors, electricians and so on. We think about this as a fairly powerful and transformative event in energy markets.

So there really is an opportunity to strengthen America by creating domestic jobs for the U.S. economy for U.S. citizens, and strengthening our ability to be independent of foreign energy sources. We take this in-house as a matter of great pride and highlight that continuously as we move into new markets across the United States.

I think the second point to make here is that a lot of solar creates more jobs than a lot of conventional extractive energy. That is a point that I won't go into in too much detail. It has been made several times in the previous panel's comments as well.

A final point I did want to make, though, is that these renewable resources really do play to America's strengths. They play to our strength as a mover of capital markets. They play to our strength as an innovator and ability to see rapid growth, and really take opportunity out of something which has traditionally been viewed as a negative or a down opportunity.

One last point that I will make before I close, there was a gentleman who came to work for us named Cris Cisneros in our Alamosa power plant. Cris had spent 37 years at the local perlite mine before it got shut down. He had an offer to operate heavy equipment at natural gas wells, and instead came to work for us at SunEdison building our Alamosa power plant. When he was asked why, he said, "Well, it is a nice time to be part of history."

So thank you for this time to comment, and I look forward to your questions.

[The prepared statement of Mr. Culpepper follows:]

STATEMENT OF MARK CULPEPPER, VICE PRESIDENT OF STRATEGIC MARKETING, SUNEDISON

Mr. Chairman, members of the Committee, thank you for the opportunity to testify.

My name is Mark Culpepper, and I am the Vice President for Strategic Marketing at SunEdison, LLC. SunEdison, based out of Beltsville, Maryland, is the nation's largest solar energy service provider.

We offer a unique perspective on solar energy; we sell our customers electricity, as a service. Renewable electricity, generated through photovoltaic power plants installed and maintained at their facility. This gives them the benefit of clean power at predictable price, without the upfront cost and hassle historically associated with going solar.

We're proud to count among our many clients Kohl's, Staples, the California State University System, the city of San Diego, Wal-Mart, Sacramento Municipal Utility District, and Xcel Energy. They're driven by a desire to make their energy costs predictable, and to address what many of them perceive as a growing climate concern.

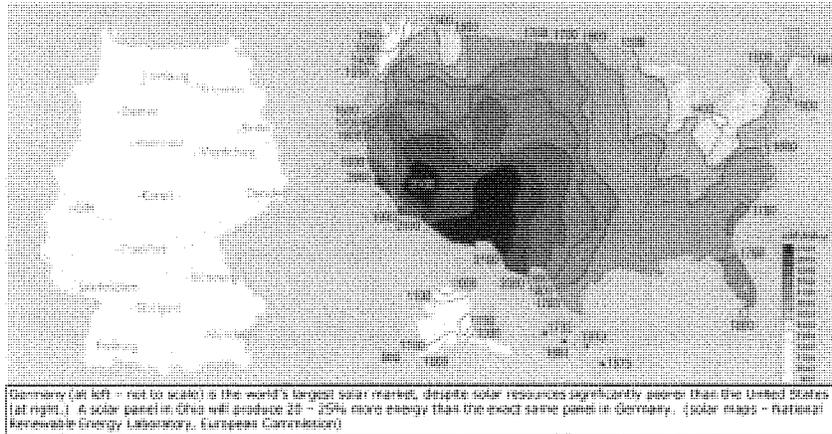
SunEdison created the model for the solar energy service provider industry, and the results speak for themselves. SunEdison has gone from roughly 15 employees in early 2006 to just under 400 today. That does not count, of course, the manufacturing jobs upstream from our industry.

However, we feel that increased attention to the climate issue is necessary to continue to send the market signal that the domestic solar industry needs to continue this strong growth and regain US leadership.

If you look at these jobs, how many of them there are, and how they're distributed, you see two interesting trends:

1. SOLAR REPRESENTS JOB OPPORTUNITIES IN LITERALLY EVERY COUNTY AND CITY IN AMERICA.

Every day the United States receives a great and predictable abundance of solar energy, enough to power the entire country many times over. Even up State New York receives more solar energy than leading solar markets like Japan and Germany. In fact, the Southeastern and Southwestern United States represent some of the best potential markets in the entire world.



Satellite modeling confirms this, and we install wherever State policies are right. Yes, we put solar panels in California and Hawaii. But we also have installations planned or underway in Wisconsin, New Jersey, Connecticut, Oregon, Maryland, North Carolina and even up in Ontario, Canada.

When we put in these power plants, we hire local workers, train them to our standards of excellence and safety, and put them to work on a continuous flow of new projects.

We can't pull our client's energy from thousands of miles away. Our electricians can't be put on the telephone network and outsourced to the far corners of the world. We put real technology on our customer's rooftops, and that takes local jobs and local talent.

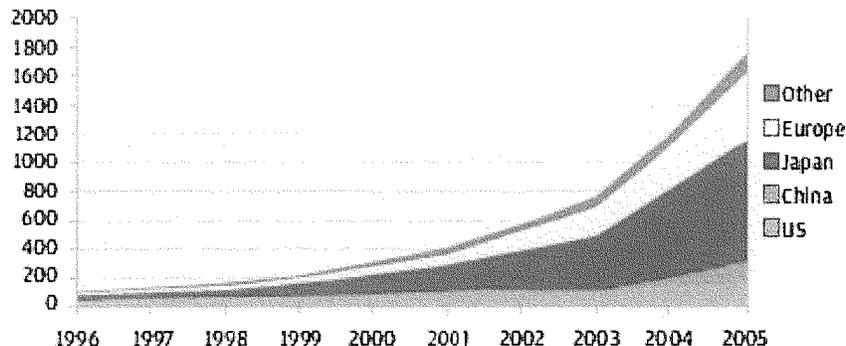
In fact, when I told you about that increase in jobs ? from 15 to almost 400 ? the majority of those are in the field, out where our key markets live. We like to build solar roofs at a steady, accelerating pace in those markets, and that means hiring local foremen, warehouse managers, logistics managers, inspectors, electricians, and installers. We now have three offices in California, two in Colorado, one in Hawaii and one in New Jersey, in addition to our Maryland headquarters. Our recent job fair in Alamosa, Colorado brought in over 200 applicants for roughly 70 new jobs.

That's a powerful thing to think about. You may not have a coal seam or a gas pocket in your state. You may not have a ready location for a nuclear power plant. But I guarantee you have enough solar energy to run a commercial solar system, and where that system goes, so do many of the jobs that go with it.

We also get much of our equipment from inside the US. There are major solar panel factories in Perrysburg, Ohio, Frederick, Maryland, Marlboro, Massachusetts, Wilmington, Delaware, and Memphis, Tennessee. They take wire tape from Torpedo Specialty Wire in North Carolina, and Tedlar film from DuPont in Buffalo, New York.

Solar strengthens America by creating domestic jobs for US citizens, independent of foreign energy. We take this as a matter of great pride.

Unfortunately, if you look to global manufacturing of these panels, you can see that markets with a nationwide commitment to reduced climate emissions and renewable energy are pulling away from us.



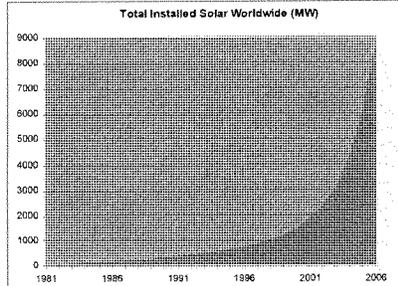
Global annual solar manufacturing shows the US falling well behind s Japan, Germany and now China (PHOTON International, "Market Survey on Cell and Module Production 2005," march 2006; PV News, Volume 24, No. 3 March 2005).

## 2. A WATT OF SOLAR ELECTRICITY MAKES MORE DOMESTIC JOBS THAN A WATT OF CONVENTIONAL ELECTRICITY RESOURCES.

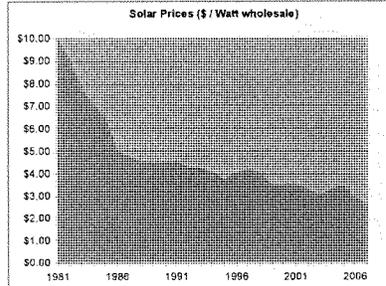
This makes sense if you think about it. You create more domestic jobs from making, installing and servicing a solar power plant than you do from burning fossil fuels.

Simply put, more labor is involved in creating and maintaining a high-tech product than there is in extracting a natural resource. Watt for Watt, the number of workers required to refine our silicon, manufacture our panels, design these systems, and bolt them to the roof, is higher than the number required to run a conventional power plant. In fact, studies show that a megawatt of solar creates between 7 and 10 times as many man hours of employment as would be obtained from a megawatt of conventional fuel sources, all else being equal.<sup>1</sup>

This is true even as we continue to make our renewable resources more efficient and less expensive. In the case of solar energy, we have seen over the last 25 years an extremely reliable trend ? each time we double the total amount of solar energy out in the world, the price of solar energy drops 18 percent. For the first time, solar is within striking distance of retail prices for conventional energy. Market signals like those provided by climate legislation would further reduce the remaining gap and drive the "virtuous cycle" of increasing sales driving reduced cost.



Prometheus Institute ([prometheus.org](http://prometheus.org)), International Energy Agency ([www.iea-pvps.org](http://www.iea-pvps.org))



Prometheus Institute ([prometheus.org](http://prometheus.org))

In fact, the Solar Energy Industries Association estimates that the solar industry has the potential to create 55,000 new US jobs through 2015.

### 3. RENEWABLE RESOURCES BUILD ON U.S. STRENGTHS

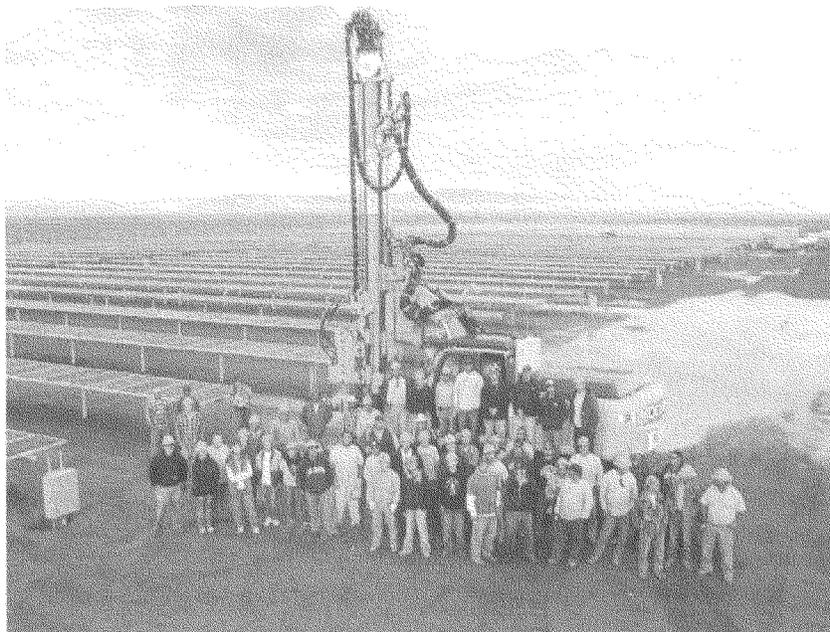
Solar energy is a uniquely native resource. There's the obvious reason that you get it at home; once you've put a solar panel on a building, you know where that building's getting its power for at least the next 20 years.

But there's something less concrete, as well. We have a great deal of natural resources in this Nation. So do many others. But I think most would agree that nowhere else can compare with the quality of our engineers, scientists, financiers, and manufacturers.

When you think about it that way, anything that moves us toward the world getting its energy from these new technologies instead of pulling it out of the ground, will, I believe, tend to drive more of the world's energy money toward us, and to our strengths as a Nation, rather than to those who have the most conventional fuels in hand today.

Energy sources that address our climate concerns favor the United States economy above all others. I think that's an advantage we should seize, and the time is now. We have to determine whether the country that invented solar power is going to be reduced to importing it, bringing in "solar tankers" full of panels from countries that moved quicker than we did. Because the world is changing around us.

When I think about this, I think about meeting Cris Cisneros out at the groundbreaking of our Alamosa plant.



The SunEdison Alamosa crew.

Cris spent 37 years at the local perlite mine before it shut down. He had an offer to operate heavy equipment at natural gas wells. Instead he came to our job fair, and we ended up hiring him and about 6 others from the mine. At the groundbreaking, the local paper asked him why he was working on our plant instead.

“It’s nice,” he said, “being part of history.”

---

RESPONSES BY MARK CULPEPPER TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

*Question 1.* When you testified before the EPW Committee, you told us that “each time we double the total amount of solar energy out in the world, the price of solar energy drops 18 percent.” Given the vast solar resources in the United States, with the right incentives and market signals, could solar potentially produce a significant portion of our nation’s electricity?

Yes, it certainly could. There are a few ways to think about this:

**Current Industry Capacity**—It’s generally accepted that the global solar industry manufactured approximately 2.7 gigawatts of new solar panels in 2006. If all of those panels had been sold into the United States, that would have been:

Five times the amount of new US generation capacity from coal in 2005 (the last year for which DOE publishes data;) or

Almost 10 percent of all new generation in the US in the same year.

What’s more, the growth in the industry is phenomenal ? the 2,600 MW of new manufacturing is up from just under 100 MW in 1996. The global industry tends to double in size approximately every 3 years, (greater than 30 percent compounded annual growth). Domestic solar deployment numbers in approaching half of all new annual US generation should be possible within a decade, with annual US deployment measured in gigawatts within 5 years.

Unfortunately, a majority of solar panels today are destined for Japan and Germany instead of the United States.

**Available Resources**—There’s enough sunlight to support viable solar energy in every State and congressional district in the United States.

A 2004 Navigant Consulting study (attached—see slide 84/94) found enough available, unobstructed, unshaded, South-facing roof space to provide more than 700 GW of solar energy to the U.S., without using one acre of land. If you look to ground-

mounted systems (on landfills or unusable farmland, for instance,) this potential increases many times over.

*Question 2.* doesn't solar energy create more jobs than the same amount of fossil-fuel based electricity?

Response. Yes. All available studies indicate that Watt for Watt, solar energy supports several times as many jobs as any conventional fuel resource. This makes intuitive sense—both fossil fuel power plants and solar power plants start off with low-value raw materials. A fossil power plant burns those materials, whereas we form them into a high-tech, high value, durable product.

See for instance (<http://rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf>)—a review of existing studies suggests that solar energy supports between 7–10 times as many jobs per Watt as coal or gas.

Senator SANDERS. Thank you very much.

Donald Gilligan is the President of the National Association of Energy Services Companies. Donald, thanks a lot for being here.

**STATEMENT OF DONALD GILLIGAN, PRESIDENT, NATIONAL  
ASSOCIATION OF ENERGY SERVICE COMPANIES**

Mr. GILLIGAN. Thank you, Senator Sanders for this opportunity for the National Association of Energy Service Companies to offer testimony. NAESCO is an organization of about 75 companies around the Country that deliver about \$4 billion worth of energy efficiency, renewable energy, and distributed generation projects each year. To put that number in perspective, NAESCO member companies deliver approximately the same dollar volume of energy efficiency projects as all of the utilities in the country combined.

NAESCO strongly supports the enactment of greenhouse gas limitation legislation and other legislation being considered by the Senate that will increase the amount of energy efficiency that is implemented in the U.S. We believe that such legislation will increase energy security, lower consumer prices, and provide significant job growth.

I would like to excerpt a couple of the key points from my written testimony for this brief oral testimony. The first is that very few people today are aware of the contribution that energy efficiency has made to our economy. Since 1980, about 50 percent of the U.S. growth in energy use has come from improvements in the efficiency of our use. Much of this improvement has been due to strong signals from both the Federal and the State Government in various Administrations, the Congress, Federal agencies and Governors and legislatures across the Country.

Improved energy efficiency has not been a brake on our economic growth. I don't think anyone could argue that our economy today is weaker than it was in 1980. Energy efficiency has in fact contributed substantially to our industrial competitiveness. It has made our workplaces and schools more productive, and made our homes more comfortable. Imagine what our world would be like today if we needed 50 percent more energy every day just to continue at our current level of economic activity. That is not a very pretty picture.

We are, however, very far from exhausting the potential for energy efficiency. Last year, the U.S. Department of Energy and the U.S. EPA convened the National Action Plan for Energy Efficiency, which was composed of 70 experts from across the Country, and co-chaired by Jim Rogers, who is the CEO of Duke Energy. The NAPEE determined that potential electricity savings can be as

high as 40 percent of our current usage, at a cost of about four cents a kilowatt hour, and potential gas savings as high as 19 percent, at a cost of about \$3 a million BTUs. This investment would produce the equivalent of about 20,000 megawatts of new electricity generation in 10 years. It would save consumers about \$22 billion a year in 2017.

Improved energy efficiency doesn't levy penalties on our economy. It provides new jobs. Let me give you a couple of examples, one of which is the room in which we sit today. About 10 years ago, the Architect of the Capitol hired two NAESCO-member companies to design and implement lighting retrofit across the whole Capitol complex. That project required about 30 man-years of labor.

The second example is my hometown, which is Sharon, Massachusetts. Last year, our school saved about \$80,000, which is the equivalent of two salaries for starting teachers. This year we are adding a new skilled mechanical technician, who we expect will double his or her salary in energy savings each year. If you replicated our program in our little school district across the whole State of Massachusetts, that would mean 1,000 new teachers and technicians. High-paying, high-skilled jobs can never be sent offshore. You can't operate a school building in Massachusetts from China or from India.

The third example is the \$150 million a year Energy Smart program that is being operated by the New York State Energy Research and Development Authority. It has been going since 1998. It is producing right now at its peak of operation about 4,200 new jobs, and 3,700 of those will be permanent, which means they will survive after the program ends, with \$275 million in annual energy bill savings, and about \$244 million annually in economic growth.

These are three examples of the type of new jobs which can be created by strong bipartisan programs, signals from the Congress and from Governors across the States, that we need more energy efficiency. I commend you, Senator Sanders, and other members of the Committee for pushing this legislation.

Thank you.

[The prepared statement of Mr. Gilligan follows:]

STATEMENT OF DONALD GILLIGAN, PRESIDENT, NATIONAL ASSOCIATION OF ENERGY SERVICE COMPANIES

Mr. Chairman and members of the Committee, thank you for providing the opportunity for the National Association of Energy Service Companies (NAESCO) to offer testimony at this hearing. NAESCO is an organization of about 75 companies that deliver more than \$4 billion of energy efficiency, renewable energy and distributed generation projects across the U.S. each year. To put that number in perspective, NAESCO member companies deliver approximately the same dollar volume of energy efficiency projects than all of the utilities in the country combined, according to a recent study published by the Lawrence Berkeley National Laboratory<sup>1</sup>.

NAESCO strongly supports the enactment of greenhouse gas limitation legislation and other legislation being considered by the Senate that will increase the amount of energy efficiency that is implemented in the U.S. We believe that such legislation will increase energy security, lower consumer prices and provide significant job growth. My testimony today will focus on the potential scale of energy efficiency implementation and the employment and economic development effects of such implementation.

<sup>1</sup>A Survey of the U.S. ESCO Industry: Market Growth and Development from 2002 to 2006, available at: <http://eetd.lbl.gov/ea/EMS/reports/62679.pdf>

## POTENTIAL SCALE OF ENERGY EFFICIENCY

Few people today are aware of the contribution that energy efficiency has made to our national economy during the past three decades. Since 1980, improvements in energy efficiency have provided more than 50 percent of the U.S. growth in energy use<sup>2</sup>. Much of this improvement has been due to the mandates and guidance provided by the Congress and Federal and State government agencies, in the form of appliance and equipment standards, building codes and industrial technology innovation programs. These Federal initiatives have been complemented by State initiatives, utility energy efficiency incentive programs, and performance contracting programs. Improved energy efficiency has not been a brake on our economic growth, but has in fact contributed to our industrial competitiveness, made our workplaces and schools more productive, and made our homes more comfortable. Imagine for a minute what our nation would be like today if we needed 50 percent more energy supply. It is not a pretty picture. Our economy would be hamstrung and our national security would be threatened.

However, we have not, despite this accomplishment, come close to exhausting the potential for energy efficiency. Last year, the U.S. Department of Energy and the U.S. Environmental Protection Administration convened the National Action Plan for Energy Efficiency (NAPEE) Leadership Group, about 70 experts from utilities, regulatory agencies, customer groups, environmental groups, consumer groups, energy efficiency organizations and industry. The Co-Chair of NAPEE was Jim Rogers, CEO of Duke Energy and, at the time, Chairman of the Edison Electric Institute. NAPEE collected the best available information from studies around the country and determined that potential savings from electric energy efficiency improvements ranged from 10 percent to more than 40 percent, and from 10 percent to 19 percent from natural gas efficiency improvements.

The cost of these improvements is estimated to average about \$.04/kWh for electricity and \$3/MMBtu for natural gas. NAPEE found that a national effort by utilities to invest about \$7 billion a year in energy efficiency, which would leverage an additional \$20–30 million of non-utility investment, would yield annual savings to consumers of about \$22 billion in 2017 and have a net present value of about \$344 billion<sup>3</sup>. The program would produce the equivalent of 20,000 megawatts of new electric generation and could be financed through utility bills, adding approximately 2 percent to current electric utility revenues and .5 percent to current gas utility revenues.

It is important to note that the NAPEE estimates are based on currently available technology. But we all know that technology does not stand still. A review of studies conducted over the past two decades shows consistent estimates of energy efficiency potential in the range of 10–30 percent, despite the achievements we have made. For example, we are now at the cusp of the fourth generation of lighting efficiency improvements (electronic lighting or white LEDs) to be commercialized since the early 1990's. Each generation replaced the previous generation cost-effectively, that is, it paid for itself from energy savings.

#### Employment and Economic Development Effects

There is not, as some people believe, a tradeoff between energy efficiency and economic growth. Improved energy efficiency does not levy penalties on our economy; it provides new jobs and economic growth. Let me give you three examples.

The first example is the building in which we sit today. About 10 years ago, the Architect of the Capitol in conjunction with an ESCO designed and implemented a lighting retrofit program in the Capitol Complex. The project employed a dozen surveyors for about 4 months (4 man-years of work) in the survey and design phase and another ESCO provided about 30 man-years of skilled labor retrofitting or replacing hundreds of thousands of fixtures.

The second example is from my home town, Sharon, Massachusetts, where our School Committee, of which I am a member, has instituted an energy efficiency program. Last year we saved \$80,000, enough to hire two new teachers; this year we are adding a skilled mechanical technician, who, we expect, will repay double his or her salary in annual savings. The efficiency of our schools before we started our program was about average, according to a survey of the schools in one New England state. If our program were mirrored across the state, it would result in the hiring of nearly a thousand teachers and technicians. These are good-paying jobs that can never be sent off shore.

<sup>2</sup>"Realizing the Potential of Energy Efficiency," July 2007, U.N. Foundation, available at: <http://www.unfoundation.org/energyefficiency/>

<sup>3</sup>National Action Plan for Energy Efficiency," July 2006, available at: <http://www.epa.gov/cleanenergy/actionplan/eaactionplan.htm>

A third example is the \$150 million per year statewide Energy \$mart program operated by the New York State Energy Research and Development Authority (NYSERDA). This program, which has been operating since 1998, has resulted in the creation of 3,700 permanent new jobs, \$275 million in annual energy bill savings and \$244 million annually in economic growth<sup>4</sup>. These permanent jobs are net of the jobs that would have been created in the utility industry without the improved energy efficiency from the Energy \$mart program and do not include the new jobs created by energy efficiency programs operated by either the New York Power Authority or the Long Island Power Authority, whose combined annual budget is about equal to NYSEDA's.

The table below, excerpted from a recent annual evaluation report summarizes the job creation by category from the New York Energy \$mart program.

**Table 3-7. 2005 Update – Net Employment Impacts of New York Energy \$mart<sup>SM</sup> Program by Industry Sector**

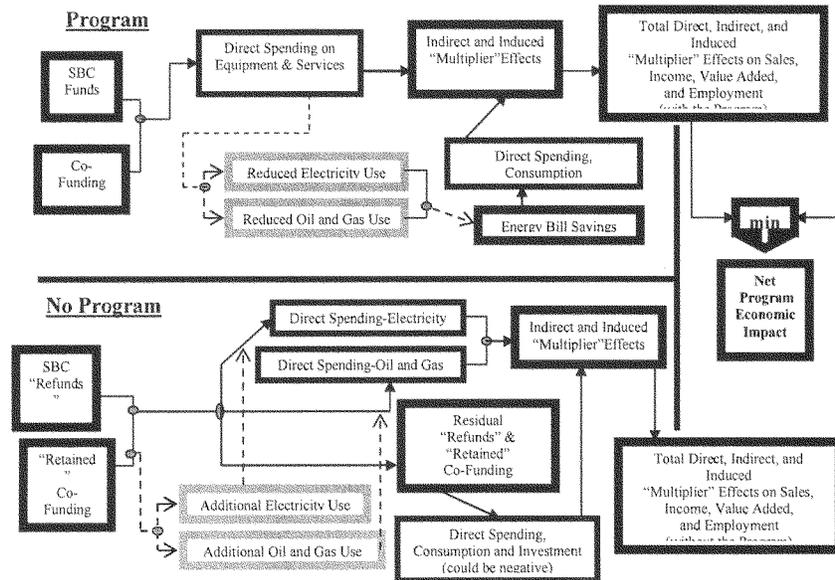
Economic Sector	Average Net Jobs per Year	
	Program Implementation Years 1999-2007	Years Following Implementation 2008-2017
Agriculture, Forestry, and Mining	19	28
Construction	876	261
Products Manufacturing	191	207
Equipment and Instrument Manufacturing	428	129
Transportation, Communication, and Other Public Services	151	119
Wholesale and Retail Trade	1,323	1,383
Personal and Business Services	2,024	2,235
Electric Utilities	(336)	(656)
Total <sup>1</sup>	4,677	3,706

<sup>1</sup> Totals may not sum due to rounding

NYSERDA's estimates of the jobs created by its statewide energy efficiency program are not "back of the envelope" calculations, but are the products of a sophisticated macroeconomic model of the New York State economy. The estimates were reviewed and approved for submittal to the New York Public Service Commission by the System Benefits Charge Advisory Group, a stakeholder group whose members include the states major utilities and representatives of all classes of consumers. The methodology used to produce the estimates is represented in the graphic below.

<sup>4</sup>"New York Energy \$mart Program Evaluation and Status Report," May 2006, available at <http://www.nyserda.org/Energy—Information/06sbcreport.asp>

### NYSERDA Macroeconomic Model



The results achieved in New York are to a large extent due to the strong, bi-partisan State government policy on energy efficiency, initiated by Governor Pataki, expanded by Governor Spitzer, and supported by the legislature. The policy sets specific targets for greenhouse gas reductions and energy efficiency implementation, and provides the programmatic infrastructure required to achieve the targets.

A larger-scale estimate of the employment effects of energy efficiency programs has been generated by the American Council for an Energy Efficient Economy (ACEEE) in its recent study of the impact of energy efficiency programs designed to save natural gas in eight Midwestern states<sup>5</sup>. The study's estimates of the potential for job creation and economic growth from a program that invests \$1.1 billion per year for 5 years in gas and electric energy efficiency in the eight states are summarized in the table below. Please note that the "Number of Jobs" and "Employee Compensation" estimates in the table are net of any job losses that would result from reduced energy use. These large effects are due to the fact that the affected states import almost 90 percent of their natural gas from other regions of the U.S. or from Canada, at a cost of nearly \$40 billion per year, which is huge drain on the State economies. Efficiency programs enable the states to keep some of that money in circulation in the State economies.

<sup>5</sup>"Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest," January 2005, available at: <http://www.aceee.org/store/proddetail.cfm?CFID=987754&CFTOKEN=91189203&ItemID=386&CategoryID=7>

**Table 25. Projected Economic Benefits of Energy Efficiency Programs by State**

State	2010		2015		2020	
	Number of Jobs	Employee Compensation in Millions \$ <sup>a</sup>	Number of Jobs	Employee Compensation in Millions \$	Number of Jobs	Employee Compensation in Millions \$
IL	6,480	\$220	9,720	\$300	13,160	\$440
IN <sup>b</sup>	N/A	N/A	N/A	N/A	N/A	N/A
IA <sup>b</sup>	N/A	N/A	N/A	N/A	N/A	N/A
MI	5,170	\$130	7,630	\$200	11,380	\$330
MN	2,570	\$70	3,570	\$90	5,260	\$140
MO <sup>b</sup>	N/A	N/A	N/A	N/A	N/A	N/A
OH	5,300	\$100	9,590	\$220	12,430	\$290
WI	3,320	\$70	4,750	\$110	7,060	\$160
<b>Total Region<sup>c</sup></b>	<b>30,220</b>	<b>\$750</b>	<b>48,270</b>	<b>\$1,230</b>	<b>66,620</b>	<b>\$1,770</b>

<sup>a</sup> All dollar values cited in the table are expressed in 2001 dollars.

<sup>b</sup> State-specific data not available (N/A) for Indiana, Iowa, or Missouri.

<sup>c</sup> "Total Region" includes aggregate results for Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

Extrapolating the results of the NYSERDA program and the estimates in the ACEEE report enables us to provide an estimate of the potential economic effects of a national program of the scope envisioned by NAPEE (\$7 billion in utility energy efficiency investment per year), as summarized in the table below.

#### Estimated Job Creation from NAPEE Program

Program	Program Budget	Jobs Created by Program	Extrapolation to \$7 Billion NAPEE Program
NYSERDA Energy Smart	\$150 Million	3,700	173,000
ACEEE Midwest Natural Gas	\$1.1 Billion	66,260	422,000
Mid-range Estimate of National Employment	---	---	297,500

#### ADDITIONAL OBSERVATIONS

One objection that might be raised this line of reasoning is that the job creation by large-scale energy efficiency programs is, in fact, a zero-sum game: for every job created by improvements in energy efficiency, a job is lost in energy production and distribution. The NYSERDA and the ACEEE reports estimate net jobs created in a State or region, but do not estimate net jobs created in the Nation. Will we just be substituting new jobs in energy consuming regions of the country for jobs lost in energy producing regions?

NAESCO believes that the answer to this question is no, for several reasons.

First, the marginal energy production jobs displaced by efficiency programs are going to be largely overseas, not in the U.S. We are dependent on foreign sources for more than half of our oil supply and are increasingly on imported Liquefied Natural Gas (LNG) to supply fuel for heating and electric generation. These imports are a drain on our national economy and a threat to our national security. Replacing imports with good jobs in energy efficiency is a benefit to the whole country.

Second, the NAPEE scenario described above does not result in the elimination of the need for all new electric generating plants. It provides the equivalent of about 20,000 MW, or about 15 percent of the estimated national requirement of 135,000 MW. Even if we estimate that a national greenhouse gas reduction program would double or triple the size of the NAPEE program, we would still not be displacing half of the estimated new power plants.

Third, in no scenario that NAESCO has seen for the growth of energy efficiency does the utility industry project layoffs of skilled trade workers, the men and women

who build and maintain power plants and transmission and distribution systems. In fact, less than a month ago, the U.S. Department of Labor Assistant Secretary for Employment and Training and Mississippi Governor Haley Barbour convened a 2-day Energy Skilled Trades Summit in conjunction with a meeting of the Southern Governors' Association. The Summit brainstormed how the utility and energy production industries can meet their daunting needs for new skilled workers during the next decade. One utility executive predicted that his industry could lose half of its skilled trade workers in the next seven to 8 years, and has no obvious source for replacing these retirees. So it appears that rather than threatening the jobs of utility workers, increased energy efficiency programs, which required different workers with skill sets than utility construction projects, may be required to keep the lights on.

Fourth, the new energy production and generation technologies on which we are all depending—widespread renewables, clean coal, nuclear fuel, oil from shale or tar sands—all require substantial research and development efforts, and will not come on line, if successful, for as long as a decade. And none of these technologies will be inexpensive enough to use inefficiently. Large-scale energy efficiency programs will enable the U.S. to bridge this R&D decade and to provide the skilled labor and technology infrastructure that will make the best use of these precious new energy resources.

#### CONCLUSION

NAESCO is grateful to the Committee for the opportunity to present this testimony. We urge the Committee to act favorably on climate change and other energy legislation that will substantially increase the implementation of energy efficiency across the U.S. We believe that a major national implementation will create hundreds of thousands of high-skill, high-wage jobs, will provide a substantial boost to our national economy, and will increase our national security.

---

#### RESPONSE TO AN ADDITIONAL QUESTION FROM SENATOR BOXER

*Question.* Your organization and its members, who are in the middle of it all, believe that such action will not only address the problem of global warming, but increase energy security, increase jobs and lower consumer prices, is that correct?

*Response.* In answer to your question, NAESCO strongly supports the enactment of greenhouse gas limitation legislation and other legislation being considered by the Senate that will increase the amount of energy efficiency that is implemented in the U.S.

- Energy efficiency contributes significantly to U.S. energy security by lowering our demand for imported energy and lessening our exposure to the problems of securing that energy from insecure or unfriendly nations. According to a recent study by the U.N. Foundation, energy efficiency has provided more than half of the increased U.S. energy use in the past 25 years. We would be much less energy secure today if we had to procure on the world market 50 percent more energy than we now use.

- There are numerous studies that document the fact that energy efficiency increases employment, net of any jobs that might be lost in the energy supply or delivery industries. Samples of these studies include evaluations of large-scale energy efficiency programs in Massachusetts and New York, which were initiated during the administrations of Republican Governors and continue under Democratic Governors, as well as projections of the potential employment effects of large-scale energy efficiency programs in the Midwest. Based on these program results and projections, NAESCO estimates that several hundred thousand jobs would be created by a national energy efficiency effort of the scale envisioned by the National Action Plan for Energy Efficiency (NAPEE)—about \$7 billion per year.

- Large-scale energy efficiency lowers consumer prices by lowering the demand for energy. Numerous studies from around the country have documented the fact that modest demand reductions, especially during system peak times, can significantly lower prices. The cost of the marginal supply resources at peak times is several times the average cost of supply, and so eliminating the need for those resources lowers the average prices which most consumers pay.

I will be happy to answer any questions that you or your staff have about this response, or to provide more information.

Senator SANDERS. Thank you very much.

See, I have a great opportunity. Nobody else is here so I can ask hours of good questions.

[Laughter.]

Senator SANDERS. Let me start focusing, before I get to Dr. Green and Dr. Kammen, talking about wind, solar and energy efficiency.

David, what is the potential in this Country for wind? You and I live in a rural State. How much energy can a small wind turbine produce for the average home in rural America? How many homes could accommodate wind turbines? What would that mean to the use of energy in America?

Mr. BLITTERSDORF. Well, wind energy can be divided into large-scale and small-scale, small for home use. We could be having hundreds of thousands of small wind turbines installed in rural backyards now. It is a volume market that has to develop. Right now, it is measured in the hundreds to thousands of installations per year. We need to go to a 100 plus thousand installations.

Senator SANDERS. And what percentage of the electric needs of a home could a small wind turbine provide?

Mr. BLITTERSDORF. In the rural landscape of Western New York, the Midwest, it could be 100 percent of the homeowners electricity. The wind turbines would probably be net metered. If we had a national net metering law instead of State law, you would turn your meter back.

Senator SANDERS. So you are saying there are hundreds of thousands of homes that could actually produce more electricity than they are consuming?

Mr. BLITTERSDORF. Exactly, just like what Germany is doing with solar and wind.

Senator SANDERS. One of the laws of economics is that the more you produce, the more sophisticated the technology. Everything being equal, prices should go down. Give me a guess. I am living in a rural area. I want a wind turbine. It can produce one half or three quarter or maybe all of my energy. How much is it going to cost me?

Mr. BLITTERSDORF. Today, with the low volumes, we are looking at \$25,000 per installed wind turbine. But in the next 5 years, if we got a volume market moving, it could be down to \$15,000 or \$12,000. Basically, you look at the cost curves like building a car. You look at the pounds of material. There is no reason it should be as high as it is. It is just a volume market.

Senator SANDERS. So it could get down to \$12,000 or \$15,000 to produce half or more of my electrical needs.

Mr. BLITTERSDORF. Yes.

Senator SANDERS. That is a pretty good deal, right?

Mr. BLITTERSDORF. Yes.

Senator SANDERS. I will be paying less for electricity under that scenario than I am now, in most cases.

Mr. BLITTERSDORF. In the long term. If you believe power prices will go down over time, no, it would be a bad deal, but energy prices are going up.

Senator SANDERS. OK. Thanks, David.

Mark, let me ask you the same question. I am sitting here kind of amazed. In the midst of all the discussion on global warming,

I don't think we are focused enough on the potential of solar. Is it unreasonable to believe that there could be millions of homes in the United States which will have solar units and solar hot water systems? I think one of the points that is made often is that even in States like the State of Vermont, which is not the sunniest State in America, it still works there. Close your eyes and tell us, if you could snap your fingers and make it happen, what would America look like in terms of solar energy?

Mr. CULPEPPER. Well, we don't focus on the residential market, but I can give you some context for other markets, particularly for the commercial market which is really an area where we have made our claim.

If you look at, say, a nationwide chain like Wal-Mart where they might have 5,000 stores, each one of those stores is capable of supporting either a half megawatt to a megawatt of power.

Senator SANDERS. Which is what percentage of what they consume?

Mr. CULPEPPER. Well, if you look at a typical home, a typical home might be four kilowatts of power. So when you look at Wal-Mart, what we are talking about is theoretically a potential to produce basically 2.5 gigawatts to 5 gigawatts of power. That is very comparable to some of the largest nuclear plants in the country at this point. So that is just one of the large big-box retail stores.

Senator SANDERS. And is that because they have an enormous amount of space?

Mr. CULPEPPER. They have an enormous amount of space on the rooftops. However, if you fly into any airport in America, you will see a lot of available rooftop space.

Senator SANDERS. What is the potential for solar plants, as opposed to rooftop projects, where you normally have an enormous amount of paneling?

Mr. CULPEPPER. Yes, I think the fundamental difference between the two technologies is one is much more of a central model, much more based on the existing paradigm. If you look at what is going on in the PV solar market, the market that we serve, the big paradigm shift—and I know that word is used loosely a lot—is that if you look at a typical residential user in the State of California that has a solar plant on their rooftop, 8 years ago they got all their power from some sort of central power plant. Today, they get anywhere from 40 percent up to 80 percent of their power from the energy produced on their rooftop. That is a significant shift in how America produces energy.

Senator SANDERS. But it needn't be either/or. I mean, we could do both, couldn't we?

Mr. CULPEPPER. We could absolutely do both. I don't think that anybody who proposes that one solution is going to solve all of our problems is really correct. I do think that a theme that has been recurrent here is the idea of the level playing field. Those consist of standard interconnection guidelines. For example, there are some States where you just can't install solar. It is not set up. The regulatory environment is not there. It is not because the technology can't support it. It is because it hasn't really been provided.

Senator SANDERS. The point has been made that zillions of dollars have gone into subsidies and tax breaks for nuclear, for coal, for fossil fuel. What would you think the solar and wind industry might require?

Mr. CULPEPPER. I really can't comment on the wind industry. As far as the solar industry goes, we are a supporter of the ITC, obviously, and we do believe that these should have a fixed time line to them. We have done a very good job I think of going pretty far with what we have been given to date. I think that one of the benefits of having transparent subsidies—and I will say that word, although it is not often used—is that it does encourage the industry to move at a faster clip than other industries do. Many of the other incentives and subsidies in other markets are essentially buried subsidies.

Senator SANDERS. Thank you, Mark.

Donald, when I was Mayor of Burlington, just at the end of my tenure, we passed a bond issue to help expand energy efficiency in our city municipally owned light department. I could be wrong on this, but I believe that now, 16 years later, with a lot of growth in the city, I am not sure that we are expending any more energy.

Mr. GILLIGAN. That is quite feasible.

Senator SANDERS. And I guess California is somewhat similar with all the growth taking place. It seems to me that the potential, I mean, that is just an extraordinary thing—growth and no growth in energy consumption. Talk about the potential of energy conservation in that sense.

Mr. GILLIGAN. Well, you are right. There are several States around the country that have made a target of strong economic growth without growth in energy use. California has achieved that on a per capita basis over the last 30 years, so they have not, in per capita terms, increased energy use, while the economy has blossomed significantly. So it is quite feasible to have strong economic growth without rampant growth in energy use.

I think in the previous panel, Mr. Armev commented on the fact that energy and energy use and economic growth are linked. We used to think that in the 1970's. We have broken that link. As I mentioned before, we are now using something like 50 percent less energy per unit of GNP than we used to use. So the notion that there is a fixed linkage between energy growth and economic growth is simply an obsolete notion.

Senator SANDERS. I have heard, and you can tell me if I am right or wrong, that many homes—and I come from a State where the climate is very cold, so we are very conscious about wasting energy in the winter time—that homes that retrofit can reduce their energy consumption 40 percent or 50 percent, which seems to be just an extraordinary potential. We are told that LED light bulbs that should be on the market within a few years can cut energy consumption compared to incandescents by one tenth, use one tenth of the energy and last a lot longer.

Mr. GILLIGAN. Yes.

Senator SANDERS. Talk a little bit about what you see coming down the pike. Again, if you could snap your fingers and make this Country energy efficient, what would America look like?

Mr. GILLIGAN. Well, first of all, we would live in more comfortable houses and buildings. The notion that there is a tradeoff between energy efficiency and comfort is again another obsolete notion. The kind of house that you are talking about which uses 50 percent or 60 percent less energy to heat would typically be a more comfortable house. The ventilation would be better. The house would have a lot of open exposure to the south, making it a very pleasant place to live.

The same with commercial buildings, the LEED buildings that you read about or the other energy efficient buildings: these are not dungeons. These are terrific places to work. They are filled with natural light. They are extremely well ventilated. The temperatures are well regulated.

So I think from the average consumer's standpoint, the most important thing would be an increase in comfort and productivity. Energy efficiency largely occurs behind the scenes. It is in the boiler room. It is in these fixtures in the ceiling. People don't know about it. They don't really care about it. What they care about is the environment in which they live, which would be more pleasant.

Senator SANDERS. It would seem to me that if we, if you like, retrofitted America and we made it more energy efficient, the number of workers that we would need to do that would be just a heck of a lot of people.

Mr. GILLIGAN. It is an extraordinary number of people. There have been some large-scale studies. There was a study by the American Council for an Energy Efficient Economy a couple of years ago that said if you had a rather modest sized program in the eight Midwestern States that targeted natural gas, it would employ about 48,000 new people, new jobs in 10 years, and about 60,000 new jobs in 15 years. That is because you would stop the hemorrhaging of part of \$40 billion of money which flows out of that region to other regions and other countries to pay for natural gas.

Senator SANDERS. Thanks very much.

Dr. Kammen, could you elaborate a little bit on how job creation based on renewables compares to job creation based on fossil fuels? If I am not mistaken, the comparison is pretty interesting. Would you say a few words on that?

Mr. KAMMEN. Certainly. I would be delighted to. In fact, I have mentioned the study that we have done to look at this a couple of years ago. We not only did our own assessment, but we looked across a range of studies done by groups, again across a wide range, and we came to a very consistent answer on that point, that there were more jobs generated per dollar invested, per megawatt installed.

But this isn't a special feature that renewables that add efficiency are somehow magical. It is largely due to the fact that we have under-invested in these areas for a long time. So this is a first after benefit. The cities, the states, the nations that do this investment first—and I think this is unequivocal, and I respectfully disagree with Congressman Arme's comments—I believe those numbers are incontrovertible. What is an issue for debate, though, is that this benefit is not out there forever. The first states and nations to act will receive those benefits.

So the story we are hearing from Germany, irrespective of whether there was a renewable portfolio standard or the feed-in tariff, was that they had seen those benefits. In fact, German solar and wind factories have multi-year backlogs, including to export to the United States. So those that act first will get these benefits, and as the global economy shifts, we are seeing more and more orders for these clean technologies. So it is in fact bad for U.S. business, as Mr. Khosla said, that we are sending ambiguous signals to our companies. So I believe there is a strong argument to be made on the jobs creation level alone.

I want to highlight this issue that has been discussed about, well, the growth in jobs in the clean area come at an equal or larger expense of the dirty area. In fact, the State of California did a study that Senator Boxer alluded to in the beginning. I was a participant in that study. That one not only did direct observation, totaling up numbers of jobs grown in clean areas and lost in other areas, as well as we did macroeconomic modeling to look at those benefits.

In California, that study was endorsed by the Governor and endorsed by the legislature, and concluded that in fact the job growth was strongly toward a larger growing economy. Yes, there are areas that lose and areas that win, but as a State overall, and in fact as a Western region, it was an overall plus.

And so, our conclusion isn't that, well, there is some growth, but there is equal loss. Instead, in fact if you re-tool toward the cleaner economy, you get those benefits and you become a much stronger exporting region. I think the U.S. could actually learn a lesson from that feature from Germany, from Denmark with wind, from Spain with wind, and from California. That is a fairly robust message.

Senator SANDERS. Thanks.

Dr. Green, I suspect you might not be in 100 percent agreement with everything that was said, so why don't you take a couple of minutes and give us your comments on what you have heard.

Mr. GREEN. Well, I believe renewable energies of different sorts—solar, wind, geothermal and cellulosic ethanol—have their place. I think the best way for us to find where that place is is to strip all subsidies and all irregularities out of the—

Senator SANDERS. You talk about stripping all subsidies. Would you take away the Price-Anderson legislation protecting nuclear?

Mr. GREEN. Absolutely.

Senator SANDERS. You would? OK.

Mr. GREEN. If I could snap my fingers, I would take all energy subsidy out of the system and let the market find us the most efficient types of energy and the most efficient places that it can be used in terms of time and space.

So I agree there are those places. I think what has gone unspoken here is the issue of cost. It is very exciting to hear people say that their technology is going to be cost competitive or is cost competitive. They have been saying this now since I remember the 1970's when I was first in California, in the oil crisis. I had just gotten a car and wanted to distill my own fuel in the San Fernando Valley. So I took up an early study of distillation and I was reading even then in Popular Science and so forth that cellulosic ethanol

was going to be 10 years away. That was in 1970. It was still 10 years away in the 1980's when I was doing my master's degree in molecular genetics and refreshed my knowledge. It is 10 years later in the 1990's, and lo and behold it is 2007, and it is still 10 years away.

So it is great to be optimistic, but at the same time one has to say if these technologies really are going to succeed, the incentive is already infinite that is out there in terms of the profit potential. If people really believe it, they don't need a subsidy. They just need to go ahead and convince people to invest their capital.

Senator SANDERS. Let me ask you a real hypothetical, which there is no reason to believe you or anybody else in the world knows the answer to. If you took away all of the subsidies, and that is, as you know, the nuclear energy industry, for example, was built on subsidies, and lives today on subsidies, and coal. What is your guess as to what energy does well? What energy becomes cost effective?

Mr. GREEN. I think you would still find the picture very similar to what it is today because of the phenomenon of energy density. It is always going to be cheapest to simply pump something up that exists, that contains within it the energy to refine itself and even to transport itself to market, than to use energy to create other forms of energy to generate still different forms of energy and move them to market.

Therefore, pulling oil out of the ground, pulling coal out of the ground and burning it would still be the most effective and most efficient things to do.

Senator SANDERS. Let me ask you this—and I don't agree, but I appreciate where you are coming from—how do you put into your free market equation the reality that many thousands of people die as a result of the pollution caused by certain types of technology—coal and so forth. Kids get asthma and so forth and so on. How do you deal with that within the context of a free market?

Mr. GREEN. That is an interesting question. I grew up with asthma in the San Fernando Valley where air pollution in the 1970's was bad enough that I probably wouldn't be able to read your name signs from here. I have always said the thing to do from a classical liberal perspective if a harm is done is to price that harm, is to put price on it, internalize the externality. If it is a genuine externality, internalize it.

So from the beginning when I started working in public policy with Reason Foundation in California, I was for emission pricing on vehicles, congestion pricing on highways, parking pricing, and requiring employers to give parking—

Senator SANDERS. You would include the damage they do in their prices?

Mr. GREEN. Yes. I would set the price and let the market do its work. The market will find the best response if you set the price.

Senator SANDERS. OK. Thanks a lot.

I think this has been a fascinating discussion, and I think you are going to hear a whole lot more of the issues that all of you have raised in the coming months and years. Thank you very much for your contribution to the process. Thanks.

The record for this hearing will remain open for 1 week.

Thank you very much.  
 [Whereupon, at 4:05 p.m. the committee was adjourned.]

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

Thank you for holding this hearing today, and for focusing attention on the economic potential of “green” and “cleantech” renewable energy industries. In Maryland and across the country, these industries are creating thousands of new, high-paying jobs. While renewable energy industries—such as solar, wind, and biofuels—lack the infrastructure and institutional support of the oil, coal, and natural gas industries, they are increasingly attracting capital and proving their viability and competitiveness with conventional fossil fuel-based sources of energy.

Green energy companies are showing us the future of clean, carbon-neutral energy. It is a future that means a cleaner, safer, more energy independent America. If we are serious about achieving national energy independence and addressing the causes of climate change, then these innovative companies and their leaders are showing us the way forward. I look forward to listening to what they have to say today.

Sun Edison, a leading solar energy provider based in Beltsville, MD, provides a glowing example—pardon the pun—and is one of the companies we will hear from today. Using photovoltaic panels to capture the natural energy of the sun, Sun Edison has developed a successful business model harnessing solar energy and selling electricity at increasingly competitive rates.

The company has built solar energy power plants across the United States and provides energy to large commercial and municipal customers, including Whole Foods, Staples, ACE Hardware, and the city of San Diego—all while leaving a carbon-neutral footprint. As companies like Sun Edison continue to grow, the renewable energy industry has the potential to create and sustain hundreds of thousands of safe, high-paying, high-tech jobs in our economy.

I would like to welcome Michael Culpepper, the Vice President of Strategic Marketing for Sun Edison, and thank him for taking the time to be here with us today and join in this very important dialog.

BP Solar, based in Frederick, MD, is the largest fully integrated solar manufacturing facility in the country. It has grown from fewer than 50 employees to over 500 in less than 2 years and shows no sign of slowing down. I visited BP Solar a few months ago. We can help companies like BP Solar and Sun Edison, and the many more clean energy companies that will follow in their footsteps, just by giving them a fair shot at success.

There is a strong consensus among the world’s leading climate scientists that global warming is happening, that much of it stems from burning fossil fuels, and that the environmental and economic consequences could be severe.

As a Senator from Maryland, I am particularly concerned. According to 2005 report of the Maryland Emergency Management Agency, Maryland is the 3d most vulnerable State to flooding and has the 5th longest evacuation times during a tropical storm or hurricane event. Tide gauge records for the last century show that the rate of sea level rise in Maryland is nearly twice the global average. Studies indicate that this rate is accelerating and may increase to two or three feet along Maryland’s shores by the year 2100. Low-lying coastal communities such as Smith Island risk being inundated, at untold economic costs. I’m pleased the Committee is holding a hearing tomorrow on global warming and the Chesapeake Bay. It couldn’t be more timely.

The good news is that addressing the threat of climate change offers an opportunity—an opportunity both to avert catastrophe and to develop new sectors in our economy that will provide high-paying jobs here in America and technologies and services we can export abroad. Let’s harness American science, innovation, and technology, which is the greatest in the world. I am confident that we can cut greenhouse gas emissions, end our dependence on foreign oil, and meet our nation’s energy needs at the same time.

Thank you, Madam Chair.

STATEMENT OF PAUL RENFROW, VICE PRESIDENT, PUBLIC AFFAIRS  
 OGE ENERGY CORP.

My name is Paul Renfrow. I am the Vice President for Public Affairs for OGE Energy Corp., which is an electric utility and natural gas pipeline company headquartered in Oklahoma City. My company and I appreciate the opportunity to

come before you today to provide what I trust will be a useful perspective for you to consider on the issue of green jobs as a result of global warming initiatives.

Our electric utility, which is called OG&E, serves approximately 780,000 customers in Oklahoma and western Arkansas. Our fossil-fuel generation mix is approximately 60 percent natural gas-fired, 40 percent coal-fired, and we currently have wind power capacity of roughly 3 percent of our total generation. Our wind power program is growing quickly and is already listed by The National Renewable Energy Laboratory as being a leader in terms of size and cost.

I can report firsthand to you from Oklahoma that the interest in environmentally friendly energy and energy related consumer behavior is, in fact, providing jobs in our state. The most apparent evidence is in the western part of our State where wind farms seem to be popping up everywhere. Oklahoma has gone from virtually no wind power just a few years ago to being ranked 6th nationally in existing installed wind power generation capacity today. And, more is on the way. I can assure you that OG&E is at least one company that intends to add significant amounts of wind power over the next few years. In fact we are planning additions in the range of 600 MW by 2015. And I might emphasize that all of this is happening without State or Federal mandates.

OGE strongly believes that it is incumbent on us as a good corporate citizen to both produce reliable and low cost power for our customers and to do so in an environmentally responsible manner. Our company's response in adopting cleaner sources of power generation is therefore motivated not necessarily by a legal compulsion but by a belief that it is simply the right thing to do. Producing electricity with fewer emissions is a rational and worthy objective regardless of whether others believe it should be done for reasons related to global climate change concerns.

Our customers want their electricity to be inexpensive and reliable, but also as cleanly generated as we can make it. It makes good business sense to respond to our customers in that regard. It also makes good business sense in our line of work to diversify our generation mix to reduce dependency on any one fuel choice option. The history of legislated fuel choice mandates in Oklahoma is strewn with undeniable and expensive disaster stories. OGE's experience with PURPA's mandatory purchase obligation is a prime example of what was destructive about that Federal policy, costing the ratepayers of Oklahoma billions for unneeded but mandated purchases of power that was priced out of market.

The bottom line is that our efforts to invest in ever cleaner sources of generation is not premised on global climate concerns, but rather on the parallel notion that producing power with diversified sources as cleanly as possible is simply good business and simply the right thing to do.

But the subject today is jobs. Those wind farms I previously mentioned employ people to secure the land and obtain rights of way; people to construct the equipment at the factory; people to transport the equipment and people to install and operate the machinery. OGE now has an in-house development team aggressively finding and evaluating renewable projects—which in our State means wind projects since we lack other alternatives. We work with wind developers across the State to determine the feasibility of such new projects. On the transportation side, I might note that what used to be the remarkable sight of tractor trailer rigs hauling 120 foot wind turbine blades across the State has now become common place and barely elicits a second glance.

One important reality you should understand about our wind resources in Oklahoma is that the wind tends to be where people are not, meaning that the commercial quality wind sites overwhelmingly tend to be in the very rural western part of Oklahoma. The significance of this is that these rural areas tend not to have existing transmission lines necessary to transport the wind power to load centers where it can be used. We are working with the Southwest Power Pool to plan and construct new transmission lines to deliver the wind power from remote areas of the State to the load centers, which will entail the investment of hundreds of millions of dollars. Again, building the necessary transmission for wind power results in more jobs for engineers, construction workers, utility linemen, and, of course, lawyers, rate specialists and regulatory personnel needed to handle those aspects of such new generation.

In addition to wind power, we are renewing our interest and focus on demand side management ("DSM") programs aimed at reducing energy use. Through programs like time of use rates, weatherization programs, highly efficient lighting and appliance incentive programs, commercial and industrial load curtailment programs and consumer education we are already reducing our system's demand for power by approximately 200 megawatts and with additional customer education, better technology such as smart meters and other programs, we believe that there is another 100 or so megawatts of additional energy savings to be obtained.

Demand side management provides jobs as well. At OG&E we have a team of 9 full time employees who design, plan and implement these programs. It takes people from our rates, engineering, marketing and communications departments for these programs to work. We even employ some of our retired OG&E employees to help us with programs like weatherization.

But as we talk about jobs that are related to the environment, I want to emphasize that in our view the concept of “green jobs” extends beyond those associated solely with renewable resources and conservation. OG&E sees the notion of “green jobs” as legitimately extending to our efforts to provide the next generation of coal-fired facilities in an environmentally beneficial way. I am not suggesting that coal plants should carry the label of “green power” but I am saying that advancements in technology are allowing for the addition of ever more environmentally responsible coal fired generation. In this regard, I want to share with you an extremely relevant experience we have just gone through in Oklahoma.

Our State has a wonderful problem. The economy is strong and growing. And with that growth comes a demand for power. As a result, OG&E’s system is in need for base load generation in the 2012 timeframe. Our sister utilities in the state, Public Service Company of Oklahoma and the Oklahoma Municipal Power Authority were experiencing the same need in the same timeframe. We partnered with those two utilities to propose building one 950 megawatt ultra super critical coal-fired power plant together rather than each of us individually building, smaller, less efficient plants scattered across the state. An ultra-supercritical plant represents the very latest in state-of-the-art technology and offers major efficiency and environmental performance advantages over older technology.

In reaching the decision of what type of plant to build, we quickly discounted wind power because it is not suitable for base load generation. We also discounted nuclear because our need for power is in 2012 which would be impossible to meet with the timeframes associated with nuclear plant construction. We have no appreciable untapped hydro power to speak of in Oklahoma and it was apparent we could not conserve our way out of the need for base load power. So that left gas and coal as our effective options.

Both those fossil fuel options come with pros and cons. Natural gas is certainly a cleaner burning fuel, but comes with high prices and enormous price volatility. We have low electric rates in Oklahoma but because the summers are so hot and so long, electric bills can be quite high since our customers tend to use a lot of electricity for air conditioning. By the same token, just 2 winters ago we were in emergency meetings trying to determine how we could supplement the funding of public and private low income assistance programs that were not going to be able to meet the projected heating needs of those customers that winter due to gas prices that had spiked over \$10. Consequently, summer or winter, we very much understand from our customers how much importance they attach to the price of their power.

Coal on the other hand is both abundant domestically and significantly cheaper than natural gas—even with the uncertainties of future environmental regulation factored in—it still handily beats the price of natural gas by many multiples. Clearly, however, the downside to coal is the environmental cost concern.

Being sensitive to the environment and to the economic needs of our customers, we decided to build the coal plant, but, to mitigate the environmental concerns, we didn’t propose just any coal plant. We stepped up to build a state-of-the art ultra-super critical plant that is the best proven technology available to us today. With the addition of this plant, OG&E’s projected carbon footprint was projected to be as much as 3 percent lower than today. This would be accomplished by being able to reduce the use of our less efficient plants and through increased use of wind power.

After a lengthy and thorough public review and comment process at the Oklahoma Corporation Commission, an administrative law judge issued a recommendation strongly in favor of approval of the plant, citing \$5.5 billion in customer savings compared to deployment of a gas-fired base load alternative. Nonetheless, 2 weeks ago, our application was denied in a 2–1 vote by the Oklahoma Corporation Commissioners. While a written order expressing the definitive basis for the majority’s decision to reject the recommendation of the ALJ’s report has not yet been issued, from the oral comments at the time of the vote it appears that the majority cited concerns about process, the evidence of the need for the power, and cost recovery. Of special interest to this Committee, environmental concerns per se were not identified as reasons for denial of the application.

While one need not necessarily agree with our characterization of our proposed ultra-supercritical plant as “green power”, it is clear to us that this plant was an environmentally responsible option for us to meet the base load need. This story is relevant to the hearing today because of its jobs impact. This plant was going to directly provide about 1,000 construction jobs for 5 years or more with dozens more

jobs required to operate the plant on a permanent basis. That doesn't include all the indirect jobs associated with the purchase of fuel and supplies, transportation, housing, retail, etc. that would have resulted as well.

I would draw the Committee's attention to several aspects of this recent experience:

First, the new coal-fired technologies such as ultra-super critical and IGCC should be viewed the same as "green" facilities. Such nomenclature would be beneficial in promoting the understanding of their environmental purpose and value.

Second, in terms of the number of jobs produced, these new coal-fired facilities create a lot more environmentally responsible jobs than do construction and operation of renewable-fueled facilities. On any basis of comparison the job creating value of these new plants is enormous.

Third, I would emphasize that beyond the jobs that would have been created by the construction and operation of the proposed plant, the \$5.5 billion in savings to electric consumers in Oklahoma would have been a very substantial economic engine for enhanced competitiveness and prosperity in the region and as an inducement for expanding jobs and attracting new job-creating investment into Oklahoma. While we need not attempt to categorize that economic activity and its job creation as "green jobs" per se, the point is that one has to appreciate that building the new generation of coal-fired facilities that will produce low cost electricity is simply critical to the overall welfare of our community. And that raises a very important additional point on the broader "jobs" story that deserves some elaboration.

In recent years, we, like many other states, have had our share of manufacturing plant closings. Just in the Oklahoma City area alone we have had a large tire plant and an automobile plant close, taking with them in excess of 4,000 jobs. In each case, we were called upon by many, including the Governor of our state, to see if there was anything we could do to lower the energy costs of these plants. We did what we could at the time, but were unable to do enough on our own to convince the manufacturer to preserve the local plants and the associated jobs.

In each of these instances, we heard the message loudly and clearly that the cost of energy matters to businesses and that is a key reason we proposed the ultra-supercritical coal-fired solution—with its \$5.5 billion in customer savings—for keeping energy costs low.

It is ironic that, generically speaking, many of our manufacturers leave the U.S. for lower energy and labor costs and wind up in countries with who-knows-what kind of government monitoring and enforcement of pollution controls. We certainly think it would be better to keep those jobs here and provide energy that is low cost and sensitive to environmental impact.

So, as you examine this subject, OG&E encourages you to broaden your view to include renewable energy, demand side management and more state-of-the-art fossil fueled generation as desirable. Furthermore, Congress should be adopting a public policy response that facilitates construction of this new generation of cleaner fossil fuel-based facilities. By this I mean Congress should provide not mandates but incentives such as suitable tax, cost recovery and regulatory policies that will help utilities design and plan such facilities and actually expedite their construction and entry into operation. It is not enough to provide incentives only for renewables and their associated "green jobs." The contribution of renewables is important but limited since they cannot serve as base load capacity. Given the relative greater role that coal and nuclear generation must play in the future as base load facilities, it is practical to consider providing incentives for these technologies and their associated jobs.

On behalf of OG&E, I want to thank you for the opportunity to share our views. I am pleased to provide any additional information that you find helpful.

STATEMENT OF DOROTHY ROTHROCK, V.P. GOVERNMENT RELATIONS CALIFORNIA  
MANUFACTURERS & TECHNOLOGY ASSOCIATION

Good morning Madam Chair and members. Thank you for having me here today to talk about climate initiatives and green technology development.

The CMTA represents a broad spectrum of large and small manufacturers and technology companies in California. We advocate for tax, energy, environmental, litigation and labor policies that will keep these outstanding companies competitive and growing in the state.

In AB 32, California decided to cap greenhouse gas emissions at 1990 levels by the year 2020. Reaching the goals of AB 32 will depend on development of new technologies that are both cost effective and technologically feasible. Therefore, one of the hoped for outcomes of

AB 32 is to spur new investments in green technologies to the benefit of California and the Nation. But AB 32 only imposes the cap and directs the California Air Resources Board and other agencies to develop regulations. It does not create policies to support new green technology development.

It is too soon to tell whether California will reap the benefits of new green technology company growth in the State because of AB 32 or other climate initiatives. Even before AB 32 there have been opportunities for energy efficiency and renewable technologies to succeed in California? we have a renewable portfolio standard and very high energy prices. To remain competitive, industries have adopted best practices and modern technologies to become highly efficient. For example, a steel company in Southern California has nearly doubled production since 1990 with only a 19 percent increase in carbon emissions.

Even if AB 32 encourages new green tech companies to grow in the state, we don't know if it will make up for economic losses that could be caused by an incorrect implementation of AB 32. I hope the focus of this hearing is on how California and the rest of the country can grow green technology companies to help meet the climate change challenge while maintaining a healthy economy.

It is noteworthy that the last technological revolution, in computer information technologies and the internet, occurred without heavy handed government programs. The power of ever faster and smaller digital technologies was simply irresistible to companies that wanted to increase productivity and consumers who wanted to improve their quality of life. We didn't put a cap on analogue transmissions or impose taxes to discourage its use. Yet companies selling digital information technologies are now some of the largest and most successful in the world.

Let's learn from that experience and go beyond the debate about whether we should impose emission caps, voluntary emission targets, carbon taxes, or other programs on the economy. We should focus first and foremost on the policies that will create the conditions in which green technology businesses will be able to succeed, and the policies that will encourage industries and consumers to purchase and use the technologies. This work is vital no matter what scheme is adopted for greenhouse gas emission reductions.

For example, making California more attractive for green technology company development will take much more than passage of AB 32—we need to overcome significant barriers to economic development, such as:

- The cost of doing business for California manufacturers is 23 percent above the national average. (This is a devastating premium when you consider that the US average cost of doing business is nearly 32 percent higher than our trading partners.)
- California is one of only three states that imposes sales taxes on the purchase of manufacturing equipment without an offsetting tax credit.
- Our labor laws require overtime pay after 8 hours in a day rather than after 40 hours a week.
- Permitting processes for facilities development or to install major new pieces of equipment are lengthy and expensive.
- Companies can't find skilled welders, machinists and other technicians because career and technical education courses are disappearing from the middle and high schools and students are dropping out in record numbers.

At the State level we need to take care of these challenges. At the national level, we need a unified and strategic program for climate change along with the incentives and policies to reach the goals. We agree with the National Association of Manufacturers that we should make permanent the R&D tax credit, increase funding for DOE's energy efficiency programs, authorize an energy efficiency loan program to spur efficiency gains with longer term paybacks, and increase R&D on combined heat and power, distributed generation, carbon capture and storage, and diesel technology. Leadership on the technology development front could be provided by a new agency within DOE dedicated to overcoming the long-term, high risk technological barriers to the development of advanced energy technologies.

Thank you for your consideration of my testimony today.

# Center for American Progress



September 25, 2007

Senator Barbara Boxer  
Chairman, Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Senator James Inhofe  
Ranking Member, Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Dear Senators Boxer and Inhofe,

It has come to my attention that one of the witnesses who will participate in today's Environment and Public Works Full Committee hearing, "Green Jobs Created by Global Warming Initiatives," has submitted testimony that claims to represent the Center for American Progress's viewpoint on nuclear power. As the President and CEO of the Center for American Progress (CAP), I am taking this opportunity to set the record straight.

In her testimony for today's hearing, Carol L. Berrigan, Director of Industry Infrastructure, Nuclear Energy Institute, states:

"Nuclear energy also is a part of the strategy for combating climate change in an energy security plan released by the Center for American Progress, a progressive think tank. The center recommends that the United States establish a "renewable portfolio standard" mandating that 10 percent to 25 percent of electricity be produced from renewable resources and nuclear energy by 2025."

The paper to which Ms. Berrigan refers is not a Center for American Progress report. "Energy Security in the 21<sup>st</sup> Century: a New National Strategy" is a product of the National Security Task Force on Energy. Although I served as a member of this task force along with several other CAP Fellows and employees, the paper clearly states on its second page that the people listed as task force members

“have endorsed this report as individuals, not as representatives of their respective organizations. Their endorsement does not necessarily indicate agreement with each specific recommendation.”

Therefore, Ms. Berrigan’s statement is incorrect: neither is this report a CAP plan, nor does it provide recommendations that are specifically endorsed by CAP.

Ms. Berrigan’s statement also suggests that the “Energy Security in the 21<sup>st</sup> Century: a New National Strategy” describes unqualified support for nuclear energy. In fact, the report clearly identifies the threat of proliferation and management of nuclear waste remain two issues that must be resolved in order for nuclear power to play an increasingly important role as a low-carbon energy source. The recommendation to which Ms. Berrigan refers reads as follows (*italics added for emphasis here*):

“Until the national carbon cap-and-trade system is in place, establish a national renewable Portfolio Standard (RPS) mandating that 10 to 25 percent of domestic electricity be produced from renewable sources and *responsibly generated* nuclear power by 2025.”

In 2006, CAP, along with the Worldwatch Institute, released a report, “American Energy: the Renewable Path to Energy Security.” This report outlines CAP’s view that the path to energy security lies in the development of renewable, low carbon energy sources, energy efficiency, and distributed micro power generation. I have attached this report here for the record.

I appreciate this opportunity to clarify the record on CAP’s viewpoint on the role of nuclear power in the development of a low carbon energy economy.

Sincerely,



John Podesta  
President and CEO of the Center for American Progress

Cc: Senator Max Baucus  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Joseph I. Lieberman  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Thomas R. Carper  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Hillary Rodham Clinton  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Frank R. Lautenberg  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Benjamin L. Cardin  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Bernard Sanders  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Amy Klobuchar  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Sheldon Whitehouse  
Environment and Public Works Committee  
410 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator John Warner  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator George V. Voinovich  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Johnny Isakson  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

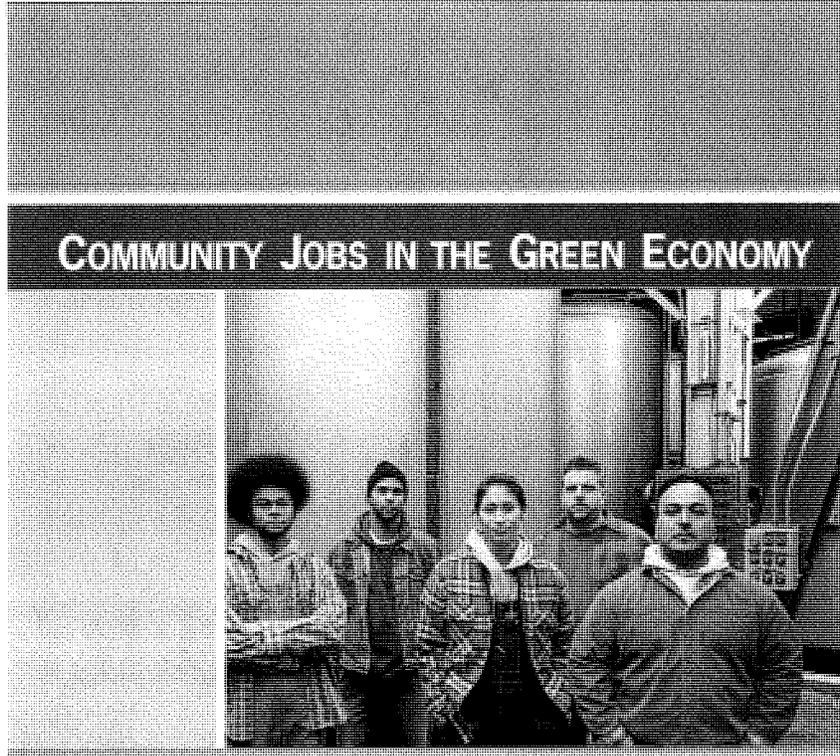
Cc: Senator David Vitter  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator John Barrasso  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Larry E. Craig  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

Cc: Senator Lamar Alexander  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175

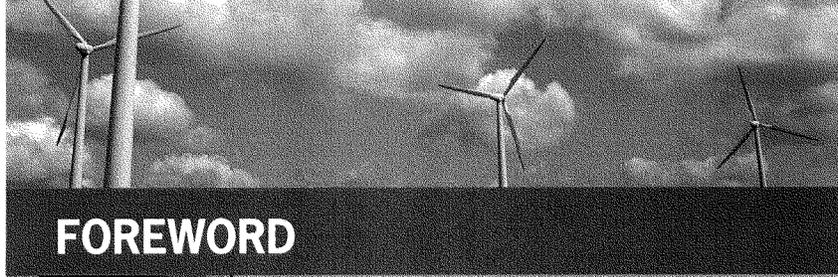
Cc: Senator Christopher S. Bond  
Environment and Public Works Committee  
456 Dirksen Senate Office Building  
Washington, DC 20510-6175



• Apollo Alliance  
• Urban Habitat







Van Jones  
 President, Ella Baker Center for Human Rights  
 Member, Apollo Alliance  
 National Steering Committee

Van Jones and Ella Baker Center for Human Rights Co-convene the Oakland Apollo Alliance with the International Brotherhood of Electrical Workers Local 595.

See: [www.ellabakercenter.org/OaklandApollo](http://www.ellabakercenter.org/OaklandApollo) for more information on their inspirational work.

The clean-energy, "green economy" is now exploding into a billion-dollar sector—with more growth predicted.

But the green economy can do more than create business opportunities and consumer choices for the rich. It can also create job opportunities for the poor. It can do more than improve the bottom line for big corporations. It must improve the life prospects for struggling communities.

The national effort to curb global warming and oil dependence can simultaneously create good jobs, safer streets and healthier communities. That is the chief moral obligation in the 21<sup>st</sup> century: to build a green economy strong enough to lift people out of poverty.

We have the technology. Investors are lining up. The only question is: do we have the political will to make government support the transition—and the moral commitment to ensure that the new "green wave" in fact "lifts all boats?"

We have no "throw-away" resources or species. Nor do we have any "throw-away" children. All of creation is sacred, and all our people are precious. And we must act again as if we know this truth.

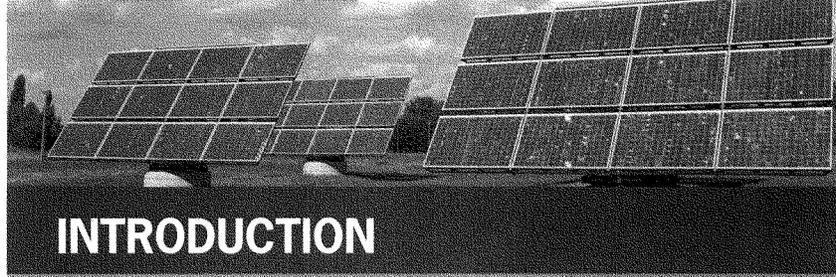
When we do so, our dying blue-collar towns and neighborhoods will bloom again—as dignified, "green-collar" meccas. Urban youth, too often fodder for prisons, could instead be trained to create zero-pollution products, heal the land and harvest the sun. Urban America can be put back to work, rebuilding our cities for the clean-energy future.

We dream of clear skies over our major port cities. Where idling ships once fouled the air, we see solar-powered energy stations that let docking sea vessels power up cleanly. We imagine trucks purchasing cleaner bio-diesel blends, to take the fair trade goods off the ships without polluting the neighborhood.

We envision eco-industrial parks on land once blighted by prisons. We dream of struggling cities like Watts, Detroit and Newark blossoming as Silicon Valleys of green capital. We dream of a multi-ethnic, grassroots movement transforming urban America by creating jobs, reducing violence and honoring the Earth.

Some will call this unrealistic. They will advise urban America to keep its dreams small. But that cynicism is the problem, not the solution.

Those communities that were locked out of the last century's pollution-based economy must be locked into the new, clean and green economy. This report represents a guiding light on that journey.



# INTRODUCTION

**T**his report, a collaborative effort between the Apollo Alliance and Urban Habitat, is a reflection of our shared belief in the potential of the "green economy" to generate quality jobs in our nation's low-income communities and communities of color. We believe that America can move toward energy independence while simultaneously creating high-skill and high-wage jobs for residents of low-income urban communities—residents who have not historically benefited from economic development strategies. To achieve this goal, we must take advantage of America's land, sun and wind resources, high-skilled workforce, strength in ingenuity and innovation, and creative partnership-building potential.

We believe that through investment at the national, state and local level in four key areas—renewable energy, alternative cars and fuels, high performance buildings and infrastructure, and equitable development—America can build a clean energy future. More important, we know that this future will be built on the shoulders of all Americans—farmers, workers, entrepreneurs, businesspeople, and consumers—and that every American must reap its economic and environmental benefits.

In this report, we present an overview of key industries in the green economy, as well as discussions about the necessary workforce development infrastructure needed to train workers to take advantage of these opportunities. We also provide some case studies of Americans who are already employed in these jobs. Finally, we present strategies that cities can use to take advantage of this new economic development engine. Our goal is to provide a roadmap for community organizers, economic development practitioners, labor representatives, and city managers who wish to learn about and create high quality, green jobs in their communities.<sup>1</sup>

## Report Summary

- 1** Section I describes our vision for a green economy that ensures equitable development.
- 2** Section II outlines a range of "green industries" that currently exist in the U.S., and the types and number of jobs associated with each industry. As this report will illustrate, many high-skill, high-wage jobs are available through the energy efficiency, renewable energy, and renewable fuels sectors. However, high-quality, family-supporting jobs do not necessarily follow from every investment in green industry. Cities must proactively and explicitly prioritize and encourage the development of local jobs across all skill sets, in order for green economic development to achieve equitable outcomes for residents. Cities also play an instrumental role in building partnerships and crafting workforce training programs to prepare their local residents for jobs in the green economy.
- 3** Section III presents some strategies and policies to help cities ensure new green jobs are accessible to all residents. These strategies and policies represent the many ways in which cities can tailor a green economic development plan to suit their specific needs. Here we also look at how two California cities, Los Angeles and Richmond, are starting the journey toward a cleaner, greener, more equitable future.



## I. THE VISION

### The Vision for a Green Economy and Equitable Development

**A**merica's energy economy is not working. Our addition to fossil fuels has dire consequences, from global warming to roller coaster energy bills to expensive power outages that cripple our business economy. Meanwhile, low-income urban communities—the sites of most of our dirty power generation—continue to be plagued by poor education and health, high crime, limited employment opportunities, and a diminishing affordable housing stock.

For years, many people saw these situations as unrelated. However, it has become clearer and clearer that investing in clean energy technology can also create good jobs, and that these jobs are clustered in high-density urban areas. An early Apollo Alliance study shows that major national investments in the four priority areas—renewable energy, alternative cars and fuels, high performance buildings and infrastructure, and equitable development—would result in almost three and a half million “green jobs” for Americans. “Green jobs” are those that are directly related to local investments in energy efficiency, renewable energy, and renewable fuel sectors. For instance, a city that decides to install a wind turbine to generate clean power creates “green jobs” in every sector of the wind industry, from component part manufacturing to turbine installation to sales to operating and maintenance. Because the wind turbine is located in the city, many of these jobs are local. Moreover, many of these jobs, especially in the construction and manufacturing sectors, do not require a college degree but are relatively high-wage. Thus the clean energy economy has the potential to provide valuable opportunities to the millions of unemployed and displaced workers who live in our communities.

#### **Vision:**

**A green economy that benefits all Americans and is strong enough to lift people out of poverty**

If cities want to realize this potential, policymakers and communities must explicitly ensure that the benefits of the clean energy economy include low-income workers and people of color. As the green economy continues to grow, it is important to ask some hard questions, including:

- What makes for a successful green economy?
- Who benefits from green economic development policies and practices?
- What policies and practices will ensure that green jobs will go to the under- or unemployed in our low-income communities?

Unless cities candidly address these issues, much of the green economy's most important features, including the opportunity to create decent jobs for low-income Americans, will be lost. For this reason, Urban Habitat and the Apollo Alliance are committed to advancing a green economy that is rooted in the principles of equitable development. Equitable development is premised on the notion that a city's development practices result in affordable housing, safe, reliable public transit, living-wage jobs, quality education, a clean environment, and quality health care for all city residents. In practice, equitable development goes beyond the physical development of a place—for example, the construction of various types of buildings, placement of buildings, and activities within those buildings. Truly equitable development must also meaningfully engage residents, workers, community organizations, businesses, and organized labor in planning and decision-making processes, before the first brick is laid.

Equitable green economic development presents a unique opportunity to address three essential goals simultaneously: a healthy environment, a vital economy, and social equity. We hope this report helps illustrate how that opportunity can become reality.



## II. THE JOBS

**W**e've said that the green economy can create jobs. But what kind of jobs are they? What skill levels? And will they be within low-income workers' reach? In this section we hope to answer some of these important questions, by detailing the types of jobs available in three major areas: energy efficiency and green buildings, renewable energy, and renewable fuels.

### Energy Efficient Buildings

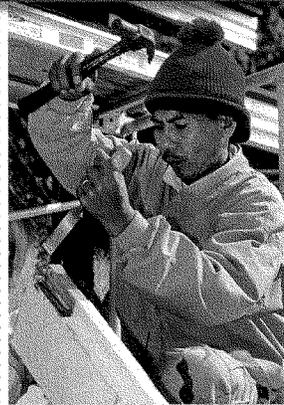
Energy efficiency projects are a huge win for local communities, from both an environmental and a jobs perspective. Incorporating energy efficiency concepts into building design, construction, and retrofits can reduce energy use—and energy bills—significantly. It can also create jobs in energy efficient product manufacturing and installation, as well as general construction jobs.

Here we discuss two primary ways to bring jobs in energy efficiency into a community: through new efficient construction (also known as "green building") and through energy efficiency retrofits on existing buildings.

### Green Building

Green building is the practice of constructing healthier and more resource-efficient structures by improving the ways buildings use energy, water, and materials.<sup>1</sup> Green buildings, also called "high performance" buildings, incorporate both the efficient use of existing energy supplies and the installation of renewable energy systems where appropriate. The main jobs associated with green or high performance building are in the manufacturing of efficiency components and renewable energy systems, and in construction.

Green building creates demand for a whole range of specially manufactured products and technologies. As the demand for green buildings increases, so will the manufacturing jobs that supply green products. These jobs include those with manufacturers of energy efficiency and low-waste systems, such as compact fluorescent lights, waterless urinals, water filtration systems, permeable concretes, insulation, flooring, and low-chemical paints and carpets. They also include jobs with manufacturers of small-scale renewable products such as solar PV panels, solar hot water heaters, small wind turbines, and geothermal heat pumps.



*"We understand that the future of development lies with a new approach to building and we see the opportunities to create new businesses and new jobs while building a better, healthier more sustainable Boston."<sup>2</sup>*

—Boston Mayor Thomas M. Menino  
on Green Building

**Energy Efficiency Retrofit Jobs**

- Auditing energy use in existing buildings
- Manufacturing materials and devices
- Installing efficient lighting and heating systems
- Installing insulation, windows, and appliances



Employees of California Tech Energy Services conduct energy audits and install materials to help low-income households save energy and money.

Of course, green building also involves jobs in construction. Construction workers on green building projects do many of the same types of jobs as construction workers on any building site, though some of these jobs may require special training or certification to work with green products and technologies.

While green building projects employ construction workers, they may not necessarily create many more jobs than a regular “non-green” construction project would create. That’s because it takes the same size crew of carpenters, laborers, plumbers, electricians, roofers, etc. about the same amount of time to build a regular building as it does to build a green building, once the green materials and technologies have been obtained and assuming that the construction crew is trained in green building practices.

However, despite the fact that green building may not create many additional construction jobs, it does have the potential to create entry level job opportunities for low income and people of color when cities implement a combination of policies that promote green building, job training, and labor standards. We describe these policies more in section three of this report.

**Energy Efficiency Retrofits**

An energy efficiency retrofit involves upgrading or replacing lights, heating and cooling systems, insulation, windows, and other components of an existing building so that the building will use less energy. Energy efficiency retrofit projects always create new jobs because such projects involve work on existing buildings that wouldn’t have been done otherwise. Jobs in energy efficiency retrofits include manufacturing the construction materials and devices designed to make buildings more efficient, such as compact fluorescent light bulbs, motion sensors, thermostats, efficient windows and window treatments, and efficient appliances. Energy efficiency retrofits also create construction jobs and high-skill auditing jobs.

Common construction activities in residential, commercial, industrial, and institutional retrofit projects require a wide range of trained construction workers. Heating, ventilation, and air conditioning (HVAC) system installation is probably the most highly skilled and labor-intensive job associated with retrofits. HVAC work employs pipefitters, sheetmetal workers, HVAC technicians, commissioning engineers, and electricians. Lighting projects range from installing efficient bulbs to replacing fixtures. The first requires little training; the second is a higher-skill activity performed by licensed electricians. Motors used for large scale heating and cooling systems and other applications need to be installed and replaced by licensed electricians. Construction workers are needed to install more efficient windows, plumbing fixtures, appliances, and insulation.

Energy audits of existing buildings are a necessary part of energy efficiency retrofits and a source of high quality employment. Auditors provide technical and financial information to consumers about how to reduce their energy bills, and at what cost. Actions can range from reducing energy consumption to installing energy efficient devices, to switching to renewable energy and fuel sources. Energy auditors also work with Home Energy Efficiency Rating Systems to verify that suggested energy systems are installed correctly. Energy auditing is a high-skill job that requires training and certification and can become a well-paying career.

An important set of retrofit jobs are those in the weatherization industry, which employs and trains workers specifically to retrofit homes and businesses to lower heating and cooling bills. The U.S. Department of Energy estimates that for every \$1 million invested in weatherization programs in low-income communities, 53 jobs are created in those communities. Weatherization projects alone require workers to do a range of jobs including installing insulation, improving furnace systems, reducing air flow through buildings, repairing chimneys, installing control devices on water heaters and other appliances, reducing hot water flows in showers, and improving lighting systems.

Energy efficiency retrofit projects create new, local jobs. The Los Angeles Apollo Alliance estimates that retrofitting 100 of the City's older buildings will create job opportunities for 2,000 people.

Green Economy Worker—Li Ling Young

Li Ling Young is a Green Economy Worker at the Los Angeles Apollo Alliance. She works on energy efficiency retrofits in low-income communities, helping homeowners reduce their energy bills and improve their living conditions.



Li Ling Young is a Green Economy Worker at the Los Angeles Apollo Alliance. She works on energy efficiency retrofits in low-income communities, helping homeowners reduce their energy bills and improve their living conditions.

Li Ling Young is a Green Economy Worker at the Los Angeles Apollo Alliance. She works on energy efficiency retrofits in low-income communities, helping homeowners reduce their energy bills and improve their living conditions.

Green Economy Career Pathway

- Minimum wage: \$10.50
- Training: 2-4 weeks
- Independent employment: Yes
- Startup costs: \$0
- Job growth: High

**Generating electricity using clean renewable energy sources creates more jobs than using fossil fuels.**

Renewable energy technologies were a \$40 billion global industry in 2005. The industry is projected to quadruple in size over the next ten years.<sup>6</sup>

**Jobs in Solar PV**

- Manufacturing parts for solar PV systems
- Assembling solar panels
- Installing solar panel systems on rooftops
- Maintaining and repairing solar PV systems

**Renewable Energy**

Renewable energy is power generated from naturally replenished sources like the wind, the sun, and plants. In this section we describe four different renewable energy technologies. Table 1 demonstrates that the use of these renewable energy technologies creates more jobs per megawatt (MW) of electricity generated than typical natural gas power plants.

**Solar PV**

Solar technology allows us to harness the sun's power and turn it into electricity. Every bit of solar power that we create allows us to use a little less power from fossil fuel sources such as coal-fired power plants. The major component of solar energy technology is the photovoltaic (PV) cell. PV cells assembled in modules, also called solar panels, are professionally installed on buildings and other structures to catch the sun's rays and transform them to electricity. This electricity can be used directly by the building or fed into the power grid.

The solar PV industry offers numerous job opportunities for skilled laborers such as roofers, electricians, and sheet metal workers—workers who currently play no role in traditional energy generation.<sup>7</sup> In fact, PV technology requires more manufacturing and construction labor per MW installed than any other renewable energy source. The manufacture of PV cells and the assembly of solar panels accounts for approximately 80% of all jobs in this sector, while installation of the solar panels accounts for most of the remaining jobs.

Specific jobs in solar PV include manufacturing the component parts to be assembled into solar PV systems, including metals, glass, raw silicon (often leftovers from computer industry), batteries, inverters, wiring, and roof mounting structures that hold the solar panels in place. In addition to manufacturing, there are also jobs in assembling the solar panels prior to installation. Assemblers connect cells with one another and add glass and plastics to produce the finished solar panel. Systems integrators put the solar panel together with wires and prepare it for installation. Installers set the solar panel on the roof by connecting it to the inverter, and connecting the inverter to the power grid. Maintenance workers provide routine maintenance and repairs to this entire system of solar panels. And there are other associated jobs in sales and in the transportation of component parts and completed solar panels.

**Table 1. Jobs in Renewable Energy per Megawatt (MW) of Electricity**

Power Source	Manufacturing* (jobs/MW)	Construction & Installation (jobs/MW)	Operation & Maintenance (jobs/MW)	Total Jobs/MW
Solar PV	15.2	7.1	0.1	22.4
Wind	3.5	2.6	0.3	6.4
Solar Thermal	N/A	5.7	0.2	> 5.9
Geothermal	4.8	4.0	1.7	10.5
Natural Gas**	N/A	1.0	0.1	> 1.1

\* Includes component manufacturing.  
 \*\* Natural Gas is not considered a renewable energy. It is included here for comparison.

Source: Renewable Energy Policy Project.<sup>8</sup>

### Wind Energy

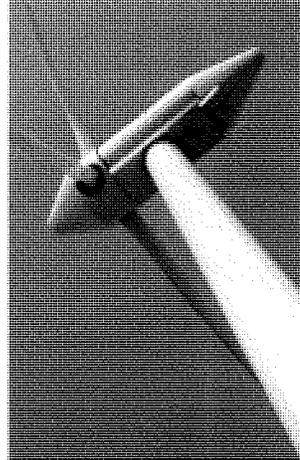
Because of the size of the turbines and the complex machinery inside them, wind power can bring many jobs to a community. Experts predict that for every 1000 megawatts (MW) of wind power generated, 3500 manufacturing jobs will be created.<sup>9</sup> Major activities in the wind industry include blade manufacturing, turbine and gearbox manufacturing, and tower and turbine installation. As in the solar industry, most of the manufacturing is segmented, meaning that most jobs (70%) are in component part manufacturing rather than in complete wind turbine system manufacturing. Many existing manufacturing firms already produce similar component parts for other purposes, and could likely transition to producing component parts for wind turbines in order to meet increased demand. Parts include: turbine blades, towers, gearboxes, electronic systems, brakes, and generators. Increased demand for wind energy will also require manufacturing of accessory equipment like anemometers for wind measurement, cables, and mechanical wind-driven pumps. Some manufacturers also produce machines under 50 kilowatts for home and single community use.

Developing wind farms, with many towers and turbines working together, creates a range of good construction jobs. Skilled workers build access roads and other infrastructure necessary for the wind farm. These skilled workers erect towers, install turbines, and connect the electricity to the grid.

Wind tower operators and maintenance workers are responsible for the upkeep of the huge turbines year after year, and perform functions such as blade cleaning and repair work. Utility workers maintain the lines connecting wind turbines to the power grid.

In addition to the numerous jobs in manufacturing, construction, operation and maintenance, demand for modern wind energy creates jobs for professionals and niche firms. Wind assessment and mapping consultants locate sites with good wind resources. Environmental service consultants conduct environmental impact assessments for planned wind developments. Re-powering firms replace outdated wind turbines with new models.

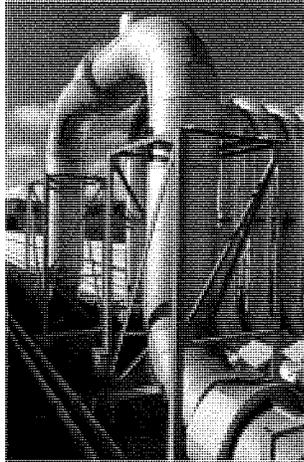
**Wind energy could ultimately supply 20% of the nation's electricity, employing tens of thousands of people in associated manufacturing, construction, and maintenance jobs.**



#### Wind Energy Jobs

- Manufacturing parts for wind turbines and towers
- Constructing wind farms
- Operating and maintaining wind turbines

Erecting policies to boost demand for wind power, the State of Pennsylvania convinced the Spanish wind company Gamesa to open a manufacturing facility in a part of the state that has been hit hard by the decline of the steel industry. The facility will create over 500 good paying jobs.



geothermal heat pump

#### Solar Water Heater Jobs

- Manufacturing parts
- Assembling finished heating systems
- Installing the heaters
- Providing regular maintenance
- Marketing and selling systems to consumers

#### Geothermal Heat Pump Jobs

- Manufacturing equipment and parts
- Installing the heat pump system

Geothermal heat pump installation is labor intensive and creates local jobs at a range of skill levels.

#### Solar Water Heaters

Like PV cells, solar water heaters convert the sun's rays into energy, in this case into heat for hot water systems in commercial buildings and private homes. Solar water heaters are generally very simple devices: sunlight strikes and heats an "absorber" surface within a "solar collector." Either a heat transfer solution or simply regular water flows through tubes attached to the absorber and picks up its heat. The heated water is then stored in a separate tank (often a conventional water heater tank) until needed. Traditional hot water heaters provide any additional heat that may be needed. In general, solar water heating systems can reduce the use of grid electricity by up to 80% and lower water heating bills substantially.<sup>10</sup>

The jobs related to the use of solar hot water heaters include: manufacturing the component parts that will be assembled into completed solar hot water heaters, assembling the finished heating systems, installing the system in a building, and providing regular maintenance. There are also jobs in sales and transportation.

#### Geothermal Heat Pumps

Geothermal energy systems work by accessing the Earth's heat—which can reach 7000 degrees Fahrenheit—to produce electricity, or to heat water or air directly. Geothermal heat pumps transfer heat from the soil to buildings in winter and from buildings to the soil in summer, using an environmentally friendly heat exchange fluid similar to antifreeze. This process is very efficient, reducing electricity consumption by 30% to 60% in any given building. These pumps can be used in any kind of building, from a house to a factory, so long as the natural resources exist. In addition to heating and cooling, geothermal heat pumps can be used to heat water.

Because underground temperatures are fairly constant, geothermal energy is a renewable resource that many people are starting to use in homes and businesses across the United States. In addition, as home heating and cooling costs rise, a number of cities are exploring using geothermal heat pumps to heat and cool their municipal buildings.

Geothermal heat pumps are installed on individual buildings, so they tend to generate local installation and maintenance jobs. In one Canadian study, experts approximate that for every 1000 pumps installed in private residences, 150 jobs are created, most in lower-skill industries.<sup>11</sup>

Specific jobs associated with the use of geothermal heat pumps include: manufacturing mechanical equipment and primary metal supplies (such as wall shaft casings, drilling equipment, and power plant equipment), manufacturing polyurethane pipes through which heat exchange liquids are pumped, and manufacturing the heat pumps themselves. There are also jobs in installation and maintenance. Installers dig trenches and wells, install pipe loops, and perform electrical and duct work. Installation jobs can be performed by most HVAC contractors, and include trench digging, backhoe operation, pipe fusing, and backfilling.



Many unions have state-of-the-art training programs to prepare workers for careers in the renewable energy sector.

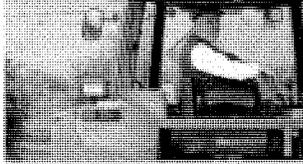
**Michelle Penny**

Michelle Penny is a member of the International Brotherhood of Electrical Workers (IBEW) Local 1000 in the Washington, D.C. area. She is a skilled electrician and has been working in the industry for over 10 years. She is currently completing her training for a career in the renewable energy sector.



**Green Economy Career Pathway**

The Green Economy Career Pathway is a program designed to help workers transition into the renewable energy sector. It includes training in solar panel installation, wind turbine maintenance, and energy efficiency audits. The program is supported by various unions and industry organizations.



### Renewable Fuel Jobs

- Growing and harvesting crops for feedstock
- Collecting waste oils for feedstock
- Manufacturing parts for production facilities
- Constructing production facilities
- Working in the production facility
- Distributing and marketing fuel

in the state of Washington, where recent policies created reliable markets for biofuels, Imperium Renewables is building a large biodiesel refinery at the Port of Grays Harbor. The construction of the refinery is creating 250-350 union jobs in an area that has suffered job loss with the decline of the timber industry. After it is up and running, the plant will employ 50 permanent workers.

### Renewable Fuels: Ethanol and Biodiesel

A key part of the green economy is domestically-produced renewable fuel. The two most common renewable fuels in use today are ethanol and biodiesel, both of which produce less greenhouse gas than conventional gasoline or diesel.

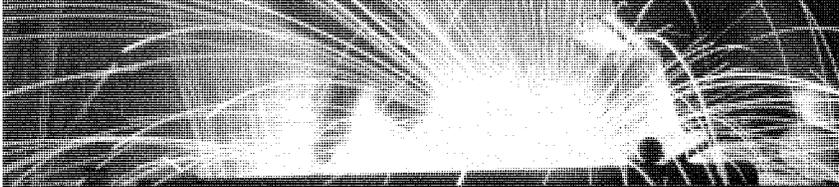
Ethanol is a fuel made from either sugar-based plants, such as corn, or from cellulose-based plants such as switchgrass. Ethanol is commonly used as a fuel additive in mixes of 90% gasoline and 10% ethanol (called "E10"), which can be used in any gasoline vehicle. However, "flex-fuel" vehicles that have been designed to run on either gasoline or ethanol can run on mixes of 85% ethanol ("E85") and more. Biodiesel is a renewable fuel created mostly from plant oils (such as soybean, canola, or mustard), animal fats, or used cooking oil. It can be used in standard diesel engines as a substitute for diesel fuel, or an additive to diesel.

Many of the jobs in the biofuels sector are in plant growing and production, meaning that they are most often located in rural areas near farmland. Biofuel production can be a good economic development tool in these places, especially if the production facilities are owned by local farmers who can earn money both by selling their crops and the fuel produced from those crops.

In urban areas, jobs in this sector can include waste oil collection from area businesses, biodiesel production, and distribution. There are also manufacturing and construction opportunities associated with ethanol and biodiesel production facilities.

Major jobs associated with biofuels include growing and collecting feedstock, manufacturing parts for production facilities, constructing the biofuel facilities, producing fuel in the facilities, and distributing the final product. Growers who currently farm corn, soy, canola, and other raw plant material can tap into the biofuels market when selling these commodities. Many growers are also cooperative owners of biofuel production facilities. In urban areas, municipal employees or private contractors can collect waste vegetable and animal oils from area restaurants and processing plants to use in biodiesel production. Component manufacturers make many of the parts used in biofuel production facilities. For instance, metal fabricators make the steel tanks used to refine and store ethanol and biodiesel. Construction workers build the plants that turn plant matter or oils into biofuels. Estimates for construction jobs on average-sized ethanol or biodiesel plant projects range from 75 to 200 jobs, for 12 to 18 months, though newer and bigger plants may create up to 400 construction jobs.

Workers at biofuel production facilities perform a range of functions. An average ethanol plant produces about 40 million gallons of ethanol a year and employs around 35 people in the following types of jobs: general manager, plant manager, maintenance supervisor, plant operators, purchasing manager, lab manager and technicians, craftsmen, laborers, and instrument technicians.<sup>12</sup> Biodiesel plants employ fewer people, around 28 workers for an average plant making 30 million gallons per year. Jobs in these plants are similar to those in ethanol plants, though ethanol plants have the potential to hire more skilled lab workers and technicians as they move from fuel-only facilities into more sophisticated chemical operations.



## III. CREATING GOOD JOBS

**N**ow that we've laid out the types of jobs that make up the clean energy economy, the big question remains: how can we bring those jobs to our cities and communities? And just as important, how can we ensure that low-income residents can access these new high-quality, family-supporting jobs—especially those residents who are currently unemployed or underemployed, or who have barriers to employment such as limited language skills or a history of incarceration?

In this section we explore policies cities can enact to jump-start the clean energy economy. We also look at job quality and job training programs that can help ensure the benefits of this new economy are shared with local residents, especially in low-income and underserved communities.

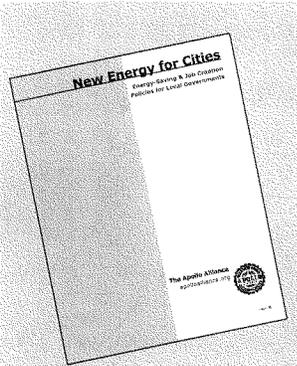
### Growing the Clean Energy Economy in Your City

America's cities have a unique opportunity to take advantage of the growing interest in a new green economy. Cities are directly in control of thousands of buildings and vehicles that can be retrofitted or upgraded using new energy-saving technologies and renewable fuels. City governments have the power to negotiate clean energy practices with utilities that serve them. Land use policies can be a tool for encouraging developers to build green or to attract green manufacturing and industry. Cities can also use their bond ratings and control over local tax structures to provide financial incentives for renewable energy and energy efficiency programs.

Cities across the country have used a variety of innovative strategies to advance these goals. The Apollo Alliance recently released a report, *New Energy for Cities*, detailing many of these strategies, and providing case studies—with contact information—for each strategy.

The Apollo Alliance and Urban Habitat believe all cities should embrace Apollo's Four-Point Plan for a cleaner energy future, which includes using concrete strategies to bring quality jobs to low-income communities and communities of color.

- 1 Invest in Renewable Power**  
By 2013, generate the maximum feasible volume of regional electricity in the state from new clean, renewable sources, through policies and programs that prioritize in-state production, workforce development, and good jobs.
- 2 Create High-Performance Buildings**  
Prioritize communities by auditing and retrofitting all state buildings that fail to meet minimum energy efficiency standards, requiring efficient and green construction practices in all new public and private buildings, reducing energy consumption, and creating good jobs and job training for state residents.
- 3 Drive Toward Energy Independence**  
Reduce oil consumption by promoting mass, renewable fuel alternatives and efficient motor vehicle technologies through policies and programs that prioritize in-state renewable fuel production and good jobs.
- 4 Build High-Performance Cities**  
Promote low-energy, high-performance cities and communities connected by regional public transportation networks, through policies and programs that prioritize local hiring and good jobs.



The manufacturing, construction, installation, and maintenance of renewable energy and energy efficiency systems will happen almost entirely in metropolitan areas. The physical infrastructure America needs to build these new technologies—factories, universities, and research parks—is in or near cities. The workers who provide a strong foundation for America's clean energy future already live near this infrastructure. Best of all, because union densities are higher in cities, clean energy jobs in the city are far more likely to be good-paying union jobs than jobs created outside the city.

The Apollo Alliance's *New Energy for Cities* publication is available on the web at [www.apolloalliance.org](http://www.apolloalliance.org)

Some of the most far-reaching and effective strategies include:

- Installing renewable power systems, such as solar PV and small wind turbines, to power municipal buildings and publicly-financed projects such as affordable housing developments.
- Updating city building codes to require green and efficient building practices.
- Auditing all city buildings and performing retrofits on older structures; providing incentives to private owners to retrofit their buildings.
- Collecting waste vegetable oil and converting it to biodiesel in municipally-owned facilities.
- Converting city vehicle fleets, including city and school buses, to biodiesel, flex-fuel, or hybrid vehicles.
- Directing municipal utilities, or negotiating with private utilities, to increase renewable energy generation.

Many of these strategies—whether energy efficiency measures or renewable energy systems—involve up-front capital costs that will result in reduced energy use and savings over time. For that reason, the Apollo Alliance *New Energy for Cities* report recommends a number of financing options, from bonding initiatives to low-interest loans, for cities to use to fund clean energy projects. Also, though the Apollo plan creates millions of new jobs in manufacturing, installation, construction and services, cities and communities must actively work to make sure these jobs are high-skill jobs paying a family-supporting wage, and that they are accessible to low-income, traditionally under-served workers. One way to do this is to attach job quality and job training standards in all new energy policies.

The next section more fully explores these important job standards.

### Capturing High-Quality Jobs for Community Residents

Many of the clean energy strategies that we recommend in *New Energy for Cities* involve some sort of government subsidy or tax break to private companies that produce, buy, sell or distribute energy efficient or clean energy products. Cities can and should attach job quality and job training standards to these types of subsidies to achieve greater public benefit. Essentially, these standards require that any business receiving a government subsidy or tax credit must provide employees decent, family-supporting wages and/or benefits. These standards ensure that new jobs created will be "high-road" jobs: providing a decent income and health benefits, and helping residents avoid the "hidden taxpayer costs" that occur when working families rely on government subsidies like food stamps, Medicare, and the Earned Income Tax Credit. They also ensure that when jobs are created, they will benefit those who need them most.



**Apprentice Utilization Requirements**

By offering worker recruitment, classroom instruction, and on-the-job training and job placement, state-approved apprenticeship programs provide a gateway to quality jobs for workers from disadvantaged communities. Training academies can help workers with little education, unstable employment backgrounds, or a history of incarceration to gain important skills and credentials. To date, requirements to use apprentices have been most successfully integrated into Project Labor Agreements (PLAs), the agreements between units of government and contractors carrying out publicly funded projects. For example, PLAs can require contractors to use apprentices for a specified percentage of all hours worked.

**Local Hiring Policies**

By requiring employers who benefit from public financing or subsidies to reserve a percentage of jobs for local residents, local hiring strategies tie economic development to local training and employment opportunities. For example, some cities have required developers using public money to ensure that 50% of all construction jobs go to locally-owned businesses that include apprenticeship programs for local residents, or have required developers to go to local companies first for all jobs before contracting outside the community. This ensures residents in economically isolated communities benefit from the investments happening in their community.

**Wage Policies**

Local governments can tie public subsidies to wage standards that require employers to pay good wages to employees working on the project. Wages can be tied to the state or regional median or average wage, or to the prevailing wage in a particular geographical area and industry, or to a "sustainable" or living wage standard. Another option is for local governments to require businesses to provide health benefits to employees, or to pay for a specific percentage (50–80 percent) of employees' health care costs. The idea behind these standards is that people who work in communities across America should be able to live decently and raise their families in those communities.

Studies show public projects in states with such laws save taxpayer dollars.<sup>13</sup> In contrast, contractors in states with no prevailing wage laws tend to hire inexperienced workers in an attempt to keep down payroll costs. However, occupational injuries soar on these projects and the use of low-wage workers routinely results in increased supervision, maintenance and cost overruns.

**Further Resources on Job Training and Workforce Development**

**Apprenticeship utilization and job standards**

For the Apollo Alliance's page on applying apprenticeship utilization standards to clean energy policies and projects, see [apolloalliance.org/cleanenergy/cleanenergyregulation/cleanenergyregulation.htm](http://apolloalliance.org/cleanenergy/cleanenergyregulation/cleanenergyregulation.htm).

For model legislation providing minimum standards for jobs created through state subsidies, see [www.apolloalliance.org/resources/legislation/standardsforthebond.html](http://www.apolloalliance.org/resources/legislation/standardsforthebond.html).

For a collection of papers demonstrating the effect of prevailing wage requirements on construction costs, see [www.bond.org/education/distribution/prevailing.htm](http://www.bond.org/education/distribution/prevailing.htm).

For a compilation of studies on prevailing wage, apprenticeship standards, and living wage standards, see [www.bond.org/education/prevailing\\_wage/law\\_made.htm](http://www.bond.org/education/prevailing_wage/law_made.htm).

**Workforce training and workforce intermediaries**

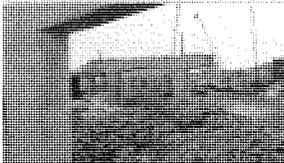
Rubenstein, Gwen, and Andrea Piper. 2004. Training Policy in Brief. An Overview of Federal Workforce Development Policies. Washington, D.C.: The Workforce Alliance.

Gilson, Robert P. (Ed.). 2004. Workforce Development: Public, Civic, Community and Performance. Philadelphia: Temple University Press.

Gilson, Robert P. (Ed.). 2005. Workforce Intermediaries for the Twenty-First Century. Philadelphia: Temple University Press.

**Community Benefits in Milwaukee**

In Milwaukee, residents of the Park East neighborhood worked with the city to make sure that when two downtown freeway ramps were demolished, the land would go on a high-density, mixed-use development including affordable housing and mass transit. The Community Benefits Agreement the residents signed with the city also included a commitment to green building and good labor standards both for construction workers and for those who will ultimately work in the developer's commercial buildings. The Park East CBA, including legislative language, can be found at [www.milwaukee.gov/CommunityBenefits/CommunityBenefitsIndex.aspx](http://www.milwaukee.gov/CommunityBenefits/CommunityBenefitsIndex.aspx). For more information on community benefits agreements generally, see [www.communitybenefits.org](http://www.communitybenefits.org).



Milwaukee's Park East neighborhood after two freeway ramps came down in 2004.



New development plan for Park East, put together by neighborhood residents and city planners, including affordable housing, transit, green building principles and high-wage job guarantees.

**Energy Credits for Job Standards or Job Training Programs**

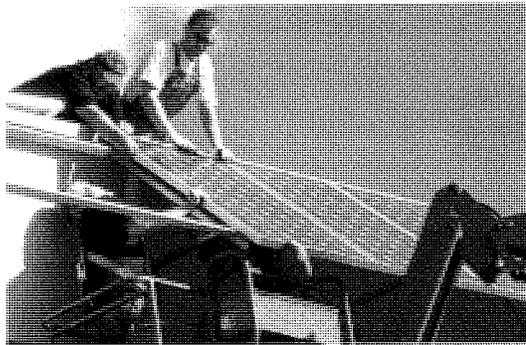
Renewable energy legislation can be a vehicle for linking renewable energy certificates (RECs) to state-approved apprenticeship programs or wage programs. Extra RECs can be earned when matched with apprenticeship utilization requirements.<sup>14</sup>

For example, in November 2006 Washington State passed a Renewable Portfolio Standard requiring the state's larger utilities to either produce a certain amount (15%) of power from renewable sources by 2020, or buy "Renewable Energy Credits" to offset their non-renewable power use. If, while developing a new renewable energy facility, a utility includes an apprenticeship program to train new workers, the utility can get extra credit toward meeting the renewable energy goal set by the state. This provision, which was originally proposed in the failed 2002-03 Energy Portfolio Standard bill, was developed and recommended by the Washington State Labor Council, Seattle King-County Building Trades, and the United Steelworkers, District 11.

**Community Benefits Agreements**

Community Benefits Agreements are another powerful tool for ensuring that issues of community and economic justice are advanced by economic development efforts. CBAs link public subsidy in the development process to specific community enhancements that benefit the broader community.

Milwaukee's Park East neighborhood provides a good example of a clean energy/good jobs CBA. When two freeway ramps were torn down on the northern side of downtown Milwaukee, city activists and unions formed a coalition to ensure that any new development incorporate transit access, good jobs, and environmental benefits. The Good Jobs and Livable Neighborhoods Coalition and the City of Milwaukee ultimately signed a CBA conditioning the sale of city land freed up by the freeway demolition on a number of community benefits, including access to mass transit, prevailing wage for construction jobs, living wage for post-construction jobs, and green design principles incorporated into all proposals.



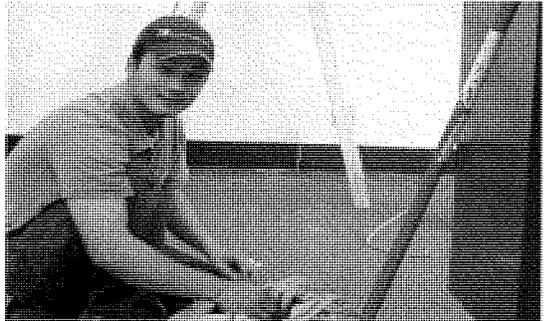
**Workforce Development: Regional Training Partnerships and Workforce Intermediaries**

A key component of any green economic development strategy is developing the skilled workforce needed to fill these new green jobs. Because the energy efficiency and renewable energy industries are relatively new, communities have the opportunity to develop new strategies and policies to help workers access the manufacturing, construction, and operating and maintenance jobs that make up these industries. How communities approach workforce development for green jobs is crucial, as these programs can make the difference between a “high-road” economy with good, family-supporting jobs filled by local workers, and a “low-road” economy with imported, low-wage labor.

Traditional approaches to workforce development often focus on increasing job access and providing limited job training. But for economic and workforce development programs and policies to truly contribute to vibrant local and regional economies, they must embrace the twin goals of 1) encouraging employers to hire locally, provide a living wage and create family-supporting jobs and 2) helping workers with job placement and long-term worker retention.

One way to address these two goals is through public-private regional partnerships known as “workforce intermediaries.” Workforce intermediaries (WIs), also known as “regional training partnerships,” are partnerships among regional economic development stakeholders, including businesses, unions, technical and community colleges, job training programs, community organizations, and local and state workforce development officials. Rather than being one-size-fits-all approaches, they are place-specific partnerships that work to develop and implement pathways for career advancement and family-supporting employment for low-skill workers.

These approaches are only just beginning to be applied to industries in the green economy. For instance, Wisconsin is just starting to look at developing career ladders for workers in the ethanol industry. However, there is no reason that communities cannot start to build bridges among employers, workers, and training programs in other green industries, such as energy efficiency and renewable energy.



16 | Community Jobs

**Some Examples of Successful Workforce Intermediaries**

**The Wisconsin Regional Training Partnership (WRTIP)**, with partnerships in manufacturing, construction, hospitality, health care and finance, has trained 5,000 workers and placed 1,400 job seekers into high wage employment. The Partnership includes the Milwaukee Area Technical College, the Private Industry Council and a range of community based organizations.

**Project Quest** in San Antonio, TX, has placed over 1,400 people into high wage jobs, working with COPS/MIAs, a community based organizing network, negotiating resources from state and local governments, and helping develop new ways of teaching at the local community college.

**The Seattle Jobs Initiative** has placed 1,000 job seekers, combining job training and placement programs with health service integration, industry-specific economic development programs (often called “sectoral partnerships”), and a network of culturally diverse community organizations.



### Key Policy Question

Can the business establishments that generate green products and services, as well as the manufacturers and service providers that supply them, expand in Los Angeles to create good paying jobs that benefit local residents equitably?

Economic Roundtable, Jobs in L.A.'s Green Technology Sector, on the web at [www.economicrt.org/publications.html](http://www.economicrt.org/publications.html).

## Identifying High-Growth, High-Potential Green Industries

At this point, readers may be thinking, "This all sounds great—but how do I get started?" For many cities and communities, clean energy economic development is a very new concept, and it may be difficult to decide which of the many renewable energy and energy efficiency sectors to focus on first. Two California cities, Los Angeles and Richmond, offer examples of how cities can begin to transition to a greener economy.

### Los Angeles

The City of Los Angeles recently took a hard look at the potential job opportunities that would result from developing its "green technology sector." The Los Angeles Workforce Investment Board, Community Development Department, and Department of Water and Power commissioned a study to identify which sectors of the energy economy the city already has in place; and then to determine which of these sectors currently provide high-quality jobs and career ladder opportunities. Of particular interest to the city were the solar, wind, and biomass sectors, and all the possible manufacturing and construction jobs that go along with these sectors.

Once this analysis was complete, the city was able to decide which industries to target with policies and programs designed to maximize their role in the local clean energy economy. Ultimately, the city concluded that Los Angeles has a large and diverse industrial base that is well-suited to the manufacturing and construction industries necessary for developing green technologies, and also that many of these industries have average wages of at least \$2500/month. This information will allow the city to target public investment and incentives toward those industries, while at the same time building a workforce development system to train urban residents to fill those emerging green technology jobs.

In a parallel effort, Los Angeles Apollo—run through the social justice organization SCOPE—has been working to identify public buildings in the city that are ripe for renovation and retrofitting. Los Angeles Apollo hopes to spearhead an effort to do energy efficiency retrofits on these buildings, through a program that offers apprenticeship programs and job training to local residents.

### Richmond

Just like Los Angeles, many other cities across the country are recognizing the cross-cutting ways in which green jobs are addressing issues in their communities. In California's Bay Area, the City of Richmond is one such example.

Richmond is a city in need of a new economic plan. The city's heyday was in the 1940s, when the Kaiser Shipyards employed tens of thousands of workers building ships and launching them from Richmond's port. When the war ended, these jobs went away, and Richmond has been struggling ever since. Though the city has seen some positive revitalization efforts, most of these are aimed at higher-income residents. The rest of the city is still plagued by a lack of high-quality employment opportunities, diminishing affordable housing stock, and high crime rates. Moreover, Richmond is home to several high-polluting industries, which have a negative effect on the health of its residents, especially its low-income residents who live near these industrial zones.

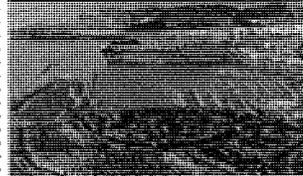
As Richmond looks to the future, it is faced with a unique opportunity to employ equitable green economic development to not only revitalize and renew the city, but also to address some of the deeper economic and health issues that have impeded the city's growth. In 2005, the City of Richmond was presented with a unique opportunity to become involved in the Green Wave Initiative, an investment program offered by the State Treasurer's Office for industries in the emerging green technology industries. The city subsequently approached Urban Habitat to research the potential for green economic development to bring quality jobs to Richmond residents. In February 2006, the City of Richmond, in collaboration with Urban Habitat, crafted a resolution to illustrate the city's commitment to green economic development. This resolution formally established Richmond's position that "economic opportunity, environmental integrity and societal equity are the foundation upon which sustainable cities can build a better quality of life for their residents." Furthermore, the resolution detailed the following essential elements of a sustainable community:

- Ecological Integrity: satisfying basic human needs such as clean air and water; protecting ecosystems and biodiversity; pollution prevention strategies.
- Economic Security: local reinvestment; meaningful employment opportunities; local business ownership; job training and education.
- Empowerment and Responsibility: respect and tolerance for diverse views and values; viable non-government sector; equal opportunity to participate in decision-making; access to government.
- Social Well-Being: a reliable local food supply; quality health services, housing and education; creative expression through the arts; safety from crime and aggression; respect for public spaces and historic resources; a sense of place making a contribution to the community.

Urban Habitat has continued to work with the city and to provide policy and procedural recommendations as Richmond moves forward with its green economy plan. These recommendations, which include a combination of energy policy ideas and commitments to job quality and job training, highlight the multi-faceted approach necessary to a truly equitable green economic development process.

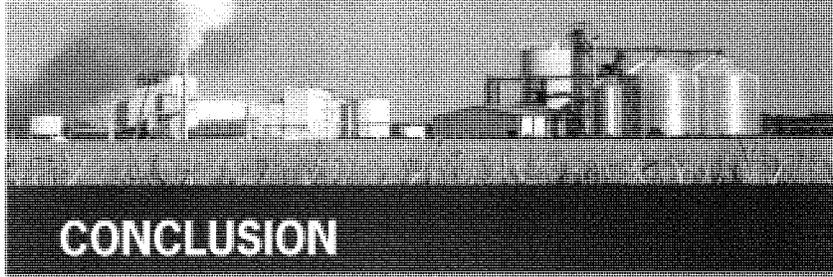
Green economic development cannot provide guaranteed solution for all of Richmond's economic and environmental woes, but it may be able to make significant contribution toward the city's health and prosperity.

**Richmond's industrial base, access to shipping lanes, and labor supply provide a solid foundation for green economic development.**



*"Economic opportunity, environmental integrity and societal equity are the foundation upon which sustainable cities can build a better quality of life for their residents."*

*Richmond City Council Resolution on Green Economic Development*



## CONCLUSION

The emerging green economy holds great promise for America's cities, and especially for our low-income, heavily minority urban communities. Every aspect of clean energy development, from manufacturing to construction, operating and maintenance, can create good jobs, clean up the air and water, and save consumers money on their energy bills. Every city and community in the United States has some potential to capitalize on this new economy, whether through good wind or solar resources or through retrofit programs to bring old, dilapidated buildings up to energy efficiency codes.

But this promise will not be realized without communities getting involved in the details of green economic development. To ensure good, local jobs that are accessible to low-skilled workers, we need to push policymakers to tie local and state tax credits and incentives to labor standards such as prevailing or living wage. We need to make sure our governments invest in the worker training programs necessary to move low-skilled workers into good jobs, and that they include local hire and apprenticeship programs in city projects. And we need to make sure that communities have a seat at the table when economic development decisions are being made.

The Apollo Alliance and Urban Habitat are committed to fighting for a clean energy future that benefits not only businesses and the environment, but also workers and low-income communities. We hope this report serves as a framework for states, cities and neighborhoods invested in these same fundamental ideals.



#### Reports on Jobs Related to Energy Efficiency or Renewable Energy

Apollo Alliance "The Apollo Jobs Report: Good Jobs & Energy Independence" (January 2004) available at: [www.apolloalliance.org](http://www.apolloalliance.org)

Economic Policy Institute "Clean Energy and Jobs: A Comprehensive Approach to Climate Change and Energy Policy" (September 2002) available at: [www.epi.net.org/studies/cleanenergyandjobs.pdf](http://www.epi.net.org/studies/cleanenergyandjobs.pdf)

Redefining Progress "Smarter, Cleaner, Stronger: Secure Jobs, A Clean Environment, and Less Foreign Oil" (October 2004) available at: [www.redefiningprogress.org/bluegreen/SmartCleanStrong\\_National.pdf](http://www.redefiningprogress.org/bluegreen/SmartCleanStrong_National.pdf)

Renewable and Appropriate Energy Laboratory of University of California, Berkeley "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?" (April 2004) available at: [www.rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf](http://www.rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf)

Renewable Energy Policy Project "The Work that Goes into Renewable Energy" (November 2001) available at: [www.respp.org/articles/state/01/0908\\_FinAA\\_REV.pdf](http://www.respp.org/articles/state/01/0908_FinAA_REV.pdf)

Renewable Energy Policy Project "Wind Turbine Development: Location of Manufacturing Activity" (September 2004) available at: [www.respp.org/articles/state/04/09/04/WindLocator.pdf](http://www.respp.org/articles/state/04/09/04/WindLocator.pdf)

Union of Concerned Scientists "Renewing America's Economy" (2005) available at: [www.ucsusa.org/assets/documents/clean\\_energy/Renewing-Americas-Economy-2005.pdf](http://www.ucsusa.org/assets/documents/clean_energy/Renewing-Americas-Economy-2005.pdf)

World Wildlife Fund "Clean Energy: Jobs for America's Future" (October 2001) available at: [www.worldwildlife.org/climate/publications/clean\\_energy\\_jobs\\_2001.pdf](http://www.worldwildlife.org/climate/publications/clean_energy_jobs_2001.pdf)

**Green building**

U.S. EPA's Green Building, available at: [www.epa.gov/greenbuilding/](http://www.epa.gov/greenbuilding/)

U.S. Green Building Council, available at: [www.usgbc.org](http://www.usgbc.org)

**Energy Efficiency Retrofits**

American Council for an Energy Efficient Economy, available at: [www.aceee.org](http://www.aceee.org)

Apollo Alliance "Jobs in Energy Efficiency" (2003) available at: [www.apolloalliance.org/strategy\\_center/model\\_legislation/jobs.cfm](http://www.apolloalliance.org/strategy_center/model_legislation/jobs.cfm)

**Solar PV**

U.S. DOE Solar Energy Technologies Program "Photovoltaics" (2006), available at: [www.eere.energy.gov/solar/photovoltaics.html](http://www.eere.energy.gov/solar/photovoltaics.html)

Real time information on the output of IBEW 569's solar array available at: [www.view2.aspx?panel=569TST/Portal/SullivanElectric/Local/EndUser/View.html](http://www.view2.aspx?panel=569TST/Portal/SullivanElectric/Local/EndUser/View.html)

**Wind**

American Wind Energy Association, available at: [www.awea.org/resources/](http://www.awea.org/resources/)

**Solar Water Heating**

U.S. DOE Building Technologies Program "Solar Hot Water Heating" (2006) available at: [www.eere.energy.gov/buildings/info/components/water\\_heating/solar\\_hot.html](http://www.eere.energy.gov/buildings/info/components/water_heating/solar_hot.html)

U.S. DOE Solar Energy Technologies Program "Solar Heating" (2006) available at: [www.eere.energy.gov/solar/solar\\_heating.html](http://www.eere.energy.gov/solar/solar_heating.html)

#### Geothermal Heat Pumps

Renewable Energy Policy Project "Geothermal Energy for Electric Power: A RFPF Issue Brief" (December 2003) available at: [www.respp.org/articles/state/03/12/03/Geothermal\\_Issue\\_Brief.pdf](http://www.respp.org/articles/state/03/12/03/Geothermal_Issue_Brief.pdf)

US DOE Energy Efficiency and Renewable Energy "Geothermal Technologies Program" (2006) available at: [www1.eere.energy.gov/geothermal/](http://www1.eere.energy.gov/geothermal/)

**Renewable Fuels**

David Morris "Ownership Matters: Three Steps to Ensure a Biofuels Industry That Truly Benefits Rural America" (Institute for Local Self Reliance, 2006) available at: [www.newrules.org/agri/ownershipbiofuels.pdf](http://www.newrules.org/agri/ownershipbiofuels.pdf)

US DOE Energy Efficiency and Renewable Energy "Biomass Program" (2006) available at: [www1.eere.energy.gov/biomass/](http://www1.eere.energy.gov/biomass/)

**City Energy and Jobs Policy**

Apollo Alliance "New Energy for Cities" (2006) available at: [www.apolloalliance.org/issue\\_and\\_local/](http://www.apolloalliance.org/issue_and_local/)

**Job Standards**

Good Jobs First "The Policy Shift to Good Jobs" (2003) available at: [www.goodjobsfirst.org](http://www.goodjobsfirst.org)

**Local Hiring Policies**

PolicyLink "Local Hiring Strategies" available at: [www.policylink.org/LTKL/LocalHiring/default.html](http://www.policylink.org/LTKL/LocalHiring/default.html)

**Wage Policies**

Dan Gardner "The Truth about Prevailing Wage" (Oregon Bureau of Labor and Industries) available at: [www.boli.state.or.us/BOLI/WH/OPWR/docs/prevscwh.pdf](http://www.boli.state.or.us/BOLI/WH/OPWR/docs/prevscwh.pdf)

**Apprenticeship Utilization**

Apollo Alliance "Apprenticeship Utilization" (2003) available at: [www.apolloalliance.org/strategy\\_center/model\\_legislation/aurecm](http://www.apolloalliance.org/strategy_center/model_legislation/aurecm)

State Building and Construction Trades Council of California, "Building California Construction Careers" available at: [www.buildingca.com](http://www.buildingca.com)

**Job Training and Workforce Development Programs**

Energyldeas Clearinghouse "Education and Training Links for Renewable Energy Careers" (2006) available at: [www.energyldeas.org/pages/default.cfm?o=hp&c=126](http://www.energyldeas.org/pages/default.cfm?o=hp&c=126)

Helmets to Hardhats, Program for veterans to transition to careers in the trades, available at: [www.helmets-to-hardhats.org](http://www.helmets-to-hardhats.org)

National Joint Apprenticeship and Training Committee of National Electrical Contractors Association (NECA) and International Brotherhood of Electrical Workers (IBEW) available at: [www.njatsc.org](http://www.njatsc.org)

**Community Benefits Agreements**

Center on Policy Initiatives "Unprecedented Community Benefits Agreement Approved by City Council: Ballpark Villages Project Sets New Standards for Affordable Housing and Jobs" (2004) available at: [www.onlinescipi.org/CBA.html](http://www.onlinescipi.org/CBA.html)

Los Angeles Alliance for a New Economy "Los Angeles Sports and Entertainment District Project Community Benefits Program" available at: [www.laanae.org/docs/policy/cbas/cba\\_basports.pdf](http://www.laanae.org/docs/policy/cbas/cba_basports.pdf)

Partnership for Working Families available at: [www.communitybenefits.org](http://www.communitybenefits.org)

## Endnotes

1. The term "green economy" is often used to describe a broader range of economic activities than those we address here. While we focus on the energy sector in this report, we recognize that the larger "green economy" includes a range of products and practices related to improving or preserving the natural environment and the quality of the air, water, and food in our communities.
2. For more information on green building, see The U.S. Green Building Council's web page at [www.usgbc.org](http://www.usgbc.org), and the U.S. Environmental Protection Agency's Green Building web page at [www.epa.gov/greenbuilding/](http://www.epa.gov/greenbuilding/).
3. Boston Redevelopment Agency, "Mayor Manino Awards 'Green Building Grants'" (Press Release, August 11, 2004), available at [www.cityofboston.gov/BRA/press/PressDisplay.asp?pressID=236](http://www.cityofboston.gov/BRA/press/PressDisplay.asp?pressID=236).
4. California Youth Energy Services (CYES) is a project of the Rising Sun Energy Center. For more information, see the Rising Sun Energy Center website at [www.risingsunenergy.org](http://www.risingsunenergy.org).
5. U.S. Dept. of Energy/EERE, "Weatherization Assistance Program: Improving the Economies of Low-Income Communities" (last update August 2006), available at [www.eere.energy.gov/weatherization/improving.html](http://www.eere.energy.gov/weatherization/improving.html).
6. Joel Makower et al., "Clean-Energy Trends 2006" (Clean Edge: March 2006), available for download at [www.cleandgs.com/reports-trends/2006.php](http://www.cleandgs.com/reports-trends/2006.php).
7. Virinder Singh and Jeffrey Fehrs, "The Work that Goes into Renewable Energy" (Renewable Energy Policy Project: November 2001).
8. Data in this table is from two reports: Masashi Shibaki, "Geothermal Energy for Electric Power: A REPP Issue Brief" (Renewable Energy Policy Project: December 2003), available at [www.crest.org/articles/static/1/binaries/Geothermal\\_Issue\\_Brief.pdf](http://www.crest.org/articles/static/1/binaries/Geothermal_Issue_Brief.pdf); and George Sterzinger and Matt Svrcek, "Component Manufacturing: Ohio's Future in the Renewable Energy Industry" (Renewable Energy Policy Project: October 2005), available at [www.crest.org/articles/static/1/binaries/Ohio%20Manufacturing%20Report\\_7.pdf](http://www.crest.org/articles/static/1/binaries/Ohio%20Manufacturing%20Report_7.pdf).
9. George Sterzinger and Matt Svrcek, "Wind Turbine Development: Location of Manufacturing Activity" (Renewable Energy Policy Project: September 2004).
10. U.S. Dept. of Energy/EERE, "Building Toolbox: Solar Hot Water Heating" (last update June 2006), available at [www.eere.energy.gov/buildings/info/components/waterheating/solarhot.html](http://www.eere.energy.gov/buildings/info/components/waterheating/solarhot.html).
11. Jose Etcheverry et al., "Smart Generation: Powering Ontario with Renewable Energy" (David Suzuki Foundation: 2004), available at [www.energyintef.no/prosjekt/Annex29/Publikasjoner/GSHPs\\_OntarioReport2004.pdf](http://www.energyintef.no/prosjekt/Annex29/Publikasjoner/GSHPs_OntarioReport2004.pdf).
12. Hosein Shapouri and Paul Gallagher, "2002 Ethanol Cost-of-Production Survey" (USDA: July 2002).
13. Oregon Labor Commissioner Dan Gardner, "The Truth about Prevailing Wage," available at [www.hill.state.or.us/COI/WHD/PVR/docs/pvrtruth.pdf](http://www.hill.state.or.us/COI/WHD/PVR/docs/pvrtruth.pdf) (last viewed February 20, 2007); see also Dale Belman and Paula B. Voox, "Prevailing Wage Laws in Construction: The Cost of Repeal to Wisconsin," (UW-Milwaukee: Oct. 1995).
14. Renewable Energy Certificates are also known as RECs, green tags, green energy certificates, or tradable renewable certificates. These certificates represent the technological and environmental attributes of electricity generated from renewable sources, and are usually sold in 1 megawatt-hour (MWh) units. A certificate can be sold separately from the megawatt-hour of generic electricity with which it is associated. This flexibility enables customers to offset a percentage of their annual electricity use with certificates generated elsewhere.





Worldwide Office  
4245 N. Fairfax Drive  
Suite 100  
Arlington, VA 22203-1606

Tel: (703) 841.5330  
Fax: (703) 527.3729  
nature.org

September 24, 2007

The Honorable Barbara Boxer  
Chairman, Committee on Environment and Public Works  
United States Senate  
Washington, DC 20510

The Honorable James Inhofe  
Ranking Member, Committee on Environment and Public Works  
United States Senate  
Washington, DC 20510

Dear Madam Chairman and Senator Inhofe:

On behalf of The Nature Conservancy, and representing our state chapters in Maryland and Virginia, we are pleased to submit the attached written statement for the Committee's September 26, 2007, hearing on Impacts of Global Warming on the Chesapeake Bay.

We thank you for your interest in this subject, which is vital to the region's ecological and economic health.

Sincerely,

Handwritten signature of Nathaniel Williams in black ink.

Nathaniel Williams  
Maryland/District of Columbia State Director  
The Nature Conservancy

Handwritten signature of Michael Lipford in black ink.

Michael Lipford  
Virginia State Director  
The Nature Conservancy

cc: The Honorable Barbara A. Mikulski  
The Honorable Benjamin L. Cardin  
The Honorable John W. Warner  
The Honorable James Webb

**Statement of The Nature Conservancy**  
**regarding**  
**Impacts of Global Warming on the Chesapeake Bay**

Hearing of the U.S. Senate Committee on Environment and Public Works  
September 26, 2007

Accelerating sea-level rise is a looming threat throughout the world. The Intergovernmental Panel on Climate Change recently estimated that sea level will increase globally by up to 59 centimeters (23.2 inches) during the 21st century. Some climatologists warn the IPCC estimate is far too conservative and that melting the Greenland ice sheet and collapse of the West Antarctic Ice Sheet could over time lead to increases of one to five meters.

In few places on Earth is sea-level rise more of a threat than along the Atlantic Coast of the United States. From Cape Cod to Cape Canaveral, our nation's Eastern Seaboard is a vast ecological system that, because of its low, flat geologic profile, will be transformed radically as the climate continues to change and ocean waters to rise.

Since before the first colonists began to arrive from Europe, the barrier islands, marshes, swamps, rivers, beaches, bays and estuaries along the Atlantic Coast have been sources of sustenance, wealth and security for the nation. They have fed us, sheltered us and provided safe harbors for our ships. They have inspired our artists. They have inspired *us*. They have provided solitude and sunrises and been places of retreat in a world of rapid change. Much of our culture and our economy have been built on the back of the Atlantic Coast's ecosystems. Their value—in terms of biological diversity, ecosystem services and cultural significance—is unmeasured.

Near the center of the Atlantic Coast, the Chesapeake Bay is rightfully considered one of the most important estuaries on Earth. Famous for its once abundant oysters and blue crabs, the Bay still serves as perhaps *the* most essential nursery area for many other important species such as striped bass, menhaden and American shad. For many reasons, the Bay's health remains critical to the ecology and economy of much of the Eastern Seaboard.

As a result, The Nature Conservancy is particularly concerned about impacts of climate change and sea-level rise on the Chesapeake.

Since it was established in 1951, The Nature Conservancy has invested millions of dollars to protect more than 160,000 acres of natural systems around the Chesapeake Bay watershed. Many of the lands we have helped protect are now threatened by climate change and sea-level rise, including:

- Blackwater National Wildlife Refuge – more than 27,000 acres in Maryland and designated under the Ramsar Convention as a Wetland of International

Significance. Blackwater is one of the sites along the Atlantic where the impacts of sea-level rise are already dramatically apparent. Due partly to sea-level rise and partly to rapid land subsidence and other factors, 8,000 acres of tidal marsh have already been lost at the refuge, at a rate of 150-400 acres per year.

- Nassawango Creek – the largest private nature reserve in Maryland and home to more than 20 globally rare species.
- Nanticoke River – flowing through Delaware and Maryland and supporting a third of all freshwater tidal wetlands in Maryland.
- Calvert Cliffs – sensitive beach and cliff habitat along the Maryland portion of the Bay. Home for two federally listed species.
- Virginia’s Chesapeake Rivers – the Rappahannock, Mattaponi and Pamunkey are some of the most pristine examples of tidal freshwater systems remaining along the East Coast. Bald eagles and migratory waterfowl thrive in the marshes and bottomland hardwood swamps along these rivers.
- Virginia Eastern Shore – a narrow finger of land that separates the Chesapeake Bay from the Atlantic Ocean. It is home to the longest expanse of coastal wilderness remaining on the Eastern Seaboard. The Nature Conservancy’s Virginia Coast Reserve is comprised of 14 undeveloped barrier islands, thousands of acres of pristine salt marshes, vast tidal mudflats, shallow bays and forested uplands. Situated at the lower end of the Delmarva Peninsula, the Virginia Coast Reserve is one of the most important migratory bird stopover sites on Earth.

The predicted impacts of climate change on the Chesapeake are many. Some of those that concern the Conservancy most are:

- Loss of critical habitats, such as marshes, swamps and seagrass beds because of sea-level rise. These habitats are already dramatically threatened.
- Changes in the location and timing of fish and bird migrations and reproduction patterns that could result in the loss or reduction of some species and the services they provide.
- Increased pollution delivered to the Bay due to changes in precipitation patterns.
- The loss of some species of plants and animals as rising water temperatures exceed acceptable limits.
- Increases in invasive species as conditions in the Bay change and become more stressful on established species.
- Increased impacts from storms as barrier islands and wetlands that provide buffers against wind and wave energy are inundated by sea-level rise.

Also of concern is the likelihood that ill-considered responses to climate change and sea-level rise—such as building bulkheads along shorelines or filling low areas to prevent flooding—may prove even more significant in terms of their negative impacts on natural systems. Existing government programs—such as federal flood insurance, agricultural subsidies, highway funding and community development projects—may also have negative consequences by providing incentives for public and private development in areas that will be threatened by sea-level rise in the not-too-distant future.

It seems virtually certain that, in coming decades, there is the potential for a major transformation of the Chesapeake Bay, as well as other Atlantic Coast estuaries. Combined with and even exacerbated by our own actions, the climate-related changes in the Bay could have catastrophic results for the nation unless we begin working now to prepare the Bay's natural and human systems so they will be able to adapt as conditions around them change.

This will require foresight and diligence. Because of the importance of the Chesapeake to the region, the nation and the planet, it is essential that we begin now to reduce the carbon dioxide and other greenhouse gas emissions that through their heating effect on the Earth's atmosphere are placing this ecosystem at risk.

To that end, we urge the Committee to mark up and report legislation this fall that would include the strongest possible mandatory caps on greenhouse gas emissions, and provide a market mechanism for trading allowances. The Conservancy is a member of the US Climate Action Partnership and supports its recommendations on targets and timetables for emissions reduction.

Because deforestation contributes close to one-fifth of global greenhouse gas emissions, such a program should create strong incentives to sequester carbon, reduce emissions and protect habitat by allowing domestic and international forest and other land conservation and restoration activities full access to the carbon market created by a cap and trade bill. Here in our region, conserving forests is also an important part of protecting the watersheds that feed the Chesapeake Bay.

Even with the best imaginable effort to reduce our emissions, the climate changes to which we are already committed as a consequence of past emissions will necessitate efforts to help the Chesapeake and other vulnerable places along the Atlantic Coast and across the nation adapt to a changing climate. For that reason, the Conservancy has recommended that Congress develop a significant and dedicated stream of funding that could be used to undertake the efforts that will be needed to conserve this and other critical ecosystems and the species that dwell within them. The Conservancy stands with many other wildlife conservation organizations in supporting efforts to dedicate at least ten percent (10%) of the proceeds from a cap-and-trade auction system to assure the mitigation, adaptation, conservation, and resiliency of fish and wildlife and their habitats threatened by climate change.

The Conservancy thanks the Committee for its interest in understanding and addressing climate change, which the Conservancy's view as an extremely serious threat to our mission and more generally, to the health of the natural world and those who depend on it for their livelihood and well-being. We stand ready to assist you as Congress crafts responses to address this critical issue.

245

