

S. HRG. 111-1205

**CLEAN ENERGY JOBS, CLIMATE-RELATED POLICIES
AND ECONOMIC GROWTH—STATE AND LOCAL
VIEWS**

JOINT HEARING
BEFORE THE
SUBCOMMITTEE ON GREEN JOBS
AND THE NEW ECONOMY
AND THE
COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

—————
JULY 21, 2009
—————

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



Available via the World Wide Web: <http://www.gpo.gov/fdsys>

**CLEAN ENERGY JOBS, CLIMATE-RELATED POLICIES AND ECONOMIC GROWTH—STATE
AND LOCAL VIEWS**

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

BARBARA BOXER, California, *Chairman*

| | |
|----------------------------------|-------------------------------|
| MAX BAUCUS, Montana | JAMES M. INHOFE, Oklahoma |
| THOMAS R. CARPER, Delaware | GEORGE V. VOINOVICH, Ohio |
| FRANK R. LAUTENBERG, New Jersey | DAVID VITTER, Louisiana |
| BENJAMIN L. CARDIN, Maryland | JOHN BARRASSO, Wyoming |
| BERNARD SANDERS, Vermont | MIKE CRAPO, Idaho |
| AMY KLOBUCHAR, Minnesota | CHRISTOPHER S. BOND, Missouri |
| SHELDON WHITEHOUSE, Rhode Island | LAMAR ALEXANDER, Tennessee |
| TOM UDALL, New Mexico | |
| JEFF MERKLEY, Oregon | |
| KIRSTEN GILLIBRAND, New York | |
| ARLEN SPECTER, Pennsylvania | |

BETTINA POIRIER, *Staff Director*

RUTH VAN MARK, *Minority Staff Director*

SUBCOMMITTEE ON GREEN JOBS AND THE NEW ECONOMY

BERNARD SANDERS, Vermont, *Chairman*

| | |
|---|---|
| THOMAS R. CARPER, Delaware | CHRISTOPHER S. BOND, Missouri |
| KIRSTEN GILLIBRAND, New York | GEORGE V. VOINOVICH, Ohio |
| BARBARA BOXER, California (<i>ex officio</i>) | JAMES M. INHOFE, Oklahoma (<i>ex officio</i>) |

C O N T E N T S

Page

JULY 21, 2009

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 | 5 |
| Bond, Hon. Christopher S., U.S. Senator from the State of Missouri | 8 |
| Menendez, Hon. Robert, U.S. Senator from the State of New Jersey | 11 |
| Cardin, Hon. Benjamin L., U.S. Senator from the State of Maryland | 12 |
| Alexander, Hon. Lamar, U.S. Senator from the State of Tennessee | 14 |
| Lautenberg, Hon. Frank R., U.S. Senator from the State of New Jersey | 17 |
| Barrasso, Hon. John, U.S. Senator from the State of Wyoming | 18 |
| Udall, Hon. Tom, U.S. Senator from the State of New Mexico | 21 |
| Vitter, Hon. David, U.S. Senator from the State of Louisiana | 22 |
| Merkley, Hon. Jeff, U.S. Senator from the State of Oregon | 23 |
| Crapo, Hon. Mike, U.S. Senator from the State of Idaho | 24 |
| Whitehouse, Hon. Sheldon, U.S. Senator from the State of Rhode Island | 26 |
| Klobuchar, Hon. Amy, U.S. Senator from the State of Minnesota | 26 |
| Voinovich, Hon. George V., U.S. Senator from the State of Ohio, prepared statement | 370 |

WITNESSES

| | |
|--|-----|
| Ritter, Hon. Bill Jr., Governor, State of Colorado | 28 |
| Prepared statement | 30 |
| Responses to additional questions from: | |
| Senator Boxer | 34 |
| Senator Carper | 37 |
| Senator Inhofe | 40 |
| Gregoire, Hon. Chris, Governor, State of Washington | 42 |
| Prepared statement | 44 |
| Responses to additional questions from: | |
| Senator Boxer | 56 |
| Senator Carper | 59 |
| Senator Vitter | 63 |
| Senator Crapo | 64 |
| Hoeven, Hon. John, Governor, State of North Dakota | 67 |
| Prepared statement | 69 |
| Responses to additional questions from: | |
| Senator Carper | 72 |
| Senator Inhofe | 75 |
| Senator Vitter | 76 |
| Senator Crapo | 78 |
| Corzine, Hon. Jon S., Governor, State of New Jersey | 79 |
| Prepared statement | 81 |
| Responses to additional questions from: | |
| Senator Boxer | 90 |
| Senator Carper | 96 |
| Senator Inhofe | 100 |
| Response to an additional question from Senator Vitter | 102 |
| Responses to additional questions from Senator Crapo | 104 |
| Kiss, Hon. Robert, Mayor, Burlington, Vermont | 164 |
| Prepared statement | 167 |

IV

| | Page |
|--|------|
| Kiss, Hon. Robert, Mayor, Burlington, Vermont—Continued | |
| Response to an additional question from Senator Inhofe | 177 |
| Euille, Hon. William D., Mayor, Alexandria, Virginia | 179 |
| Prepared statement | 182 |
| Responses to additional questions from Senator Boxer | 277 |
| Lowery, Hon. John, Representative, District 6, Arkansas House of Representatives | 279 |
| Prepared statement | 281 |
| Responses to additional questions from: | |
| Senator Inhofe | 291 |
| Senator Vitter | 292 |
| Response to an additional question from Senator Crapo | 294 |
| Palmer, Hon. Douglas H., Mayor, Trenton, New Jersey | 304 |
| Prepared statement | 306 |
| Responses to additional questions from Senator Boxer | 361 |

ADDITIONAL MATERIAL

| | |
|---|-----|
| Letter to Arkansas State Representative John Lowery, Jr., from Chemtura, July 20, 2009 | 372 |
| Green Jobs, Ole: Is the Spanish Clean-Energy Push a Cautionary Tale?, article from the Wall Street Journal, March 30, 2009 | 373 |
| Pages from U.S. House of Representatives bill H.R. 2454 | 374 |

**CLEAN ENERGY JOBS, CLIMATE-RELATED
POLICIES AND ECONOMIC GROWTH—STATE
AND LOCAL VIEWS**

TUESDAY, JULY 21, 2009

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON GREEN JOBS AND THE NEW ECONOMY,
Washington, DC.

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

Present: Senators Boxer, Inhofe, Carper, Lautenberg, Cardin, Sanders, Klobuchar, Whitehouse, Udall, Merkley, Voinovich, Vitter, Barrasso, Crapo, Bond, and Alexander.

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

Senator BOXER. The committee will come to order.

We all welcome our distinguished panel, and of course, the one after.

I am going to ask Senator Sanders to sit right next to me because this is really a hearing of the full committee organized by his subcommittee, so he is going to be chairing the hearing.

The focus of today's hearing is on clean energy jobs, economic growth and global warming policies from a State and a local perspective.

Providing incentives for clean energy is a win-win for our country, because it helps to address the threat of global warming and it builds a foundation for long-term recovery and long-term prosperity.

Right now, our States, cities and counties are leading the way in adapting smart policies to drive the transition to a clean energy economy. I tell my colleagues often, if we fail to act, we are going to have the cities, the counties, the States and the regions acting.

We already know that my State of California, the Western States, and the Northeastern States are acting. So we are going to have a number of jurisdictions acting to protect our children from pollution, and we if do not act it will be a patchwork as well as the EPA doing its job under their endangerment finding.

I want to again thank our distinguished witnesses for being here today.

On our first panel, we have Governor Bill Ritter from the State of Colorado, Governor Chris Gregoire from the State of Wash-

ington, Governor John Hoeven of the State of North Dakota, and we hope that Governor Corzine from New Jersey will join us shortly.

On the second panel, we have Mayor Robert Kiss from the city of Burlington, Vermont; Mayor William Euille from the city of Alexandria, Virginia; State Representative John Lowery from the State of Arkansas; and Mayor Douglas Palmer from the city of Trenton, New Jersey.

We are facing two historic challenges today: the current recession and the dangers of unchecked global warming. We have the opportunity to address with a single solution what will create millions of clean energy jobs in America, reduce our dependence on foreign oil, and protect our children and grandchildren from pollution.

I agree with President Obama, who said, "We can remain one of the world's leading importers of foreign oil, or we can make the investments that would allow us to become the world's leading exporter of renewable energy. We can let climate change continue to go unchecked, or we can help stop it. We can let the jobs of tomorrow be created abroad, or we can create those jobs right here in America and lay the foundation for lasting prosperity."

Legislation that provides incentives for clean energy will create jobs and will increase our energy efficiency. In the long run, it will save families and businesses money and energy costs, and it will drive technological innovation.

When we provide incentives for clean energy development, we invest in American jobs. What kinds of jobs are needed to build the clean energy economy? The University of Massachusetts at Amherst found that clean energy industries employ construction workers, electricians, boilermakers, mechanics, plant operators, farmers, engineers, scientists and teachers.

My State of California is a national leader in clean energy job creation. A June 2009 Pugh Charitable Trust report found that more than 10,000 new clean energy businesses were launched in California from 1998 to 2007. During this period, clean energy investments created more than 125,000 jobs and generated jobs faster than the State's economy as a whole.

We all know that the recession has taken a great toll on my State and on most States. However, this is our bright spot in our State's economy.

I look forward to today's testimony from State and local officials who are implementing innovative policies to help build a foundation for the clean energy economy.

So, at this time, I am going to call on my friend, the Ranking Member, Senator James Inhofe, I am going to hand the gavel over to Senator Sanders and stay as long as I can.

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

Senator INHOFE. Thank you, Madam Chairman.

As a former Mayor, I always enjoy these hearings where you have people coming from the, well, I often say to my friends back home, I know what a hard job it is; I used to be a Mayor. If you are a Mayor or a Governor, there is no hiding place like there is here in Washington.

States differ in many respects as you will hear in the different perspectives today. As I have stated before, cap-and-trade benefits the coasts at the expense of the heartland. Cap-and-trade divides rather than unites America behind a sensible, workable energy policy.

This fact is clear in the testimony of Arkansas State Representative John Lowery, who is Democrat and will be on the second panel. When it comes to Waxman-Markey, Representative Lowery is clear. Unfortunately, he said, this bill will devastate my region. It will kill jobs, harm our school system, throw back our economic progress gained the last few years, and impose a disproportionate burden on Arkansans.

Representative Lowery also speaks eloquently about a way of life that would perish under cap-and-trade. He is referring to life in Arkansas and rural America. Cap-and-trade supporters see rural America as wasteful, environmentally backward. They say they see those in rural America as mere contingencies in the battle to save the planet. But these are real people with real jobs and real families. And for them, cap-and-trade will spell economic disaster.

When they lose their jobs because the factory moves overseas, they will struggle to put food on the table. When they are forced to pay high prices for gasoline, groceries and electricity, they will, in some cases, have to choose between heating their homes and feeding their families.

Last week, I would say to my good friend from Arkansas, I went to Mountain Home, Arkansas. There was the regional meeting of all of the farmers' co-ops. They stated publicly that they have more to lose than anyone else, the farmers of America.

The debate over cap-and-trade is not partisan. It is regional. I can tell you, when it comes to energy policy, Democrats in the Midwest and the South think differently than Speaker Pelosi and Henry Waxman. On the one hand, the policy of the coasts is to ration energy and make it more expensive through regulations and mandates. On the other hand, the policy of the heartland is to increase domestic energy supplies including wind, solar, geothermal, as well as oil, gas, nuclear and coal to make energy cleaner, more affordable and more abundant.

You know, if we did just what I mentioned up here, really exploited that, we would end our dependence on the Middle East for our ability to run this machine called America.

In our part of the world, we invite new energy development, whatever its form, because we know it creates jobs and expands our economy. This is the policy of North Dakota, as Governor Hoeven will describe in his testimony. North Dakota is finding success in deploying new technologies to burn coal more cleanly and to drill and extract oil and gas with a minimal environmental footprint. North Dakota is not taxing or creating new layers of bureaucracy. It is developing domestic resources and creating jobs and energy security. Thus, it is no surprise that North Dakota currently has a budget surplus.

Those in the heartland are rightly skeptical about the promises of green jobs in the new economy. They ask a simple question: what does this mean for my community and my State? There is nothing inherently wrong with green jobs as long as they do not

replace existing jobs. But this is exactly what Speaker Pelosi and Henry Waxman are talking about. They, along with President Obama, want to emulate the Spanish model, which has been a miserable failure.

Let us look at Spain for a minute. Now, it is true that new wind farms and other forms of alternate energy have created jobs in Spain. But a new study concludes that these jobs are temporary and have received \$800,000 per job in subsidies while the wind industry jobs cost \$1.4 million each. And do not forget that each new job entails the loss of 2.2 others.

Just do the math. The Waxman-Markey bill will destroy far more jobs than it will create. In fact, the authors of the bill assume that it will kill jobs. When I read through it, I found an unemployment program that is written into the bill. In other words, you pass this bill, you are going to get an unemployment program with it because it is going to lose jobs.

Rural America wants a different policy, one that recognizes the need to produce all forms of energy ranging from wind to clean coal. No policy that includes 1,400 pages of mandates, taxes and regulations will produce jobs in the energy industry.

And by the way, there are a lot of people who agree with me on this. I was noticing Jim Hanson, who has been the real hero of the global warming people, he said cap-and-trade is a temple of doom. It would lock in disasters for our children and grandchildren. Why do people continue to worship a disastrous approach, and on, and on, and on.

Thank you, Madam Chairman.

[The prepared statement of Senator Inhofe follows:]

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

As a former Mayor, I have a unique appreciation for this hearing. Whether a Mayor, Governor, or town councilman, whether Republican, Democrat, or Independent, local officials have a keen, first-hand understanding of their States and communities and the issues that affect them. I look forward to your testimony today.

Because States differ in many respects, you will hear differing perspectives on cap-and-trade and green jobs. As I've stated before, cap-and-trade benefits the coasts at the expense of the heartland. Cap-and-trade divides rather than unites America behind a sensible, workable energy policy. This fact is clear in the testimony of Arkansas State Representative John Lowery, who is a Democrat.

When it comes to Waxman-Markey, Representative Lowery is clear: "Unfortunately," he said, "this bill will devastate my region. It will kill jobs, harm our school system, throw back our economic progress gained the last few years, and imposes a disproportionate burden on Arkansans."

Representative Lowery also speaks eloquently about a "way of life" that would perish under cap-and-trade. He is referring to life in Arkansas and rural America. Cap-trade supporters see rural America as wasteful and environmentally backward. They see those in rural America as mere contingencies in the battle to save the planet. But these are real people with real jobs and real families. And for them, cap-and-trade will spell economic disaster.

The debate over cap-and-trade is not partisan; it's regional. And I can tell you, when it comes to energy policy, Democrats in the Midwest and the South think differently than Speaker Pelosi and Henry Waxman.

On the one hand, the policy of the coasts is to ration energy and make it more expensive through regulations and mandates.

On the other hand, the policy of the heartland is to increase domestic energy supplies—including wind, solar, geothermal, as well as oil, gas, nuclear, and coal—to make energy cleaner, more affordable, more abundant, and more reliable. In our part of the world, we invite new energy development, whatever its form, because

we know it creates jobs and expands our economies. This is the policy of North Dakota, as Governor Hoeven will describe in his testimony. North Dakota is finding success in deploying new technologies to burn coal more cleanly and to drill and extract oil and gas with a minimal environmental footprint.

North Dakota isn't taxing or creating new layers of bureaucracy; it's developing domestic resources and creating jobs and energy security. Thus it's no surprise that North Dakota currently has a budget surplus.

Those in the heartland are rightly skeptical about promises of green jobs and a new economy. They ask a simple question: what does this mean for my community and my State?

There's nothing inherently wrong with "green jobs," so long as they don't replace existing jobs. But this is exactly what Speaker Pelosi and Henry Waxman are talking about. They, along with President Obama, want to emulate the Spanish model, which has been a failure.

So let's look at Spain for a minute. Now it's true that new wind farms and other forms of alternative energy have created jobs in Spain. Yet a recent study by Dr. Gabriel Calzada of the Universidad Rey Juan Carlos calculates that the programs creating those jobs destroyed nearly 110,500 jobs elsewhere in the economy—or 2.2 jobs destroyed for every "green job" created.

The study also concludes that these jobs are temporary—in fact, only 1 out of 10 jobs has been created for actual operation and maintenance of new plants. And the authors conclude that the costs of creating green jobs "do not appear to be unique to Spain's approach but instead are largely inherent in schemes to promote renewable energy sources."

This math just doesn't add up. The Waxman-Markey bill will destroy far more jobs than it will create. In fact, the authors of the bill assume that it will kill jobs. When I read through it, I found an unemployment insurance program designed specifically for workers who lose their jobs because of Waxman-Markey. It also includes Federal assistance for job relocation and job searching.

Rural America wants a different policy, one that recognizes the need to produce all forms of energy, ranging from wind to clean coal. No policy that includes 1,400 pages of mandates, taxes, and regulations will produce jobs or energy. And any such policy will threaten the rural way of life. We must defeat this bill or anything like it and pass a common sense energy policy for America.

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

Senator SANDERS [presiding]. Thank you, Senator Inhofe.

Let me begin by thanking Senator Boxer for the leadership that she has shown for so many years on environmental issues, on the crisis in global warming and on job creation, the creation of green jobs. Thank you, Senator.

And let me, as a former Mayor of Burlington, Vermont, let me welcome our guests. I think we understand that one of the advantages of our Federalist form of government is that a lot of great ideas are taking place at the local level, they are taking place at the State level, and in fact the function of this hearing is to see how we can work together, how we can learn from you, how you can learn from us, and how together we can address some of the major crises this country faces, the issue of energy independence.

Does anybody here think it is a good idea that we spend approximately \$450 billion every single year importing oil from abroad? I do not think there is anyone here who thinks that is a particularly good idea.

Many of us, including the leading scientists in the world, are worried about what this planet will look like if we do not reverse greenhouse gas emissions and do not deal with global warming. And these are some of the issues that you have been dealing with. And more importantly, as Senator Boxer indicated, we are in the midst of a major recession, and we need to create millions of good paying jobs as we break our dependency on foreign oil and as we

lower greenhouse gas emissions. That is what this hearing is about.

It seems to me that what we need to be doing is waging an energy revolution, nothing less than an energy revolution. What that means is that we need a future in which we create millions of good paying jobs in areas in wind, in solar, in geothermal, in biomass, in mass transportation, in areas that not only cut back on greenhouse gas emissions, but have the side effect of cleaning up our country and making us a healthier Nation so that the kids in Vermont are not breathing particulates which cause asthma.

So, we are moving in a direction for a win-win-win situation. Energy independence. Think about what it means to invest \$450 billion a year in our economy, and all of the things that we can accomplish. Think about where we could be in 2025, where we could be producing a quarter or more of our electricity from clean, sustainable energy sources.

I see a revitalized American manufacturing base where, instead of importing 90 percent of the batteries used in hybrid vehicles, 46 percent of solar PV cells and modules, and half of all wind turbines used in the U.S., we can be producing these products right here in the United States of America.

I see a future where, instead of creating 330 jobs to build yet another fossil fuel plant, we create 4,000 jobs building a solar thermal plant that has no carbon dioxide emissions and does not pollute our air and whose only fuel is endlessly renewed, at no cost, from the sun.

I see a future where, by 2020, our Nation is far more energy efficient than it is today. In Vermont, we have recently seen 2 consecutive years where our electricity demand has been lowered, lowered thanks to our energy efficiency efforts. And this is the greatest investment that we can make in terms of energy. It costs only 3 cents for each kilowatt hour we save through energy efficiency, while it costs 14 cents for each kilowatt hour we buy from new generation, and we can put large numbers of people to work in terms of energy efficiency and weatherization.

I see a future where, by 2020, we can do nationally what Vermont has been doing on a State level, making major savings through energy efficiency.

By stressing efficiency, we will also create the framework for innovative technology development and economic growth. We will see companies like Cree, based in North Carolina, which produces LED lighting, create jobs and expand all across the Nation. In 2002, Cree had 893 employees. Now, they have more than 3,000 in a rapidly growing industry with LED light.

I see a future where getting to work or to school or to the store does not have to cause pollution. There is extraordinary opportunity, not only in hybrid plug-ins manufactured in the United States, but electric vehicles as well.

I see a future where we have reinvested in our mass transportation and rail systems. So that when we go to Europe, or Japan, or China, we do not have to say, why can we not do that in the United States? Why can we not have the kind of mass transportation, the kind of rural transportation, that this country des-

perately needs, and in the process, creates millions of good paying jobs?

So, we have, right now, enormous opportunities in front of us. We can lead the world in cutting greenhouse gas emissions, we can lead the world in creating the kind of good paying jobs that our people desperately need, and in the process we will create a cleaner and healthier America.

[The prepared statement of Senator Sanders follows:]

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

Let me welcome our guests to this committee today, Governors and Mayors and elected officials. A great deal of exciting and innovative work has been taking place in States and cities throughout our country in breaking our dependence on fossil fuel and foreign oil, in lowering greenhouse gas emissions, and in the process, moving us to the creation of millions of good paying jobs in the years to come. We are here today to learn from your efforts and see how Washington and States and cities can go forward together in transforming our energy system and our global environment.

THE OPPORTUNITY TO REINVEST IN AMERICAN JOBS

Today, as a Nation we spend some 350–450 billion dollars a year importing oil from abroad—from countries like Saudi Arabia, Nigeria, Mexico, Russia, Venezuela, and Iraq. Think for a moment what an incredible impact \$450 billion a year could have on our economy and job creation here if that money were invested in this country in weatherization, energy efficiency, sustainable energies like wind, solar, geothermal, bio-mass and other technologies, public transportation and automobiles that are far more energy efficient or not using fossil fuels at all.

What we are talking about is an energy revolution—a revolution that leads us toward energy independence and the ability to avoid Mideast wars fought over oil; a revolution that not only has the potential to save the planet from the devastating damage being caused by global warming, but which will also, as a side effect, clean up our air and water and make us a healthier Nation. This is a big deal.

Now in terms of green job creation let me say a few words about where we are today, what some other countries are doing that we can learn from, and the direction that we should be going in the next 5 to 10 years.

Today, it is estimated by the Pew Charitable Trusts that there are some 770,000 green jobs in America. These include a wide range of jobs at every level of education and for every skill set. These are jobs for machinists, engineers, and electricians. These are jobs for workers who weatherize older homes and buildings—making them far more energy efficient, and in the process, saving substantial sums for the inhabitants on their fuel bills. These are jobs for factory workers who are now producing the most advanced insulation material, energy efficient windows, and improved roofing materials. These are jobs being created in companies in America that build, distribute, install and maintain wind turbines, photovoltaic panels, solar hot water systems, geo-thermal heating and cooling systems, and bio-mass heating systems. These are jobs being created on our farms and in our forests as workers produce bio-fuels and use farm waste to generate electricity. These are good paying, domestic jobs that put people to work while turning the tide against global warming and pollution.

MY VISION FOR A NEW AMERICAN GREEN ECONOMY

I see a new future for this Nation where our need for energy independence and environmental sustainability drives our economic growth. While today we have hundreds of thousands of green jobs, tomorrow we can have millions of green jobs. According to the Pew Charitable Trusts, green jobs grew by 9.1 percent between 1998 and 2007, and during the same period other jobs grew by just 3.7 percent. According to the Center for American Progress and Green for All, if we invest \$150 billion per year in the public and private sectors in sustainable energy, we can create 1.7 million net new jobs per year. That is almost 2 million jobs a year—17 million new jobs over a decade. And although these are good paying jobs, roughly 870,000 of them each year would be available to workers with high school degrees or less. Green investments, green energy, green jobs: this is how we will replace our lost manufacturing jobs.

I see a future where by 2025 we are producing a quarter or more of our electricity from clean, sustainable energy sources. I see a revitalized American manufacturing base where instead of importing 90 percent of the batteries used in hybrid vehicles, 46 percent of solar PV cells and modules, and half of all wind turbines used in the U.S., we make these products here. In 1970, Denmark made a commitment to renewable energy and now gets 20 percent of its electricity from wind alone. In doing so, it also created a new export industry: Danish companies now earn billions and lead the world in wind energy. I see our Nation's commitment to renewable energy producing a similar influx of good jobs in this country. I see a future where instead of creating 330 jobs to build yet another fossil fuel plant, we create 4,000 jobs building a solar thermal plant that has no carbon dioxide emissions and does not pollute our air—and whose only fuel is endlessly renewed, and no cost, sunlight.

I see a future where by 2020 our Nation is far more energy efficient than it is today. In Vermont we have recently seen 2 consecutive years where our electricity demand has been lowered thanks to our energy efficiency efforts. This is the greatest investment truth in sustainable energy: it costs only 3 cents for each kilowatt hour we save through energy efficiency, while it costs 14 cents for each kilowatt hour we buy from new generation. I see a future where States compete with one another to see which can be the most efficient and where businesses seek out efficient States in which to locate so they can reap the economic and environmental benefits for their businesses and employees. I see a future where by 2020 we can do nationally what Vermont has been doing on a State level—making major savings through energy efficiency. Efficiency can save utility customers \$168 billion, avoid the need for 390 medium-sized coal plants, and reduce carbon dioxide emissions so much that it would be the same as taking 48 million cars off the road. Efficiency.

By stressing efficiency, we will also create the framework for innovative technology development and economic growth. We will see companies like Cree, based in North Carolina, which produces LED lighting, create jobs and expand all across this Nation. In 2002, Cree had 893 employees; now they have more than 3,000, and these workers are producing environmentally friendly products for a fast growing global marketplace.

I see a future where getting to work, or to school, or to the store does not have to cause pollution. I see a future where plug-in hybrid vehicles and electric vehicles are commonplace, producing a fraction of the emissions of conventional vehicles while providing the same mobility for drivers. Already today, a Chinese company called Build Your Dreams is producing plug-in hybrids for sale in China. We need to see American companies producing such advanced vehicles and exporting that technology to other nations, instead of the other way around.

I see a future where we have reinvested in our mass transportation and rail systems. For every \$1 billion we invest in public transportation, we see 30,000 jobs created, thousands of dollars saved annually by individual commuters, and dramatic reductions in greenhouse gas emissions for each mile traveled.

I see this future already being planned in Vermont, where our cities and towns are working to develop district energy systems that capture “waste” heat from power plants and use it to heat buildings. I see it in our efforts to power and heat our schools and public housing with clean technologies such as wood chips and solar hot water heating. I see it in the Vermont National Guard's facilities, which we are working to convert to solar, geothermal, and biomass powered and heated facilities. I hope to see these and other world changing innovations and common sense practices replicated throughout our country.

CLOSING

I am pleased to have worked with Chairman Boxer to convene this first hearing of the Green Jobs and New Economy Subcommittee. I look forward to learning what each of our witnesses is doing in their State or city to create green jobs and build a foundation under our vision of a new, green future for our Nation.

Senator SANDERS. OK. I think our next is Senator Bond.
Senator Bond.

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

Senator BOND. Thank you very much, Mr. Chairman.
Are we going to have the demonstrations through the testimony?
[Laughter.]

Senator BOND. As a former Governor, I know the pressure that elected officials face to create jobs and promote economic development. During these tough economic times, new jobs are needed now more than ever. At the same time, regrettably, carbon cap-and-trade legislation threatens to kill millions of jobs through higher energy costs that help our competitors in China.

We are learning in this debate that green jobs are not the full answer. Some make a good deal of economic sense, like nuclear power and energy conservation efforts. Others, like wind and solar jobs, are not so much created as bought. Last week the National Black Chamber of Commerce told us how even after considering the gains from new green jobs, cap-and-trade legislation will kill approximately 2.5 million jobs.

On Senator Sanders' committee, as the Ranking Member, I put out a report earlier this spring on green jobs, Yellow Light on Green Jobs. We found that some green jobs, especially wind and solar, kill existing jobs to pay for new green jobs. They pay low wages and require expensive taxpayer subsidies to create.

The disturbing information comes from green jobs advocates themselves. A coalition of labor organizations, Teamsters, SEIU and the Sierra Club, found in a report entitled High Road of Low Road, Job Quality in New Economy, that State and local taxpayer subsidies of tens of thousands and dollars, and sometimes hundreds of thousands are dollars, per green job, total tens of millions of dollars spent. This means green jobs are not created but instead must be bought with heavy taxpayer subsidies.

An example is the Vestas wind power turbine tower manufacturing plant in Pueblo, Colorado. State, county and local officials spent nearly \$32 million in incentives and tax breaks to attract this Danish wind turbine company to build a new facility in Pueblo.

This chart shows how officials gave away economic development funds, training funds, incentives, matching grants, investment tax waivers, sales tax waivers, employee tax credits, enterprise zone credits and healthcare tax credits. A grand total of \$32 million attracted 450 jobs. That comes out to \$71,000 per job.

I understand that these are local decisions. The people of Pueblo think 450 jobs are worth \$32 million. What I do know is that the citizens and taxpayers in my State do not want their energy taxes raised or their other jobs killed to pay for green jobs.

The ironic thing is that this thing will operate in Pueblo next to the GCC Cement Plant, the Evraz Rocky Mountain Steel Mill and the Xcel Energy Coal Fired Power Plant. It is ironic because the drive for cap-and-trade legislation being justified with Vestas' green jobs will likely doom the steel, cement and affordable power jobs.

High power and carbon allowance costs will make America's cement and steel uncompetitive and force closure of those plants. Emission reductions cut too fast and too deep will cause the closure of coal fired plants. Pueblo may well lose more jobs than it creates.

Do not get me wrong. I support American green jobs. Expanding our affordable American clean energy sources will produce them.

My State has led the Nation in biofuels from corn and soy beans. We are working on cellulosic fuels and fuels from biomass and

algae. We are a center of new battery technology and are beginning production of all-electric delivery trucks and hybrid SUVs. Domestic mass production of hybrid and plug-in vehicles will help the environment, lower costs for consumers and provide good paying manufacturing work.

Nuclear power, clean coal technology, environmentally friendly drilling for oil and gas off our shores, conservation in existing buildings and other facilities—these are American sources of energy that will create American jobs, keep us independent of our adversaries, and ensure plentiful supplies to keep prices lower.

Clean energy, American energy, affordable energy, an all of the above strategy that does not kill jobs and raise energy taxes is what we need. This is the path I urge the committee, this Congress and America to take.

I thank the Chair.

[The prepared statement of Senator Bond follows:]

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

Madam Chairman, thank you for holding this hearing on cap-and-trade legislation and State and local green jobs.

As a former two-term Governor of the State of Missouri, I know the pressure that elected officials face to create jobs and promote economic development. During these tough economic times, new jobs are needed now more than ever.

At the same time, carbon cap-and-trade legislation threatens to kill millions of jobs through higher energy costs and help our competitors in China.

We are learning in this debate that green jobs are not the answer. Last week, the National Black Chamber of Commerce told us how even after considering gains from new green jobs, cap-and-trade legislation will still kill 2.5 million net jobs.

As ranking member of the Green Jobs and the New Economy subcommittee, I issued a report entitled *Yellow Light on Green Jobs* that found that green jobs efforts will kill existing jobs to pay for new green jobs, pay low wages, and require expensive taxpayer subsidies to create. This disturbing information came from green jobs advocates themselves.

A coalition of environmental and labor organizations including the Sierra Club, Teamsters, and SEIU found in a report entitled *High Road or Low Road? Job Quality in the New Economy*, that State and local taxpayer subsidies of tens of millions of dollars oftentimes produced only a few hundred jobs. At this rate, taxpayer green jobs subsidies cost tens of thousands, and sometimes hundreds of thousands of dollars, per green job.

Thus, green jobs are not created but instead must be bought with heavy taxpayer subsidies.

An example is the Vestas wind turbine tower manufacturing plant in Pueblo, Colorado. State, county and local officials spent nearly \$32 million in incentives and tax breaks to attract this Danish wind turbine company to build a new facility in Pueblo. (From the Pueblo Chieftain)

This chart shows how officials gave away economic development funds, training funds, incentives, matching grants, investment tax waivers, sales tax waivers, employee tax credits, enterprise zone credits, and health care tax credits. The grand total of \$32 million attracted 450 jobs; that works out to \$71,000 per job.

I understand that these are local decisions. Perhaps the people of Pueblo think 450 jobs are worth \$32 million. What I do know is that many taxpayers in Missouri do not want their energy taxes raised or their own jobs killed to pay for green jobs.

The ironic thing is that this plant will operate in Pueblo next to the GCC cement plant, the Evraz Rocky Mountain Steel Mill, and the Excel Energy coal-fired power plant. Ironic, because the drive for cap-and-trade legislation that is being justified with the Vestas green jobs will likely doom the cement, steel and affordable power jobs right next door.

High power and carbon allowance costs will make American cement and steel uncompetitive, likely forcing the closure of those plants or plants like them. Emissions reduction cuts too fast and too deep will force the closure of coal-fired power plants, to be replaced by more expensive natural gas. Pueblo may very well lose more jobs than created by this effort.

Don't get me wrong. I support new American green jobs. Expanding our affordable, American, clean energy sources will produce them.

Missouri has led the Nation in biofuels from corn and soybeans and is working on new cellulosic fuels from biomass and algae. We are a center of new battery technology and are producing all electric trucks and hybrid SUVs. Domestic mass production of hybrid and plug-in vehicles will help the environment, lower costs for consumers, and provide good paying manufacturing work.

Nuclear power, clean coal technology, environmentally friendly drilling for oil and gas off our own shores—these are American sources of energy that will create American jobs, keep us independent of our adversaries and ensure plentiful supplies to keep prices lower.

Clean energy, American energy, affordable energy—an all of the above strategy that does not kill jobs and raise energy taxes. This is the path I urge this committee and America to take.

Senator SANDERS. Thank you, Senator Bond.

With the indulgence of the committee, if we could take a little bit of a break, Senator Menendez is here to introduce Governor Corzine. He is going to have to run, so I would like to have Senator Menendez say a few words. Then we will come back to Senator Lautenberg or Senator Cardin.

Senator Menendez.

**OPENING STATEMENT OF HON. ROBERT MENENDEZ,
U.S. SENATOR FROM THE STATE OF NEW JERSEY**

Senator MENENDEZ. Thank you, Mr. Chairman, very much. I appreciate the courtesy. And thank you to you, the Chairlady of the full committee, and the Ranking Member.

It is my sincere honor today to join my senior Senator from New Jersey in recognizing and introducing Governor Corzine to this hearing on clean energy and job growth.

As Governor Corzine himself has said, a healthy economy and a healthy environment are inextricably linked. By leveraging existing industries and creating new ones, New Jersey is paving the way for a clean economy and a healthy one.

The Governor's past experience in finance and as a United States Senator has allowed him to appreciate how important it was to embrace the Recovery Act and use its resources as quickly and effectively as possible. The Council of Economic Advisors has estimated that New Jersey's use of these funds from the Recovery Act will create or save over 100,000 jobs over the next 2 years.

Many of these jobs, by virtue of the work the Governor is doing, are in the clean energy and environment protection sectors. For example, New Jersey is distributing \$20 million in competitive grants for innovative energy efficiency and renewable energy projects at State facilities including public colleges and universities.

The Governor has recently announced that the State will use Recovery Act Funds for a much-needed wetlands restoration project that, in turn, will create 100 new construction-related jobs, as well as being a good steward for the land for future generations of New Jerseyans.

The Governor is also working with businesses to close the skill gaps in the emerging green economy. The New Jersey Green Job Training Partnership Program builds on existing partnerships between industry and educational institutions and offers apprenticeship opportunities for a 21st century energy industry. Over the

past 3 years alone, nearly 2,000 New Jersey workers have been trained in the clean energy sector.

I could go on and on about Governor Corzine's statewide Energy Efficiency Program, his Clean Energy Manufacturing Fund, his ground-breaking energy master plan or his continued efforts to finance mass transit and smart growth policies. All of these impressive programs will not only create jobs, but they will reduce greenhouse gas emissions and improve the quality of life for millions of New Jersey citizens.

He is leading the State out of this deep recession by creating jobs, saving energy, and building foundations of a green energy economy that will serve New Jersey for decades. So, I cannot think of anyone better who will be before the committee to help you as you deal with this issue.

Thank you, Mr. Chairman.

Senator SANDERS. Thank you very much, Senator Menendez.

We will get back to regular order, Senator Cardin followed by Senator Alexander.

Senator Cardin.

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

Senator CARDIN. Thank you, Mr. Chairman.

In the interest of time, I am going to ask that my entire statement be put in the record and just welcome the Governors that are here and welcome our local officials.

I think one thing is very clear: the United States has always been the leader in the development of new technology. We have done that in telecommunications, we have done that in manufacturing, and we have done it in every critical area of our economy. And we are doing it on energy. We have developed the technology. The problem is that we have allowed the jobs to be exported overseas because we have not had the right incentives in America for the creation of clean jobs here in our own country.

The Lieberman-Warner bill last year, a bill that this committee worked on, would have created jobs here in America. I think one of our prime tests in moving forward with energy legislation and environmental legislation is not just energy security for America, which is critically important, we need to do that, it is not just the fact that we need to clean up our environment and be a leader internationally in bringing down global climate change and greenhouse gases, but we also need to keep jobs and create jobs in America.

That is why, Mr. Chairman, I was so pleased that you put together this panel of the leaders that are in the forefront of dealing with the economic realities in their individual States and communities. They know what it is to be competitive in attracting jobs and expanding jobs.

In clean energy, we have a real opportunity to give them additional tools from a national perspective in order for our States to energize job creation in America and, at the same time, have a clean environment and, at the same time, be energy secure.

So, I am looking forward to our witnesses, and I thank them for being here.

[The prepared statement of Senator Cardin follows:]

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

Chairmen Boxer and Sanders, thank you for holding this hearing.

Robust clean energy and climate legislation will transform the American economy. The United States has always been a world leader in technical innovation and production. From automobiles and airplanes to communication, computing and information technologies, all started and flourished here in the United States. So it comes as no surprise that clean energy production technologies such as wind and solar also got their start here in the U.S.

The first wind turbine used to generate electricity was constructed in 1888 outside of Cleveland, Ohio, and small scale wind power was a part of rural energy production in the United States throughout the 20th century.

Similarly, modern photovoltaics used to capture and generate power from the Sun were developed at Bell Laboratories and were an integral part of the NASA space program from the start, including the Apollo 11 lunar mission which we are celebrating the 40th anniversary of this week.

However, unlike information technology or modern defense systems, the companies leading the way in research, development and production of clean energy technologies are overseas. This has to change, and it starts with a policy framework that reflects the country's desire to lead. This opportunity for American workers and American entrepreneurs cannot be allowed to pass them by.

In May 2007 I toured BP Solar's U.S. headquarters, located in Frederick, Maryland, just after the company had completed a \$25 million facility expansion. At the time, BP Solar employed 2,000 workers at their Frederick headquarters and was planning a second facility expansion.

During my visit I had the chance to meet and speak with dozens of Marylanders working at "green jobs." The experience reaffirmed my commitment to the United States' leadership in developing renewable energy technologies.

As was noted at last Thursday's hearing by venture capitalist John Doerer from KPBC, current U.S. policy stifles innovation and competitiveness. And my State knows firsthand what it means to lose good paying, skilled, green jobs in the energy sector to countries that are outpacing the U.S. toward the goal of clean energy future for the world.

A year after breaking ground on the second expansion of their Frederick headquarters, BP Solar altered its plans. The company decided to move the manufacturing facility to Spain where government programs create greater incentives for renewable energy companies to do business. BP Solar's decision did not just impact projected job growth at the Frederick facility but was a factor in the elimination of 140 existing jobs at the plant.

I would like to see those 140 jobs and many more come back to Maryland in a new green economy, but it is not likely to happen without a firm commitment to clean energy from the U.S. Government.

A study conducted by the Political Economy Research Institute and the Center for American Progress estimates that investing just a little over 1 percent¹ of the annual U.S. gross domestic product into clean energy technologies nationwide would generate 26,000 new jobs for Maryland and hundreds of thousands of jobs nationwide.

We cannot rely on corporate altruism or the American "free market," which under current Federal regulation heavily favors the fossil fuel industry, to move the American economy toward clean energy and green job development. There are many other countries around the world competing for these industries to do business on their soil, and they are implementing policy frameworks that make it much easier for clean energy companies to do business abroad than to do business here in America.

Foreign government policies are not establishing lax environment or labor standards; rather countries like Spain, France, Japan and Germany have merely established robust renewable energy standards creating lucrative markets for companies to do business there. It is unfortunate that we import so much of our finite energy resources from abroad as it is, and it is unconscionable that we would do the same with renewable energy sources in the future.

Given America's historical ingenuity and manufacturing capacity we can become the world's leading supplier of essential renewable energy technologies. Revamping the American economy for the 21st century will put us in charge of our own energy

¹Or \$150 billion.

supplies. The Clean Energy and Green Jobs legislation we pass will put us on a path to energy independence, and that's a path to improved national security, increased GDP and increased job growth.

I thank Chairmen Sanders and Boxer for holding this hearing.

Senator SANDERS. Thank you very much, Senator Cardin.
Senator Alexander.

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

Senator ALEXANDER. Thank you, Mr. Chairman. I am also looking forward to the witnesses. I like to see Governors come to Washington, and thank you very much for taking time to be here.

Of course, we are talking about the wisdom of Governors and Mayors and what a great decentralized country this is. But the Waxman-Markey bill starts out by denying that, by imposing on all the States a so-called 15 percent renewable energy standard, which is to tell you exactly how to make your electricity and by when.

The goal is laudable. It is no carbon, zero carbon. So, in that spirit, I am going to be asking, when my turn comes, what you each think of the idea of a base load energy standard.

Renewable energy, solar and wind, and mostly wind, is really part-time energy. It is only available about one-third of the time. Today, you cannot store it. The wind blows a lot at night when we have plenty of extra electricity, and solar during the day, which is a good peak time. But altogether, it is about 3 or 4 percent of all of our electricity.

So, let us just assume that is a good idea and we double or triple that in the next several years, and that gets us up to around 10 percent. Since the United States uses 25 percent of all of the electricity in the world, where are we going to get the rest of it? I would assume that we would want that also to be zero-carbon electricity, as much as possible.

If it is a good idea for those of us in Washington to tell you that you have got to make, say, 15 percent of your electricity from zero-carbon renewable energies, which are very narrowly defined, why is it not a good idea for us to tell you that you need to make 20 percent of your electricity from zero-carbon base load electricity?

Now, that could be anything, but it probably would be mostly nuclear. The Senator from Vermont talked about how clean his State was, and I congratulate him for that. I believe it is the No. 1 State in terms of low carbon emissions. It also the No. 1 State in terms of the amount of power it gets from nuclear energy, about 75 percent.

Sometimes we forget that nuclear energy produces 20 percent of our electricity but 70 percent of our carbon-free electricity. Conveniently, nuclear is excluded from the renewable energy standard. Nuclear, of course, is a base load. That is a most-of-the-time electricity. Those plants generally operate at 90 percent, while solar and wind is operating at a third.

So, let us grant that it is a good idea to require you, from Washington, to make 15 percent of your electricity from solar and wind, etc. But let us say why is it not also a good idea to go to base load.

My argument is some like nuclear, some do not. Some like wind, I do not. In the Southeast, it does not work because the wind does

not blow. A policy such as the current renewable standard that is proposed has the effect of requiring an area like the TVA region, which has the only wind farm in the Southeastern United States and which operates only about 19 percent of the time, it has the practical effect of forcing us to buy wind from other parts of the country when we would rather be spending the money on conservation, on cleaning up our coal plants, and on carbon-free nuclear power.

Let us give States some choices. Or maybe fewer choices. Let us just say we are wise enough to require you to have a renewable zero-carbon standard for wind and solar; let us do it for base load, too. Nuclear would qualify. I do not know if hydro would qualify. You could build new reservoirs. That would work. Or you could use biomass. That is what they keep telling us we can do in the Southeast, although it would take about a forest the size of Florida and Georgia to produce enough electricity to equal 20 percent of the U.S. consumption on nuclear.

And on the question of jobs, California is proud of its growth in renewable energy. But I would like to place in the record a report from the News section, not the Editorial section, of the Wall Street Journal, which says that California officials are beginning to worry that the State's focus on transitioning to renewable energy sources could lead to power shortages in the near term. California's utilities are barreling ahead to meet a State mandate to garner 33 percent of their power from renewable sources by 2020, and some officials are concerned this might push up electricity prices, cramp supplies, the State Auditor warned this week, a high risk to the State economy, and that California could find itself uncomfortably tight on power by 2011 if problems continue to pile up.

I would rather have a clean energy standard that would let States make their own decisions about whether to have wind, which as I have said in our region is about like having hydropower in the desert. But as long as we want to have a narrowly defined renewable energy standard that mostly is devoted to wind and solar, why not a 20 percent zero-carbon base load energy standard to go with it?

Thank you, Mr. Chairman.

[The referenced article follows:]

The Wall Street Journal

JULY 3, 2009

State's Renewable-Energy Focus Risks Power Shortages

By REBECCA SMITH

California officials are beginning to worry that the state's focus on transitioning to renewable-energy sources could lead to power shortages in the near term.

The state has been so keen to develop renewables that relatively few conventional power generators, such as gas-fired plants, have been built lately. That risks a possible energy shortfall in certain places if the economy rebounds any time soon.

California's utilities are barreling ahead to try to meet a state mandate to garner 33% of their power from renewable sources by 2020, and some officials are concerned the effort might push up electricity prices and crimp supplies.

The state auditor warned this week that the electricity sector poses a "high risk" to the state economy. A staff report from the state energy commission also warns that California could find itself uncomfortably tight on power by 2011 if problems continue to pile up.

Utilities complain that the ambitious renewable-energy mandates, combined with tougher environmental regulations on conventional plants, are compromising their ability to deliver adequate power. "Conflicting state policies are a problem," said Stuart Hemphill, senior vice president of procurement at Southern California Edison, a unit of Edison International of Rosemead, Calif.

The stresses being felt in California could be a harbinger of problems to come in other states. The federal Waxman-Markey climate-change bill, passed by the House of Representatives on June 26, would require states to obtain about 15% of their electricity from renewable sources by 2020. Currently, about 4% of U.S. electricity comes from renewables, excluding hydropower.

California's 33% renewable-energy target is so ambitious that it is likely to miss the goal by five years or more, energy officials now concur.

State energy agencies recently concluded it could cost \$114 billion or more to meet the 33% mandate, more than double what it might have cost to achieve an earlier 20% requirement. Consumers will bear those costs, one way or another.

Agencies also identified problems with constructing sufficient transmission capacity to move renewable-based energy to cities.

Southern California Edison, which buys more renewable electricity than any other U.S. utility, has conducted seven solicitations for renewable-energy supplies since 2002 and inked 48 renewable energy contracts. Yet it is still only halfway toward its procurement goal. In 2008, 16% of its electricity was renewable in origin, but more than 60% of that came from geothermal plants -- most of them built long before the current push for green power.

At the same time, new regulations are putting existing power plants under pressure. Last week, the state Water Resources Control Board issued a proposed policy that would clamp down on power plants that use something called "once-through cooling," which sucks water out of the ocean and rivers and discharges massive amounts of warmed water, harming some aquatic life.

The policy would end the practice at 19 plants that produce as much as 15% of the state's electricity. That has the California Energy Commission worried electricity shortages might arise if older, marginal plants are shut down before there is replacement power is available.

Building conventional power units is notoriously tough in Southern California because of air-quality problems and difficulty getting air-emissions credits, which are essentially rights to spew specified amounts of pollutants.

Early this year, the local air agency, the South Coast Air Quality Management District, imposed a moratorium on issuing air credits from its "bank" that affected 10 power plants that were under development.

"It's too early to tell how the pieces will fit together, but all the agencies and utilities are talking," said Edison's Mr. Hemphill. "Something has to be worked out."

Senator SANDERS. Thank you, Senator. Senator Lautenberg followed by Senator Barrasso.
Senator Lautenberg.

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

Senator LAUTENBERG. Thanks, Mr. Chairman.

I was pleased to hear from my colleague in the Senate, Bob Menendez, who has been a fighter for a long time to improve environmental conditions. And I am delighted to see Governor Corzine here. We used to know Jon Corzine as Senator Corzine and saw him establish a record there fighting for a cleaner environment. We are pleased to see Governor Corzine here and to hear his views on things.

It has been our State's luck to have Jon Corzine as Governor, and it has been his hard work and the smart decisions of people in New Jersey that have made our State a leader in clean energy and a model for others to follow.

It was New Jersey, for example, that worked with California and won the right to regulate greenhouse gas emissions from vehicles. It was New Jersey, led by Governor Corzine, which passed a law to reduce greenhouse gas emissions 80 percent by 2050 within our State. It was New Jersey that enacted one of the most aggressive renewable electricity standards in the country. And as a result, more than 2,000 clean energy companies now call New Jersey home, employing over 25,000 people.

Our State is setting a pace. But in the race to build a clean energy economy and the millions of clean energy jobs that come with it, our Nation is dangerously close to falling behind.

We are all warned that China is the world's largest exporter of the materials needed to build solar panels and exports 95 percent of its goods to Europe and the United States. We have got to wake up and move the ball. Stop the woe be unto us, and get on with doing the job, making the investments.

You know, China is building wind farms that can generate as much as 20,000 megawatts of electricity. But, by the way, China now has surpassed the United States in the emission of greenhouse gases. So, we can improve China's position by establishing a leadership role for America. It is time for Congress to get our country back up to speed.

Last month, the House of Representatives passed a landmark bill that would fundamentally change how America uses energy and fights global warming. The world's eyes are now on this body of the Senate, and especially on our committee, to pass a bill to move our country away from dirty, unstable sources of energy and toward clean, sustainable and efficient ones.

But we cannot accomplish our clean energy goals relying only on the technology we have today. We need to be building the technology that we need for tomorrow. We have to make the investments in research and development. That creates jobs in the short term and gives our country the tools to compete in the long term.

New Jersey is home to some of the most prestigious companies that do some of the most important research in the world. Johnson & Johnson, for instance, spends about 12 percent of its revenue on

research and development. But the legislation that passed the House devotes only 1.5 percent of allowances to research and development. So, we have got to increase this money and make sure our technology matches our policies.

I want to say this. We heard, and I think it is a legitimate concern, that farmers have the most to lose if we impose these costs and these rules to clean up the environment. I disagree. I think families across America have the most to lose. I think those families who have children and grandchildren yet to grow up have the most to lose. Because we know that there are more respiratory diseases growing at a rapid pace, asthma in particular.

And we also know other things. We also know that it is not just conventional farming, but it is the farm that feeds the fish in our world, as we see coral dying, and as we see less opportunity for nutritional development of fish and marine life.

So, we have all got a price to pay here. The question is, are we going to continue with our heads buried in the sand, complaining about what the costs might be, instead of having the vision that people took when they went to the Moon as we just celebrated? Are we going to step up to the plate and say, no, America leads, American does not, and America does not just say no.

Thank you very much, Mr. Chairman.

Senator SANDERS. Thank you very much.

Senator Barrasso.

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

Senator BARRASSO. Thank you very much, Mr. Chairman.

I am very concerned about preserving and creating jobs in America and especially in my own State of Wyoming, green jobs as well as red, white and blue jobs. Unfortunately, decisions are being made in Washington that threaten that.

On Friday last week, Vice President Biden's Chief of Staff was quoted in the Washington Post defending the President's \$787 billion economic stimulus proposal by saying, "The point of these programs on the jobs front is to cushion the blow."

Now, this statement ignores the fact that the President's bill was supposed to create or save 3.5 million jobs and keep unemployment no higher than 8 percent. The Administration promised immediate results, immediate, but that has not turned out to be as the Administration expected.

Since the economic stimulus package was signed into law over 5 months ago, 2 million American jobs have been lost. Unemployment rates have soared to above 9.5 percent, all of this occurring after the passage of the \$787 billion stimulus proposal.

Vice President Biden has stated that the Administration misread the economy. The President's stimulus package did not cushion the economic blow for working families. It has intensified it. It intensified it by putting America deeper into debt and by not stopping the rising unemployment. The Vice President stated just last week that we have to spend money to keep from going bankrupt. It made all the news shows, and especially the comedy shows.

This is the type of economic thinking that has led to the apparent failure of the President's stimulus package. In yesterday's

Washington Post editorial page, an editorial by Robert Samuelson, *The Squandered Stimulus*, said the program crafted by Obama and the Democrat Congress was not engineered to maximize its economic impact. It was mostly a political exercise designed to claim credit for any recovery, shower benefits on favored constituencies, and signal support for fashionable causes.

Now the Administration and the majority in Congress are saying that the Waxman-Markey bill is a jobs bill. This is despite the fact that this so-called jobs package includes language, as Senator Inhofe said, to subsidize and retrain workers who lose their jobs because of the bill. The authors of this bill and this Administration will deal another blow to the American taxpayer. This means taking away more jobs and then subsidizing a few green jobs in their place. To the folks back home beyond the Beltway, this is Alice in Wonderland economics.

Let me give you an example of the blow that is being felt by Waxman-Markey to American jobs. In Wyoming, and in California, here is the American soda ash industry. Now, these are the only two States in America that produce soda ash. It employs thousands of Americans, hardworking men and women who make the basic necessary ingredient for glass, fiberglass, toothpaste and baking soda.

Under this bill, there is no protection for this industry. The result will be that higher energy costs and new regulations will drive the soda ash manufacturers from Wyoming and California overseas to China.

Now, the China soda ash industry is highly energy intensive and polluting, consuming over 220 trillion BTUs of energy and emitting nearly 20 million tons of carbon dioxide on an annual basis. That is because they use synthetic production methods.

This is going to cause irreparable environmental damage by moving the businesses from America to China. Under Waxman-Markey, thousands of hardworking Americans will lose their jobs in the soda ash industry in Wyoming and in California. They will lose their jobs even though they produce a natural, more environmentally respectful product than the Chinese. These jobs will shift overseas to China and spur their economic growth, not ours.

The Chinese will then sell back to the United States a synthetic product with a much higher environmental cost. The synthetic product is what will go into the glass and fiberglass that this country will use to build the green homes and buildings that are being constructed in the future.

So, according to the Administration, if Waxman-Markey passes and the soda ash industry go overseas, Americans will pay additional tariffs on the synthetic soda ash that we now will have to buy, all of it, from the Chinese. Only in Washington can we develop these thoughtless policies.

This is not an isolated case. So, I ask each of my colleagues to examine the real impacts to the jobs in each of your States as a result of this bill. Please make sure the so-called green jobs that are being promised by this bill are not being created in China at the expense of each of our constituents' jobs.

It does not have to be that way. We need an all of the above energy strategy that includes nuclear, clean coal, natural gas, hydro,

wind, solar, all the renewables. We need it all. We need to make America's energy as clean as we can, as fast as we can, without raising prices on American businesses or families.

Thank you very much, Mr. Chairman.

Senator SANDERS. Thank you.

Senator Bennet has dropped in to introduce Governor Ritter.

Senator Bennet.

Senator BENNET. Thank you, Senator.

I would like to thank the Chairman and the Ranking Member for holding this important hearing. It is fascinating to have the chance to listen to the work that you are all doing and for extending to me the courtesy of introducing our Governor, Bill Ritter, who has been Colorado's Chief Executive since 2007.

Prior to assuming the Governorship, Governor Ritter was Denver's District Attorney, earning a reputation as one of the country's most effective prosecutors. He was educated at Colorado State University and the University of Colorado. Before becoming District Attorney, he and his wife, Jeannie, lived in Africa for 3 years serving as missionaries, educating people in Zambia about nutrition and health care. Bill Ritter's very life and work experience make him a tremendous asset for our State.

Colorado's Governor Ritter is sure to tell you in detail that it is a State that is blessed with an abundant array of energy resources, both traditional, like our abundant supply of clean burning natural gas, and renewables, namely our rich wind and solar resources. There is perhaps no one more qualified to talk about how Colorado is harnessing this vast supply of resources, thereby creating thousands of clean energy jobs and attracting substantial new investment in our State than Governor Ritter.

As Governor, he has led the Nation in spearheading initiatives to transition our economy toward clean, renewable energy. For example, in 2007, he signed legislation into law that spurred our State's large investor-owned utilities to procure at least 20 percent of their electricity from renewable sources by the year 2020.

Initiatives like these contributed to a recent Pugh Charitable Trust finding that clean energy job growth in Colorado is more than double—double—that of normal job growth, 18.2 percent as opposed 8.2 percent, respectively. Furthermore, the study found that venture capital investment in green technology in Colorado topped \$620 million over the past 3 years.

These numbers are proof positive that Governor Ritter's leadership is cementing Colorado's place in the forefront of the new energy economy. Governor Bill Ritter is the sort of leader who can help us reach all of our important goals moving to this new energy economy.

Mr. Chairman, I am pleased to introduce to the Committee Governor Bill Ritter.

Senator SANDERS. Not quite yet.

[Laughter.]

Thank you, Senator Bennet.

Senator Udall, to be followed by Senator Voinovich.

Senator Udall.

**OPENING STATEMENT OF HON. TOM UDALL,
U.S. SENATOR FROM THE STATE OF NEW MEXICO**

Senator UDALL. We really are going to hear from you at some point, we really, really are.

[Laughter.]

Senator UDALL. I will make it short and put my opening statement into the record, and thank the Governors. Christine Gregoire and I served as State Attorneys General. I know that Sheldon overlapped with you also. And it is wonderful to have our neighbor, Governor Ritter, here.

I want to thank the Chairs for highlighting the fact that States and cities are really laying the groundwork out there on the clean energy economy. I think that it is terrific, what you are doing. And I want to highlight a couple of the facts.

No fewer than 23 of 50 States have already agreed to regional cap-and-trade programs to reduce greenhouse gases. Three regional gas-and-trade programs cover one-half of the U.S. population and one-third of U.S. emissions.

Emission trading has already begun in 10 Northeastern States in the Regional Greenhouse Gas Initiative. New Mexico is a member of the Western Climate Initiative, another bi-partisan regional cap-and-trade program of seven States and four Canadian Provinces. Then we also, in the Midwest, have the Greenhouse Gas Accord.

So, the States and cities, I think, are moving very aggressively to create this clean energy economy.

Just to highlight a little bit about what New Mexico has done. On the solar front, Governor Richardson and our delegation are working hard to create solar jobs. We have had companies come from overseas and locate in New Mexico. They are creating jobs now, even in this very, very difficult economy.

We are planting wind turbines around New Mexico like trees. We have a community college that has installed what they call the tallest classroom in the world, which 410-foot wind turbine, and those students are studying how to service and maintain the wind turbines. So, they are starting to educate people for these clean energy jobs.

Los Alamos National Lab has developed technology for geothermal, and there is going to be the creation of geothermal jobs in New Mexico and other States. I know that both Governor Ritter and Governor Gregoire know every well that the forests have huge potential for biomass, and we are going to be creating jobs there with some of the older overgrowth we have in our forests.

So, I think that it is clear that there are the jobs out there. We are getting it done. And it is great to have you here today to talk a little bit about that.

Thank you very much, and I appreciate the leadership of the two Chairs.

[The prepared statement of Senator Udall follows:]

STATEMENT OF HON. TOM UDALL,
U.S. SENATOR FROM THE STATE OF NEW MEXICO

No fewer than 23 of the 50 States have already agreed to regional cap-and-trade programs to reduce greenhouse gases. Three regional cap-and-trade programs cover half of the U.S. population and one-third of U.S. emissions.

Emission trading has already begun in 10 Northeastern States in the Regional Greenhouse Gas Initiative. Known as "Reggie," this bi-partisan cap-and-trade program includes three Republican Governors: Jodi Rell of Connecticut, Jim Douglas of Vermont and Donald Carcieri of Rhode Island.

New Mexico is a member of the Western Climate Initiative, another bi-partisan regional cap-and-trade program of 7 U.S. States and 4 Canadian Provinces. Republican Governors Arnold Schwarzenegger of California and Jim Huntsman of Utah led their States to become full members.

The Midwestern Greenhouse Gas Accord is yet another bi-partisan regional cap-and-trade program, also with 7 U.S. States. Republican Governor Tim Pawlenty of Minnesota is a full member, and Republican Governors Mitch Daniels of Indiana and Jim Rounds of South Dakota also signed the accord as observers.

We should not be surprised to see such broad, bi-partisan momentum for cap-and-trade legislation in the States, because the concept has a rich, bi-partisan history.

The bi-partisan 1990 Clean Air Act Amendments included cap-and-trade for sulfur dioxide emissions as the key feature. The House voted 401 to 25, and the Senate voted 89 to 10, and that cap-and-trade program was enthusiastically signed into law by President George H.W. Bush. This cap-and-trade program practically eliminated acid rain within a few years at very low cost.

In 2008 both parties' presidential candidates supported cap-and-trade in the campaign. Senator McCain and Senator Lieberman are the fathers of cap-and-trade legislation in the Senate. McCain cosponsored the first Senate greenhouse gas cap-and-trade program in 2003, and he introduced two cap-and-trade bills himself in 2005. Senator John Warner, the former senior Senator for the Republicans in 2007, led the charge for cap-and-trade legislation just last year.

Cap-and-trade has bi-partisan support because it is market-based, and it is designed to take advantage of innovation and the natural business instinct to cut costs. Command and control regulation might be more effective in the near term, but cap-and-trade can get the same result in the long term, at lower cost.

Senator SANDERS. Thank you, Senator.

Senator Vitter, followed by Senator Merkley.

**OPENING STATEMENT OF HON. DAVID VITTER,
U.S. SENATOR FROM THE STATE OF LOUISIANA**

Senator VITTER. Thank you, Mr. Chairman.

I, too, want to thank all of our witnesses very much.

I welcome a hearing on green jobs and the jobs impact of all of the climate change and energy policy we are considering. I just hope that we all bring a thorough, rigorous analysis to the topic, because way too often, in my opinion, as Senator Bond and others have mentioned, we just do not do that in Washington. It is fuzzy math, and it is a one-sided analysis.

On the subject of green jobs in particular, usually it is an ideologically driven analysis that focuses on one side of the ledger only and does not look at what you have to look at, which is the cost of any of these jobs in terms of taxpayer subsidies or in terms of other jobs in the economy which are lost.

There is a very important study that came out a few months ago from Spain. Dr. Gabriel Calzada of King Juan Carlos University in Madrid actually did the sort of thorough, rigorous analysis I am talking about, about green jobs in Spain. Pretty interesting results. For every 1 green job financed by the Spanish taxpayer, 2.2 real jobs were lost as a result of the same policy put in place. Nine out of 10 green jobs created by Spain over the past 10 years are no longer in existence today.

Since 2000, Spain has spent the equivalent of \$754,000 to create each green job including subsidies of more than \$1.3 million per wind industry job. These programs resulted in the destruction of nearly 113,000 jobs elsewhere in the economy. Finally, each green

megawatt installed destroyed 5.4 jobs in non-energy sectors of the Spanish economy.

So, I welcome green jobs that make sense at a reasonable cost. I just hope that we bring real, rigorous and thorough science to bear, including rigorous and thorough economic science as we figure out what policies make sense.

As I said before, I do not think that is being done in much of this debate. When you hear claims about Draconian cap-and-trade proposals like Waxman-Markey will cost Americans a postage stamp a day, that is just absolutely ludicrous on its face, particularly as supporters of the very policy admit in other venues that utility and energy costs will necessarily “skyrocket.” And that is quote from President Obama on the campaign trail.

So, I look forward to a real and a rigorous discussion so that we can focus on green jobs and other jobs that make sense and that we can procure in a reasonable way at a reasonable cost.

Thank you, Mr. Chairman.

Senator SANDERS. Thank you.

Senator Merkley.

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

Senator MERKLEY. Thank you, Mr. Chair. I look forward to hearing what the States are doing.

Certainly, Oregon is a laboratory, invested on the market side with an aggressive renewable energy standard, invested on the production side with green energy and tax credits, invested on the efficiency side ranging from the highest standard in the country for efficient appliances to encouraging utilities to increase the amount dedicated to efficiency, to the most aggressive building codes in the United States of America for future buildings.

We also have here a State Representative who is very involved in a program to help overcome the up front costs, Representative Jules Bailey, State legislator from Oregon, who laid out a strategy in partnership with our utilities to cover with low cost loans the up front costs of energy improvements on residential and commercial buildings so that the energy savings would more than pay for the costs of the up front installation, greatly to expand, and it is a model that certainly I am pursuing here at the national level.

The result is that jobs in Oregon, green energy jobs, are growing seven times as fast as the rest of the economy. And we are addressing key strategic interests of the United States of America, from ending our dependence on foreign oil, to strengthening our economy by converting the \$2 billion a day we spend overseas to spending it here in America creating jobs, to addressing the challenge of carbon dioxide in our atmosphere.

I look forward to the work that your States are doing and the innovations that we can help inform the debate we are holding here in the U.S. Congress.

Senator SANDERS. Thank you, Senator.

Senator Crapo.

**OPENING STATEMENT OF HON. MIKE CRAPO,
U.S. SENATOR FROM THE STATE OF IDAHO**

Senator CRAPO. Thank you very much, Mr. Chairman.

I appreciate the opportunity to participate in this hearing, and the important issue that we are facing today requires all of us to focus very carefully on the details of how this legislation works out.

The purpose of today's hearing is to hear from our State and local officials on climate-related policies and clean energy jobs. I would like to take just a moment to talk about Idaho's record as a leader in clean energy.

Nearly 50 percent of Idaho's electricity comes from hydroelectric power. Idaho's energy plan aims for a total of 8 percent non-hydro renewable electricity production by 2015. Development of clean energies is an important investment in Idaho's energy future and in job creation.

Like Governor Ritter, I am pleased with the potential for wind manufacturing jobs in my State. Recently, the Department of Energy announced a conditional loan guaranty to expand Nordic Windpower's manufacturing plant in Pocatello, Idaho. In fact, my State ranks 13th in the Nation in wind potential and has tremendous potential for geothermal expansion as well. Nearly 100 megawatts of geothermal and biomass landfill gas plants are planned on behalf of Idaho customers through 2015.

I am also looking to hear more from Governor Corzine and Governor Gregoire about ongoing algae to fuel research in their States. Algae has tremendous potential as a second generation biofuel, and I have introduced a fuel bill that would ensure that algae-based biofuels have the same tax treatment that cellulosic biofuels have today.

That said, I am concerned that some of the avenues that are being explored in the name of taking us forward toward clean energy and job creation will actually take us backward and destroy jobs. I agree with a number of the comments that some of my colleagues have made today.

The example of Spain has just been brought up where invested equivalents of \$37 billion for wind, mini-hydro and photovoltaic energy programs has resulted in only 50,200 jobs which, as I said has already been indicated, totals over \$700,000 of investment for each job. We should be careful not to construct a national energy policy that produces this kind of return on investment.

My point here is that we should let—I think we should incentivize and support a broad diversity of different types of energy in our country. I think we all agree that we need to move away from such a heavy dependence on carbon-based forms of energy and that we need to have a broad diversity in our energy portfolio in our country.

We should not, however, as a Congress, make the decision that we will pick the winners and losers. Instead, we should let research and the market and other dynamics lead us to where we can have the most dynamic and effective move toward a diversified energy policy. In that context, I echo concerns that will be expressed here today about the effect of this legislation.

One specific example, which has been mentioned by Senator Alexander, is nuclear. For some reason, new nuclear power is not al-

lowed to be included in this legislation in terms of meeting renewable energy standards. I think one of the reasons for that is there has been a conscious decision made that wind, solar and geothermal are preferred forms of energy and that we will direct the way that the marketplace should operate in our legislation, rather than letting a true market and true, meaningful research guide our decisions and the application of this policy to diversify our energy.

One example, in terms of constructing a new nuclear plant, between 1,400 and 1,800 jobs per plant are created, sometimes, depending on the job, sometimes even 2,800 jobs during peak employment. Nuclear energy creates long-term jobs as well. By 2020, U.S. demand for electricity is expected to grow by 355 gigawatts. If only 64 gigawatts of the demand is satisfied by nuclear energy, between 18,000 and 32,000 permanent full-time jobs could be created.

So, again, as we move forward in focusing on these issues, my effort is to try to find a way for us to allow true market forces and valid research, not guided by political decisions, take us to where we need to be in our energy policy.

We do need to diversify. We do need to move away from our heavy dependence on petroleum. But in the meantime, we need to be very careful about making sure that we do not simply decide what the preferred forms of energy will be and that we allow research and true market forces help us to get to the kind of powerful, new, diversified energy policy that our country needs.

Thank you, Mr. Chairman.

[The prepared statement of Senator Crapo follows:]

STATEMENT OF HON. MIKE CRAPO,
U.S. SENATOR FROM THE STATE OF IDAHO

Mr. Chairman, thank you for the opportunity to share a few words. I would also like to thank the witnesses for being here with us today.

The purpose of today's hearing is to hear from State and local officials on climate-related policies and clean energy jobs. I would like to take a few moments to talk about Idaho's record as a national leader in clean energy.

Nearly 50 percent of Idaho's electricity comes from hydroelectricity, and Idaho's Energy Plan aims for a total of 8 percent of non-hydro renewable electricity production by 2015. Development of clean energy is an important investment in Idaho's energy future and in job creation. Like Governor Ritter, I am pleased with the potential for wind manufacturing jobs in my State. Recently, DOE announced a conditional loan guarantee to expand Nordic Windpower's manufacturing plant in Pocatello, Idaho. In fact, my State ranks 13th in the Nation in wind potential and has potential for geothermal expansion as well. Nearly 100 MW of geothermal and biomass/landfill gas plants are planned on behalf of Idaho customers through 2015.

I am also looking forward to hearing more from Governor Corzine and Governor Gregoire about ongoing algae-to-fuel research in their States. Algae has tremendous potential as a second generation biofuel, and I have introduced a bill that would ensure that algae-based biofuels have the same tax treatment that cellulosic biofuels currently enjoy.

That said, I am concerned that some of the avenues that are being explored in the name of taking us forward toward clean energy and job creation will actually take us backward and destroy jobs. Spain, for example, has invested the equivalent of \$37 billion for wind, mini-hydro and photovoltaic energy programs, resulting in only 50,200 jobs, totaling over \$700,000 per job. We should be careful not to construct a national energy policy that produces this kind of return on investment.

Moreover, I would like to echo the concerns that will be expressed here today about Waxman-Markey's effect on refineries and jobs. This legislation is likely to have serious negative implications for fuel prices everywhere, including Idaho. The bill reserves only 2 percent of allowances for refineries, which will be responsible for 44 percent of all covered emissions.

We should be looking more seriously at nuclear as an emission-free source of energy and job creation. For example, the construction of one new nuclear plant cre-

ates between 1,400 and 1,800 jobs per plant, potentially even 2,800 jobs during peak employment. Nuclear energy generation creates long-term jobs, too. By 2020, U.S. demand for electricity is expected to grow by 355 gigawatts. If only 64 gigawatts of the demand is satisfied by nuclear energy, 18,400–32,200 permanent full-time jobs can be created.

So, I would ask that as we look to the benefits of renewable energy like solar, wind, and geothermal, we also continue to look to the job creation benefits of nuclear energy and job retention in conventional sources of energy. After all, maintaining affordable energy and keeping Americans working are imperative to achieving the desired advances in clean technology and emission reductions.

Senator SANDERS. Thank you.
Senator Whitehouse.

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

Senator WHITEHOUSE. Well, it has been a long ordeal for our witnesses. So, all I will say is that we look forward to your practical, forward looking and optimistic voices around here. It will be something of a breath of fresh air, as you have noticed. I feel sometimes it is like scuba here. You have got to bring your own fresh air in with you.

[Laughter.]

Senator WHITEHOUSE. I welcome you, and I particularly welcome Governor Gregoire, who I had the privilege of serving with when we were Attorneys General together. I was a new Attorney General, and she looked out for me, and I am very glad to have her here today. Welcome to the halls of denial, fear and partisan negativity. Thank you for being here with something different.

Senator SANDERS. Thank you.
Senator Klobuchar.

**OPENING STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM THE STATE OF MINNESOTA**

Senator KLOBUCHAR. Thank you very much, Senator.

Welcome to all of the Governors. I particularly wanted to welcome the Governor of my neighboring State, North Dakota, Governor Hoeven. North Dakota is home to not just oil but also some developing new technologies, big wind manufacturing and other things. So, thank you for being here.

Last week, we heard from a panel of experts about how China is moving ahead with full force toward a new energy economy. I was thinking this morning as I woke up and heard on the radio about how this is the 40th anniversary—I see our NASA kids back there, wave, very good—the 40th anniversary of Neil Armstrong and Buzz Aldrin landing on the Moon. We are engaging in what will be this generation's version of the space race, an energy race to provide the technologies that will power the 21st century.

But the finish line for this race will not be Neil Armstrong landing on the Moon. It will not be the great technologies that we got out of the space race, everything from GPS monitors to CAT scans to those little chocolate space sticks that my family took on camping trips in the 1970s.

This time, the finish line will be the wind turbine manufacturing in North Dakota, the new car battery manufacturing in Youngstown, Ohio, the solar panel companies in Starbuck, Minnesota. The

home grown energy is going to be everything from wind to new technology for coal to nuclear facilities to biofuels.

We will not reach the finish line for another decade. But we know we are going to be there because we will either be buying the wind turbines and the car batteries from China, or we will be selling the wind turbines and the batteries to China. It is going to be our choice.

Recently there was a quote in a Tom Friedman—a Minnesota native—column by Hal Harvey, the Chief Executive of Climate Works. And he talks about how China has already adopted the most aggressive energy efficiency program in the world. It has committed to reducing the energy intensity of its economy, energy use per dollar of goods produced, by 20 percent in 5 years.

They are doing this by implementing fuel efficiency standards for cars that far exceed our own and by going after their top thousand industries with aggressive efficiency targets. They have the most aggressive renewable energy deployment in the world for wind, solar and nuclear. They are already beating their targets.

In Minnesota, I was just up in Northern Minnesota where our unemployment rate is 20 percent right now, and we want good paying jobs across our State. The iron ore workers, the workers to make the wind turbines, the workers to fill our barges with the wind turbines to go on Lake Superior, and scientists to develop fuel cells and new cellulosic ethanol technology.

But one thing we know for sure. When we look at our job growth in our State, overall job growth is up 1.9 percent, but jobs related to the new energy economy are up 11.9 percent. Part of this is because, as a bi-partisan effort, a Republican Governor and a Democratic legislature adopted one of the most aggressive renewable portfolio standards in the country: 25 percent by 2025, 30 percent for Xcel, our biggest energy company.

We adopted that. And you can see the clear difference, just as Senator Bennet was mentioning when he introduced the Governor, in Colorado, the clear difference in the job growth that we have seen in these energy jobs compared to other States and compared to the growth overall in our job rate.

We did it because we felt it was important, we felt it was this time's space race, we felt we had to get there. And we got it done. That is what we need to do in this country.

So, I am dismayed by some of the, I think, unwarranted attacks. I agree that we need to make changes to this bill that came out of the House. I am the first one to say that we need to make some changes for the middle class and a more aggressive renewable portfolio standard that is more broad in what it includes.

But I do think that we cannot just sit on our hands and do nothing. Because if we do, other countries are going to fill the void, other countries are going to beat us, other countries are going to just jump start us, and they are going to beat us out in every way for technology.

We only have one-sixth of this technology when you look at the rest of the world. This is not what our country is all about. Our country is about being No. 1. And we can do it.

Thank you very much, Governors.

Senator SANDERS. Thank you, Senator.

Governors, thank you very much for your patience.
Governor Ritter.

**STATEMENT OF HON. BILL RITTER, JR., GOVERNOR,
STATE OF COLORADO**

Mr. RITTER. Thank you, Mr. Chairman.

[Remarks off microphone] Governors and those on the next panel to be here today.

Please enter the written version of my remarks into the record.

As Congress debates energy and climate legislation, it is hopefully helpful for you to hear how those laws are working at the State and local levels. In Colorado, our new energy economy is creating new jobs. It is attracting new companies. And it is leading the way to a new energy future for America.

It did not happen by accident. It happened through a concerted and aggressive effort starting in 2004 when it was Colorado voters who became the first voters in the country to adopt a renewable energy standard at the ballot box. One of your colleagues, Senator Mark Udall, helped lead that campaign.

One of the first bills that I signed into law after becoming Governor in 2007 doubled our renewable energy standard. I have signed four dozen energy bills into law since then, laws that encourage manufacturing, laws that increase demand for renewable energy, laws that make them more affordable.

We even passed a law that lets residents sell excess electricity back to their utility company, our Net Metering Law. I also issued Colorado's first climate action plan. We are greening Colorado's State government so that we can lead by example.

We are diversifying our energy portfolio and doing all we can to increase the demand for Colorado-produced natural gas. I know there has not been a lot of discussion about natural gas this morning, but I think it is part of this new energy economy that I speak of.

The job benefits are real. Vestas, one of the world's largest makers of wind turbines, is building four manufacturing plants in Colorado which will employ about 2,500 people. It is an over-\$700 million investment. Two solar companies, Abound Solar and Ascent Solar, they are just examples of our new energy economy. But they recently opened new manufacturing plants in Colorado during the downturn and hired hundreds of new workers.

Last month, we announced a new wind farm and 150 construction jobs on Colorado's eastern plains. In the first year I was Governor, we quadrupled the amount of wind in the eastern plains with substantial benefit to the farmers who have the land where those wind turbines are located.

Clearly the new energy economy is energizing our entire economy, even in the worst downturn in 75 years. While unemployment is just one barometer, it is important to note that Colorado's rate is 7.6 percent, nearly 2 points below the national average and lower than rates in 30 other States. It has been stable now for 4 months running. The new energy economy is certainly part of the reason we are in such relatively strong shape.

What is next in Colorado? We are making sure that we educate students so that they can succeed in green jobs, so they can help

lead a new wave of energy innovation and energy technology. We have established a P-20 Education Council and a Jobs Cabinet. We are strengthening job training programs and are giving community colleges a renewed mission in work force development.

President Obama recognized Colorado's new energy economy can serve as a national model when he came to Denver to sign the Recovery Act. Secretary Chu recognized it when he came to Colorado to tour the National Renewable Energy Laboratory. We thank them for acknowledging our leadership and for working with Congress to accelerate the progress.

We thank you for looking at how States and cities are turning energy and climate challenges into tangible economic opportunities.

Colorado's new energy economy could be a model for all of America. Our new energy economy can be America's new energy economy. It must be, because our children and our grandchildren will produce energy differently than we do today, they will consume energy differently than we do today. To help prepare them for that future, we must hand over a world that is more energy secure, more environmentally secure, and more economically secure than it is today.

There are, of course, the cynics and the skeptics who want to freeze time or even go back in time. But the world is marching forward. Our energy future is changing, our climate future is changing, and certainly our economic future is changing. We should not, and we cannot, get left behind. We must act now.

So, I thank you again for the opportunity to present testimony, and I appreciate the fact that you are listening to Governors and local officials.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Ritter follows:]

Bill Ritter, Jr.

Governor of Colorado

**Testimony before the U.S. Senate Committee on Environment and Public Works &
Subcommittee on Green Jobs and the New Economy**

“Clean Energy Jobs, Climate-Related Policies & Economic Growth – State & Local Views”

Tuesday, July 21, 2009

Madame Chair, thank you for this opportunity to provide our perspective on how the State of Colorado’s “New Energy Economy” is creating jobs, attracting business and leading America toward a more secure energy future. I thank the Committee and its Subcommittee for the time and thoughtful consideration you are giving to the issue of how clean-energy and climate-change policies can offer tangible economic and job opportunities. In this time of great distress, I strongly believe that the path back to economic growth and prosperity must involve remaking America’s energy and climate policies.

First, a bit of history. In the 1880s, the CF&I Steel Mill was Colorado’s largest employer. Forming rails for the expanding frontier of the West, CF&I employed generations of Coloradans in the Southern Colorado community of Pueblo – at one time consuming half of all of the coal excavated in the state to power the production of rails.

The promise of work in the mines and mills brought immigrants from around the country and the globe to the West. Italians, Croatians, Slovenians, Mexicans, Germans, Greeks, Japanese, Hispanic-Americans, African-Americans and many more came to the coal camps and company towns of CF&I. The workers brought their wives and children, creating some of the most diverse communities of the Western frontier.

In 1990, after over a century of production, the CF&I steel mill declared bankruptcy and devastated Pueblo. Ever since, the descendants of those first immigrants have been struggling to recover from the economic impact of the mill’s closure.

Almost exactly a year ago, I was in Pueblo to make an announcement: We are bringing steel jobs back to Pueblo. It isn’t a rail yard, but it will be lynchpin in the renewal of Colorado’s manufacturing sector. Vestas, one of the world’s largest wind turbine producers, is going to build the largest wind tower manufacturing plant on Earth here in the United States – in Pueblo. One of the many factors in Vestas’ decision to locate in this proud community was Pueblo’s deep history and culture of steel manufacturing.

Today, manufacturing is just one part of what we call the New Energy Economy, and this New Energy Economy is creating a new Western frontier. A new generation is pursuing professional opportunities in the emerging industries of renewable energy generation and energy efficiency. That same entrepreneurial spirit of Western independence and innovation that brought pioneers to the mountains and plains of Colorado is alive in a new wave of entrepreneurs, manufacturers and tradesmen. They are installing solar panels, insulating houses, building wind turbines, retrofitting buildings to consume less electricity, and reducing our dependence on energy from foreign regimes.

In Colorado, companies are turning conventional hybrids into plug-in vehicles that get 100 mpg. Companies are fueling biomass boilers in a school with woodchips made from beetle kill trees.

And one emerging business is making a flexible thin-film photovoltaic solar material that originated in the space program.

In addition to its wind tower plant in Pueblo, Vestas also is producing wind blades at a manufacturing facility in the Northern Colorado community of Windsor, and is building another blade plant and a nacelle factory in the metro Denver city of Brighton. In all, Vestas will employ nearly 2,500 people in its four Colorado facilities, which represent a \$700 million capital investment in Colorado's economy. This is one company, in one sector of the growing New Energy Economy.

People want to be a part of this growing field. They recognize change isn't just coming -- change is here, and they want to be a part of it. Vestas received 4,000 applications for its first 400 jobs. And this was before the recession hit. Even today, amid the worst economic crisis since the Great Depression, the New Energy Economy is a bright spot, a beacon of encouraging economic activity producing a steady stream of new jobs and new opportunities.

Quite clearly, Colorado is now a global leader in the New Energy Economy, which is one very likely reason Colorado's unemployment rate is nearly 2 full points below the national average and lower than the rate in 31 other states. Our success, in a short period of time, is a testament to strong leadership, sound policies and effective legislation. And Coloradans are eager for us to continue creating a new and cleaner energy future.

In 2004, Colorado voters became the first in the country to adopt a Renewable Portfolio Standard at the ballot box. Since taking office in 2007, I have enacted nearly four dozen pieces of New Energy Economy legislation, including a bill to double Colorado's voter-approved RPS. Under the new law, 20 percent of our electricity must come from renewable sources by 2020. My administration also implemented Colorado's first Climate Action Plan, calling for a 20 percent reduction in greenhouse gas emissions by 2020 and an 80 percent reduction by 2050.

If there is a lesson in Colorado's New Energy Economy for other states and the nation as a whole, it is that good energy policy and climate policy can energize the economy and help create good-paying private sector jobs.

In Colorado, education policy also is part of the equation. To ensure we are providing this growing clean-energy sector with a highly-skilled workforce, Colorado is expanding and strengthening educational, job-training and workforce development programs all across the state.

From our first days in office, my administration created a P-20 Education Coordinating Council and a Jobs Cabinet. In just a few years, we will be one of the only state's in the country with a completely aligned educational system from pre-school to grad-school, providing students with the skills and knowledge they need to succeed in modern, 21st century industries like energy. The Jobs Cabinet is creating new bridges between education and industry so that we are providing businesses and sectors with the types of workers they need, when and where they need them.

In addition, earlier this year, I signed legislation that strengthens the Colorado First job-training program, which allows industries like renewable energy and energy efficiency to partner with community colleges to better train their next generation of employees.

In the coming weeks, my administration will announce a new program that will give students in the building and construction programs certification for the latest green building practices,

technologies and techniques. At the same time, a new Green Job handbook issued by my energy office spells out for students or those wanting to shift careers a detailed roadmap to the rich variety of green jobs, and the kind of coursework and degrees needed to get there.

Colorado is blessed with some of the best research institutions in the world, and to maximize those assets, we have established the Colorado Renewable Energy Collaboratory. The Collaboratory is a partnership linking the University of Colorado, Colorado State University, the Colorado School of Mines and the National Renewable Energy Laboratory.

Based in Golden, NREL is the crown jewel of the renewable research world, responsible for much of the clean-energy innovation and development of the past few decades.

I visited NREL a month ago. Not to see a new research project or technological development, but to welcome the first graduating class from the Veterans Green Jobs Program. These graduates are recent returnees from Iraq who have now been trained to do energy audits, the first analytical step to determine what improvements are necessary in a home to make it more efficient. The veterans see the work – creating energy independence, cleaning up the environment – as an extension of their military service.

A sniper from the 1st Infantry Division in Iraq, Garrett Reppenhagen is now the regional program director for Veterans for Green Jobs. He compared the graduates with the Knights of the Round Table, who swore allegiance to a cause greater than themselves.

As I noted earlier, government policies are having an effect on our economy. We have literally created an ecosystem that supports education, training, research, development and investment. This holistic approach is having a very positive impact.

In February 2009, it was estimated that there were 17 out-of-work construction workers for every one job available in Boulder County. The county recently launched an innovative financing program where they issued bonds to pay for people to do energy efficiency and renewable energy upgrades to their homes, paid back through a voluntary assessment on their property taxes.

Nate Burger of Eco-Handyman says the program has generated \$100,000 in jobs for his small company. Renewable energy companies are hiring to keep up with demand. The first bond issuance alone is expected to create 800 new construction sites, putting people back to work this summer.

Blake Jones from Namaste Solar started his company in 2004 with two friends. Now, five years later and with a workforce of more than 50 employees, they are responsible for installing more than 650 systems in Colorado that generate over 3.5 megawatts of power – enough to power 4,500 homes. President Obama highlighted Mr. Jones and Namaste Solar when he signed the American Recovery and Reinvestment Act in Denver in February.

And of course, the Recovery Act is providing even more momentum for Colorado's New Energy Economy. Colorado will see investment in the low income weatherization program double this year. Already, weatherization agencies are ramping up and hiring insulation installers, retrofit specialists, furnace installers and others who will serve a record 10,000 low-income homes in Colorado over the next year.

Not only will this investment create direct jobs for the workforce in weatherization, but it will allow homeowners and renters to invest money saved on energy costs in other important needs. Weatherization programs like this provide an essential benefit for families living on the margins, while creating jobs and cleaning the environment.

Energy independence is not a pipe dream. America is blessed with resources unequaled anywhere in the world. Solar, wind, geothermal energy and hydro-power offer clean sources of electricity to power our homes, businesses, and vehicles of the future. Smart-grid technologies provide an entirely new way of managing electricity generation, distribution and consumption.

But this New Energy Economy is not limited to just these resources, as Colorado is proving. Our state and region have large reserves of coal, and we are committed to working with coal companies, utilities, and our sister states to develop and deploy technologies to capture and then sequester carbon dioxide. It is critically important to demonstrate these technologies on a commercial scale in multiple locations around the nation if we are to meet the President's climate goals while also maintaining a diverse electric energy portfolio.

Colorado also is home to large natural gas reserves that can play a critically important role in a New Energy Economy that is committed to meeting national climate goals. Natural gas is the least carbon-intensive fossil fuel and its use also produces far less conventional pollutants than does the combustion of other fossil fuels. It can be used to power part of our vehicle fleet, with far less impact to the environment and with significant national security benefits, since it is a home-grown fuel. It can and should be used to generate more of our electrical energy supplies. And the good news is that new discoveries of shale gas in Colorado, Texas, and in the Northeast are significantly expanding the nation's natural gas reserves. We no longer have to talk of natural gas as a transitional fuel – it is and should be a permanent part of a lower-carbon, domestic fuel source.

Now, more than ever, people in all walks of life are seeing an opportunity to seek the American dream through the emerging industries of energy efficiency and renewable energy.

The America our children and grandchildren will inherit will produce and consume energy in vastly different ways than we do today. Just as the industrial revolution created the jobs of the 20th century, we now usher in a new century of innovation, creativity, and entrepreneurial vigor. The New Energy Economy is creating the pathway to these new careers and a new American century of energy leadership.

Governor Ritter's Response to Environment and Public Works Committee Follow-Up Questions

Questions from Senator Barbara Boxer

Governor, has private industry responded to your policies to promote green jobs by relocating to your state, increasing investments, or working with the government to develop green job opportunities?

Since I took office in 2007, Colorado has enacted nearly four dozen pieces of New Energy Economy legislation, including a bill to double Colorado's voter-approved RPS. Under the new law, 20 percent of electricity generated by investor-owned utilities and 10% generated by public utilities must come from renewable sources by 2020. My administration also adopted and is implementing Colorado's first Climate Action Plan, calling for a 20 percent reduction in greenhouse gas emissions by 2020 and an 80 percent reduction by 2050.

These policies have had a significant impact on Colorado's New Energy Economy, particularly in the wind and solar sectors. In less than two years, we have quadrupled the amount of wind-generated electricity in the state, leading to the relocation or expansion in Colorado of a number of wind energy companies, including Vestas, Hexcel, Renewable Energy Systems America, Siemens Energy and REpower.

Vestas alone will employ nearly 2,500 people in its four Colorado facilities, which represent a \$700 million capital investment in Colorado's economy. In addition to its wind tower plant in Pueblo, Vestas also is producing wind blades at a manufacturing facility in the Northern Colorado community of Windsor, and is building another blade plant and a nacelle factory in the metro Denver city of Brighton. This is one company, in one sector of the growing New Energy Economy.

Another of our growing sectors is our solar industry, an industry which has grown exponentially over the past three years. In 2006, Colorado had fewer than 50 solar companies across the state. Today, thanks in large part to our focus on the New Energy Economy, Colorado has over 300 solar companies, making us 3rd nationally in installed solar photovoltaic capacity and 6th in solar resources – In 2005 before our RPS went into effect, we had 450kW of solar installed. Today, just three years later, Colorado has installed approximately 40 MW – nearly a 100 fold increase. Our success in the solar industry has led to a number of significant job creation announcements from companies like Ascent Solar, Abound Solar and Abengoa Solar among many others.

A great example of this growth is Namaste Solar, a company started in 2004 with a total of three people. Now, five years later, Namaste has grown to a workforce of more than 50 employees and they are responsible for installing more than 650 solar systems in Colorado that generate over 3.5 megawatts of power – enough to power 4,500 homes. President Obama highlighted Mr. Jones and Namaste Solar when he signed the American Recovery and Reinvestment Act in Denver in February.

Governor, a July 2009 report by the President's Council of Economic Advisers states: "Analysis suggests that particular areas of 'green' potential (e.g., wind and turbine manufacturing, mass transit or producing energy-efficient automobiles) pay more on

average than otherwise comparable jobs. They are also more likely to be held by primary earners in the household and to be unionized." Do green jobs represent a way to increase jobs opportunities in this country?

There is no doubt that renewable energy and energy efficiency (RE&EE) technologies continue to drive significant economic growth in the United States. In 2006, these industries generated 8.5 million jobs, nearly \$970 billion in revenue, more than \$100 billion in industry profits, and more than \$150 billion in increased federal, state, and local government tax revenues. Additionally, RE&EE provided important stimulus to the beleaguered U.S. manufacturing industry, displaced imported oil, and helped reduce the U.S. trade deficit.

In 2007, the news was even better. RE&EE generated more than 9 million jobs, more than \$1 trillion in revenue, and nearly \$160 billion in federal, state, and local tax revenues. Again, to put this in perspective, RE&EE sales outpaced the combined sales of the three largest U.S. corporations. Total sales for Wal-Mart, Exxon-Mobil, and General Motors in 2007 were \$905 billion. The implications for the United States—and for Colorado and other states—are obvious and serious. Nationally and locally, the RE&EE industries can help move us toward a vibrant, robust, environmentally sustainable future. If we fail to invest in RE&EE, the United States runs the risk of losing ground to RE&EE programs and industries in other nations

Governor, an April 2009 National Governor's Association document that discusses governors' priorities found that 91 % of governors said that spurring the economy -- including the green economy -- is a priority, and 81 % said that increasing energy development and conservation -- primarily renewable -- is a priority. In your opinion, how can the federal government best build on this broad level of support to help states address these types of priorities?

The federal government is in a unique position to build upon this broad based support in three key ways. First, the United States Department of Defense (DoD) should continue their goal of developing energy efficiency and renewable energy. The Energy Policy Act (EPAct) of 2005 set a mandate of 7.5% or more renewable energy use from DoD facilities by 2013. In addition, Executive Order 13423 requires federal agencies to obtain 25% of their energy from renewable sources by 2025. Finally, the Defense Authorization Act of 2007 requires that 25% of electricity consumed by military installations come from renewable sources by 2025.

Recognizing these common goals, my administration has been working with DoD bases in Colorado toward a comprehensive renewable energy plan that would achieve multiple policy objectives. Rather than each base achieving their on-site renewable energy and energy security goals individually, collectively these institutions command tremendous buying power and have the ability to spur great energy efficiency and renewable energy development in Colorado and states across the US. The federal government could direct DoD to form comprehensive state-wide energy plans, especially in states that have adopted a Renewable Portfolio Standard or are committed to voluntary greenhouse gas emissions reductions. This would create greater involvement and dialogue among DoD/Federal institutions and states toward achieving their common goals of emissions reductions, energy security and economic development.

Second, the United States can pass a meaningful National Renewable Portfolio Standard. Colorado is a microcosm of what is possible in the US with a comprehensive renewable portfolio standard. Indeed green collar jobs are being created in the 32 states that have renewable portfolio

standards, but a great deal of additional opportunity exists to create energy efficiency and renewable energy markets in the 18 states that have no such standard.

Third, the federal government must significantly increase its investment in workforce training to make certain the skills of America's workers keep up with rapid advancements in green energy technologies and the explosive growth in green energy job opportunities. Without this investment, the current expansion of green energy industries will slow due to a lack of a qualified workforce. During these difficult economic times, the critical link between a skilled workforce and economic development must be restored to take full advantage of the potential of the New Energy Economy.

Finally, by creating greater collaboration between the Department of Energy and the Department of Labor, the federal government could help to establish EE/RE job classification codes and training programs.

Questions from Senator Thomas R. Carper

Recently, I've heard some skepticism that "green jobs" are limited in number, highly specialized, and not available to most American workers. From your perspective as a state executive, is there any merit to this concern?

The term "green jobs" has been used as shorthand for jobs in the renewable energy and energy efficiency sector. Like the renewable energy sector itself, there is no precise definition. However, it is clear that many of the new jobs in this industry are based in the traditional manufacturing, construction and installation trades. All of the construction and installation taking place requires traditional electricians, welders, pipefitters, architects, and the like in order to build or retrofit energy efficiency buildings. A great example of this is Vestas, who is currently building the largest wind tower manufacturing plant in the world in Pueblo, Colorado. Vestas will be creating 650 new jobs in Pueblo, employing traditional electricians, linemen and supervisors. Training programs for these professions are currently available through Colorado's talent development system, making these types of jobs accessible to all Coloradoans.

If there is a lesson in Colorado's New Energy Economy for other states and the nation as a whole, it is that good energy policy and climate policy can energize the economy and help create good-paying private sector jobs – but education and training policies must be a part of the equation. That's why I have worked hard to ensure that Colorado is providing this growing clean-energy sector with a highly-skilled workforce.

Very early in my administration, I created the P-20 Education Coordinating Council and a Jobs Cabinet. In just a few years, we will be one of the only state's in the country with a completely aligned educational system from pre-school to grad-school, providing students with the skills and knowledge they need to succeed in modern, 21st century industries like energy. The Jobs Cabinet is creating new bridges between education, our workforce system and industry so that we are providing businesses and sectors with the types of workers they need, when and where they need them.

In addition, earlier this year, I signed legislation that strengthens the Colorado First job-training program, which allows industries like renewable energy and energy efficiency to partner with community colleges to better train their next generation of employees.

In the coming weeks, my administration will announce a new program that will give students in the building and construction programs certification for the latest green building practices, technologies and techniques through our community college system. At the same time, a new Green Job handbook issued by my energy office spells out for students or those wanting to shift careers a detailed roadmap to the rich variety of green jobs, and the kind of coursework and degrees needed to get there.

No one wants certain regions of the country or segments of the population to benefit disproportionately from the green economy. Could you please provide examples of opportunities for job creation and economic growth in rural communities? What other benefits might accrue to these communities?

I believe that rural communities can benefit from alternative energy production in a number of ways. First, wind, solar and biofuels development helps to create an important rural tax base that

supports schools, hospitals and other community enhancements. For example, in Prowers County, Colorado, wind energy development provided 30 percent of the tax base for the county during its initial production phase. After depreciation, the wind farm still provides about 20 percent of the local property tax base. This same wind energy development project created 12 to 16 permanent jobs. People holding these jobs tend to be younger and better educated because of the technological progress it brings to the area. These projects also spur local post-secondary educational institutions to train workers who can specialize in the technology. Biofuel plants also create positive local effects on grain markets helping stabilize grain prices at somewhat higher levels than would otherwise be possible.

Furthermore, farmers and ranchers benefit from wind development by receiving annual lease payments between \$3,000 to \$5,000 per turbine. This added income helps sustain agricultural producers through downturns in the agricultural economy with very minimal disturbance to the surface uses of the land.

Second, new laws around net metering are creating demand for smaller turbines which are cheaper to acquire and install and can serve individual farmsteads. Modest state grant funds, such as Colorado's ACRE (Advancing Colorado's Renewable Energy) can provide funds to help enable individuals to acquire alternative energy facilities.

In Baca County, the Colorado Department of Public Health and Environment is teaming with the local conservation district to help local landowners benefit from carbon sequestration. In total, Colorado carbon sequestration payments have risen from \$57,000 in 2006 to \$278,000 in 2008. There is renewed interest in generating energy from feedlot wastes. Federal and state grants are helping with adoption and experimentation.

Finally, the national focus on reducing fossil fuel consumption is producing secondary benefits for rural America. Farmers are increasingly adopting "precision farming" practices that utilize GPS technology to more precisely apply fertilizer and pesticides for maximum efficiency and to reduce over application of expensive inputs.

You are showing good leadership with respect to expanding access to green jobs and training opportunities in your state. What can the federal government do from here to promote green jobs and facilitate a smooth transition to a clean energy economy?

Senator Carper, thank you for your kind words. For specific details, please refer back to my third response to Senator Boxer.

As you know, the American Recovery and Reinvestment Act provided \$500 million for green jobs training. This funding, combined with funding infusions for a number of other programs -like Weatherization Assistance - is certainly helping to put people back to work. How can we ensure the sustainability of these jobs over the long term, after Recovery Act funds are expended?

Funding from the American Recovery and Reinvestment Act (ARRA) for green jobs training is a critical first-step towards green energy sector growth and energy recovery. In Colorado, grant applications will be submitted for all five categories of funding for green jobs training. In order to maximize the total economic and workforce development return on these funds, my administration is making certain that all stakeholders have their voices heard and can benefit

from these training funds. Workforce and economic development leaders, community colleges, labor unions, employers, non-profits, and state and local governments are collaborating to create innovative training programs that will ensure that workers have the skills needed to succeed in the New Energy Economy. Training dollars awarded to Colorado will directly benefit workers and families most impacted by the recession, retool the skills of workers in declining industries thereby giving these individuals new career opportunities, and revitalize the workforce in both rural and urban regions of the state.

The Low-Income Weatherization Program in Colorado is a great example of how the Recovery Act funds will provide jobs and training in the short term, but also provide direct hands-on experience and transferable technical skill development that will result in long term sustainability of green jobs. The jobs created through the Colorado residential Low-Income Weatherization Program and the associated technical training being provided as part of the \$79.5 million Department of Energy grant to the Colorado Governor's Energy Office for the Low-Income Weatherization Program will enable the development of an expanded workforce skilled in the areas of energy efficiency auditing, residential building shell efficiency, energy efficient heating and cooling, and residential building inspections.

As our drive toward a New Energy Economy expands in Colorado, these technical skills will be required to meet the demands for the future. Skilled and experienced green jobs will be necessary for the new housing industry, existing non low-income home energy efficiency retrofitting, heating and cooling/plumbing and electrical trades, and building code inspection and enforcement. Such skills will also continue to be in demand to provide a skilled workforce for the ongoing Low-Income Weatherization Program.

The technical skills and experience developed during this Recovery Act funding period will be the foundation for ensuring that we have the workforce in place that is capable of ensuring our entire housing stock in Colorado reaches the highest level of energy efficiency that is possible.

Could you elaborate on the roles of apprenticeship and vocational training in the clean energy economy? Why are these pathways to employment so important?

Both the apprenticeship and vocational education models for skills development are ideally suited for training workers in the new energy economy. Apprenticeship and vocational educational programs provide the skills and training for the high-demand, mid-level jobs that are fundamental to the New Energy Economy. These systematic and structured training programs provide workers with the precise skills needed by green energy employers. These programs not only provide career pathways, they also offer industry-specific training and allow workers to keep up with changing industry standards. For example, electricians, plumbers, and pipefitters are critical to geothermal and solar thermal energy development. Apprenticeships in these industries can help to educate and train the next generation of workers to meet the growing demands being created by the New Energy Economy. These types of apprenticeships not only help our workers obtain the skills they need, but they are also vital to small and large businesses alike.

Questions from Senator James M. Inhofe

With all the discussion that took place in the House, it surprises me to find that nowhere in the Waxman-Markey bill is natural gas mentioned as a fuel option for emissions reduction - not in the Renewable Electricity Standard, not in the offsets, nowhere. Rather than incentivize the use of natural gas, this bill ignores it. All the debate has been focused on the free allowances that go to coal-fired utilities, the refineries, and renewable at the expense of natural gas. Colorado ranks sixth among natural gas producing states, employs more than 70,000 people in the oil and gas industry, and benefits from more than \$23 billion in economic impact from the industry each year.

Additionally, three out of every four homes in Colorado is heated with natural gas. I would think you would want to make sure that natural gas has a very big role in any climate legislation - not a perceived role - but a formal role as a valid fuel option. Shouldn't natural gas be included in this bill since it has half the emissions output of other fossil fuels?

Natural Gas is a vital part of the New Energy Economy, a critical part of the New Energy Economy –a mission-critical fuel. That's why Colorado is working to expand pipeline capacity, to increase natural gas as both a transportation fuel and as a base-load energy fuel. I believe that federal legislation must recognize the value of natural gas in discussions about climate. Certainly any policy that targets reductions in carbon emissions is going to benefit natural gas due to the relatively low carbon emissions as compared to other fossil fuels as you correctly point out. It is also important to note that a 15% RES leaves 85% from fossil fuels – combined with climate legislation, low carbon resources such as natural gas will succeed in that environment. This is one of the reasons I continue to point out that our climate policies and our energy policies must be inextricably linked.

Natural gas is a critical “shaping” resource to complement renewable energy production. The ability for gas production to quickly and efficiently come online and offline ties the natural gas industry to successful growth in renewable energy generation. We can't begin to address climate change, energy security or our future energy needs in a meaningful way without including natural gas as part of our energy portfolio. The vast majority of greenhouse gases come from two areas: electricity generation and the transportation sector. Natural gas can play an important role in each. The natural gas industry has acknowledged that it was not at the table in the House of Representatives while they were drafting and debating Waxman-Markey and has pledged to be more active in the Senate. I have spoken with Colorado's Senators Udall and Bennett to ensure that appropriate provisions are considered in the Senate, and I hope that the climate bill ultimately passed out of the Senate includes such provisions.

According to EIA, "Colorado's oil shale deposits hold an estimated 1 trillion barrels of oil-nearly as much oil as the entire world's proven oil reserves." Over the long-term that could equate into hundreds of billions in economic benefit for Colorado. Few would disagree that passage of Waxman-Markey effectively kills any future oil shale production in Colorado. As Governor, are you comfortable with a federal policy that permanently walls off Colorado's oil shale?

First one must draw a distinction between “reserves” and “resources”. “Resources” are considered all deposits, while “reserves” are those deposits that are considered economically

recoverable with current technologies. As such, one must be careful with comparisons between oil shale "resources" and the world's oil "reserves".

Colorado's oil shale resources could provide a significant opportunity for an alternative to foreign sources of oil. However, there are significant unanswered questions about oil shale that must be answered before Congress, the President, or Colorado could give a green light to commercial development. For example, we need to know more about how the technologies in development will protect both surface and ground water, as well as the quantities of water that would be needed to produce shale oil; as you know well, water is our state's life blood and we guard it stubbornly. Similarly, we would need to understand both the air emissions from the shale oil industry as well as the cumulative air quality effects of shale oil production that is occurring in the same area that is attracting intense interest from the natural gas industry. And of course, we will all need to understand how much energy is needed to produce shale oil and how that energy can be developed.

Oil shale development is still in the research and development phase, and it is yet to be seen what technologies will rise to the top. However, companies pursuing R&D activities are creatively exploring more efficient power and conversion alternative energy sources. For example, AMSO has an RD&D lease in Colorado and they are exploring the potential to burn co-produced natural gas in below-ground heaters. Likewise, Shell is looking at considering using co-produced natural gas to generate electricity for its electric-resistance heaters. The oil and gas industry is among the most creative on the planet and they may well develop commercial-scale technologies that can protect our environment and produce liquid fuels for the nation. At this juncture, it is important that we provide them the time and opportunity to develop and test those technologies,

Senator SANDERS. Thank you, Governor.
Governor Gregoire.

**STATEMENT OF HON. CHRIS GREGOIRE, GOVERNOR,
STATE OF WASHINGTON**

Ms. GREGOIRE. Thank you, Mr. Chair, Madam Chair, and members of the committee, thank you for the opportunity to come before you today to talk about Washington State's view on energy and, particularly green jobs. I have submitted longer testimony for the record.

In Washington State we believe that many of the jobs of the 21st century economy will be related to energy. In 2006, like Colorado, by initiative of the people of our State, they affirmatively declared that their future would include a growing use of clean energy.

We have had tax incentives for wind and solar energy projects in place since 1996. And earlier this month, we added State tax incentives for biomass energy, for ocean energy, for geothermal, for anaerobic digestion and waste heat energy.

With these commitments, Washington State is now the fifth largest producer of wind power in the Nation, up from nothing in 2001. We are building solar power components, growing and refining biofuels, and making breakthroughs in tidal energy.

Just 2 weeks ago, a company announced that it would build the largest solar panel energy generation plant in the United States in a town called Cle Elum. Interestingly enough, it was once a coal town.

Our energy strategy is a job creation strategy. In 2007, when we adopted a set of climate change goals, we related to reduced greenhouse gas emissions and reduced fuel use. We also set a goal to triple the new of green jobs we had in our State, to reach 25,000 green jobs by the year 2020. We are less than 2 years after that goal, and rather than 25,000 by 2020, we are today at 47,000 green jobs.

Our green jobs are growing much faster than what we had predicted. These jobs range from computer software engineers for the smart grid to power line workers, from green building architects to weatherization technicians, from bioenergy venture capitalists to oil seed farmers. We learned that green jobs are not necessarily some brand new kind of job. They are often jobs that we all know about today, only they are getting the new skills for the 21st century economy, such as, for example, the electrician who can wire a smart home.

In Washington State, our commitment to green jobs is fundamentally a commitment to high quality living wage jobs, and this means high skilled workers. The key to these jobs is innovative companies and highly skilled workers. We are doing our part with innovative curriculum throughout our robust community college system that includes examples such as Bates Technical College, for green construction and remodeling, Bellevue College certificate in green sustainable design, Columbia Basin College, for solar and photovoltaic design.

I also encourage you to look at apprenticeships as a model for green jobs training. Apprenticeship programs have the industry expertise, the established networks, and the needed flexibility to

meet the challenge of this rapidly evolving new industry sector. Because registered apprenticeship is controlled at the local level by employers and employees, created jointly and sustained by law and management, it is uniquely positioned to respond quickly to industry changes and technological advancements.

We have almost doubled the number of apprenticeships in Washington State over the course of the last 4 years. We have created a pre-apprenticeship program to address dropouts from high school called Running Start for the Trades that is linking our high school students to high quality apprenticeship programs. We have made a commitment to our veterans returning from Iraq and Afghanistan, Helmets to Hardhats, training them in a direct way in apprenticeship work in this new technology and new 21st century jobs.

I would like to mention the relationship between energy and climate. In effect, the actions needed to secure our energy future are the same as those needed to respond to the imperatives of climate change science. We have taken actions that address both, including clean energy tax incentives, renewable energy standards, and strong energy efficiency standards for buildings and appliances.

Governors are actively charting a course for green jobs, making critical investments in the research and development, in training and in infrastructure. With the permission of the Chairs, I would like to submit a document to be made a part of the record. It is a statement of principles signed by a bi-partisan coalition of 31 Governors from across the country.

Our coalition calls on Congress to pass comprehensive energy legislation that breaks our dependence on foreign oil by making investments in using energy more efficiently and producing more clean energy here in the U.S. That is what will create and generate the green jobs that you are considering here today.

Forbes magazine has ranked Washington State in the top five States to do business, the top five States as green. The two are inextricably linked.

Thank you for your time today, and I look forward to your questions.

[The prepared statement of Ms. Gregoire follows:]

Statement of Governor Chris Gregoire
State of Washington

Before the

Senate Environment & Public Works (EPW) Committee
July 21, 2009

Chairs and members of the Committee, thank you for the opportunity to present Washington State's view on energy, and more specifically, on the "green jobs" that will come with a clean energy future.

In Washington State we believe many of the jobs of the 21st Century Economy will be related to energy. In its July 2009 report, the President's Council of Economic Advisers report that growth in energy and environmental related occupations is projected at 52% for the period of 2000 through 2016, while growth in all other occupations is estimated at 14%. In Washington State, we are banking on that for our economic future. With your help, we are acting now to lay the groundwork to come out of this recession even stronger than when the slowdown began.

In partnership with the private sector, Washington has been aggressively pursuing alternative energy strategies since before the current recession. In 2006, by initiative of the people, the citizens of Washington State affirmatively declared that their future would include a growing use of clean energy. We have had tax incentives for wind and solar energy projects in place since 1996, adding landfill gases and fuel cells in recent years. Earlier this month, we added state tax incentives for biomass energy, ocean energy, geothermal, anaerobic digestion, and waste heat energy.

With these commitments, in combination with federal incentives secured by Senators Cantwell and Murray with your help, Washington State is now the 5th largest producer of wind power in the nation, up from nothing in 2001 and now 5th of 36 states producing wind power. We are building solar-power components, growing and refining biofuels, and making break-throughs in tidal energy. Just two weeks ago, a company announced it will build what would be the largest solar panel energy generation plant in the United States in a town called Cle Elum that, interestingly, was once a coal town.

We have McKinstry in Seattle leading the way in construction of green buildings; Inland Empire Oilseeds in Odessa with a multi-million dollar biofuel plant; and Blue Marble Energy and Bionavitas working to turn algae into fuel. We are also fortunate to have the Pacific Northwest National Lab in Richland, Washington where grid-friendly appliances.

With the ongoing belief these new opportunities hold the key to emerging more strongly from this recession, the state legislature recently created a Clean Energy Leadership Council, a public-private collaboration tasked with identifying the necessary investments, policies and partnerships for our state to be a leader in the clean energy economy.

Our energy strategy is a job creation strategy. In 2007, when we adopted a set of climate change goals related to reduced greenhouse gas emissions and reduced fuel use, we also set a goal to triple the number of green jobs we had in the state – to reach 25,000 green jobs by 2020. Less than two years later, we can point to 47,000 green jobs right now. Our green jobs are growing much faster than predicted. These jobs range from computer software engineers for the smart grid to power line workers, from green building architects to weatherization technicians, and from bioenergy venture capitalists to oilseed farmers. Washington labor market information agency has shown real leadership in developing the tools to quantify green job efforts, and we are working with other states and private, non-profit institutions to promote solid measurement of green jobs around the country. We learned green jobs are not necessarily some brand new type of job – they are often jobs we all know, only now they include new skills to meet the needs of the new century – for example, the electrician who can wire a smart home.

In Washington State, our commitment to green jobs is fundamentally a commitment to **high quality, living wage** jobs. The key to these jobs is innovative companies and highly skilled workers. I appreciate the support you are showing for the training needs that are emerging in the green economy. Through the American Recovery and Reinvestment Act, Congress and the Administration has provided significant resources to fund the *Green Jobs Act of 2007* to invest in energy workforce training opportunities. Additionally, with the work of Senator Murray and many here, the Recovery Act increased funding to the Workforce Investment Act. I am creating an incentive fund using the WIA 10% to be used as matching awards for local WIA formula funds that Workforce Development Councils use for direct training in green jobs that promote alternative energy and energy efficiency. These funds will also be used to build capacity at our community and technical colleges as well as leverage other Recovery funds. You can count on Washington State to continue to pursue these funds creatively and aggressively.

Like President Obama wrote in his July 12 *Washington Post* op-ed, “[o]ur community colleges can serve as 21st-century job training centers, working with local businesses to help workers learn the skills they need to fill the jobs of the future.” As you look to expand training opportunities in the green economy, again, we are doing our part, particularly through our own terrific community college system. Innovative curriculum examples include: Bates Technical College, green construction and remodeling; Bellevue College certificate in green/sustainable design; Columbia Basin College, solar and photovoltaic design; Cascadia Community College has an environmental technologies and sustainable practices curricula including solar specialties and energy management skills. Clover Park Technical, Edmonds, North Seattle, Shoreline, Skagit Valley, South Seattle, South Puget Sound, and Wenatchee Valley College all have similar and creative programs.

I would also invite you to look at ways to encourage apprenticeship as a model for green jobs training. Apprenticeship programs have the industry expertise, established networks and needed flexibility to meet the challenges of this rapidly evolving new industry sector. Because registered apprenticeship is controlled at the local level by employers and employees - created jointly and sustained by labor and management – it is uniquely positioned to respond quickly to industry changes and technological advancements. In Washington State, we are already seeing apprenticeship programs making the shift to industry demand around green jobs. One program in Southwest Washington added a full year to its residential electrician training program in order to

include training on solar panels and home technology integration (Smart Houses). The Machinists in Seattle are now offering training on wind turbine technology. The Seattle area Pipe Trades apprenticeship has a class for apprentices to receive a “Green Awareness” certificate. The class covers a vast array of topics including high efficiency appliances and fixtures, water conservation, distribution systems, and irrigation and reuse systems.

In addition to providing high quality on-the-job-training, apprenticeship also offers the kind of career paths that will give workers the opportunity to earn a living in good, family wage jobs. The jobs we are talking about are about are typically in the construction trades and provide good wages and benefits.

As Governor, I have been committed to expanding apprenticeship opportunities. In Washington State, we have almost doubled the number of apprentices since I took office. We have also created a pre-apprenticeship program, “Running Start for the Trades,” that links high school students to high quality apprenticeship programs. We have made a commitment to our veterans by supporting “Helmets to Hardhats,” a program that gives veterans direct entry to apprenticeship programs and allows credit for military training.

We think apprenticeships offer an excellent training model as we move forward with our Green Jobs initiative. Our goal with training programs and apprenticeship strategies is to create strong career ladders in the green economy, growing family wage jobs and not just short term employment opportunities.

I’d like to speak briefly to the relationship between energy and climate. In effect, energy policy and climate policy are of the same cloth – the actions needed to secure our energy future are the same as those needed to respond to the imperatives of climate change science. Both energy and climate point in the same direction, and we have taken actions that, by necessity, address both in tandem – actions such as clean energy tax incentives, renewable energy standards, and strong energy efficiency standards for buildings and appliances. Just last month, the Western Governors Association – to include the governors from the 19 western states and 3 western territories – adopted a policy that urges Congress and the President to act decisively to create a national policy to that reduces greenhouse gas emissions in a manner that is both consistent with the findings of scientific research and encourages job growth, innovation, and entrepreneurship. I have submitted that policy for the record.

I’ve come to this hearing from a National Governors’ Association meeting in Biloxi, Mississippi. There, I co-chaired an Economic Development & Commerce Committee session devoted to discussing how states and the nation will emerge from this recession by virtue of technological innovations in the areas of energy as well as, for example, the life sciences. I assure you that what I’ve described in Washington State is proving true around the country.

Governors and states are actively charting a course toward the next century, making critical investments in the research and development, training, and infrastructure to support private sector success. Your actions in this committee – looking at comprehensive energy and climate legislation – are a central part of those efforts in terms of moving us toward a new energy future. That is precisely what governors are looking to Congress for.

I know that there are many Committees working on this issue and I believe that is a good thing. Energy and climate issues cross so many facets of our lives that it is as vital for Congress to work collaboratively and cooperatively across committees as it is for the President and me to have our many agencies doing the same thing. For green jobs, specifically, I believe the Health, Education, Labor and Pensions (HELP) Committee's work can also be quite instructive for supporting and retooling many excellent training programs already in place.

With the permission of the Chairs, I would like to add one additional document to be made a part of the record. This document is a statement of principles signed by a bipartisan coalition of 31 governors from every corner and region of our country. Our coalition calls on Congress to pass comprehensive energy policy legislation that breaks our dependence on foreign oil by making investments in using energy more efficiently and producing more clean energy here in the United States. These steps will generate the very green jobs we've been talking about today.

Forbes magazine ranked Washington in the top five states in which to do business and in the top five "green" states. I feel strongly that what you are doing here in Washington, DC is helping to make success possible, both in our state and around the country and, frankly, to position the United States of America to be a global leader in the "green" technological innovations of the future.

In closing, I want to thank you for the efforts you are making – for the substantial federal commitment you have made – and need to continue to make – to promote energy independence and alternative energy sources, and to ensure our economic recovery.

Thank you for your time today and thank you for your work. I am happy to take any questions you have.

**Western Governors' Association
Policy Resolution 09-3**

Regional and National Policies Regarding Global Climate Change

A. BACKGROUND

1. Atmospheric concentrations of greenhouse gases are rising due to human activities including land use changes and the combustion of fossil fuels, and are projected to continue to increase. Increasing concentrations have had and will continue to have marked effects on global climate. Numerous states and the western region have begun working together on new policies to reduce greenhouse gas emissions and to influence national and international policy.
2. In recent years, the West has experienced very significant droughts across much of the region, reduced snow pack, altered precipitation patterns, severe forest and rangeland fires, warmer temperatures and forest diseases. Climate change and variability have contributed to these impacts. Climate change will have severe economic and environmental impacts on the West in coming decades, including effects on agriculture and tourism, infrastructure (including dams, roads, water and sewer systems), loss of coastal areas, changed fisheries and wildlife, water shortages, storm impacts, and soil erosion.
3. Countries around the world are working to reduce greenhouse gas emissions. In its 2007 assessment report the Intergovernmental Panel on Climate Change declared warming of the global climate system is “unequivocal” and that it is “very likely” due to human caused increases in greenhouse gas pollutants. There is widespread global agreement that climate change presents risks that should be addressed through changed practices and preparation for changed conditions.
4. Appropriate actions are needed to reduce greenhouse gas emissions. Many of these actions could create significant economic benefit for the West, as the United States moves toward new energy sources and technologies that favor domestic resources and carbon sequestration. The opportunities to deploy clean and renewable energy and energy efficiency are abundant in the West and may economically and environmentally benefit states by providing jobs, increasing revenues, improving air quality, increasing energy efficiency, saving costs, conserving water and reducing water pollution.
5. Western states are developing and implementing greenhouse gas reduction policies and some are engaged in climate change agreements that cross state borders. A number of these policies are being developed in conjunction with Canadian provinces. The experience from these projects could be useful to other Western Governors and throughout the Nation as we implement measures to address climate change.
6. The United States government is working to enact national climate change policy. On May 19, 2009, President Obama announced a historic national policy that will reduce greenhouse gas (GHG) emissions and improve fuel economy for all new cars and trucks

sold in the United States. On May 21, 2009, the House Energy and Commerce Committee reported the American Clean Energy and Security Act calling for electric utilities to meet 20% of their electricity demand through renewable energy sources and energy efficiency by 2020 and the establishment of a national cap-and-trade program to reduce carbon emissions from major U.S. sources by 17% by 2020 and over 80% by 2050 compared to 2005 levels.

B. GOVERNORS' POLICY STATEMENT

1. Western Governors urge Congress and the President to act decisively to create a national policy to reduce greenhouse gas emissions. Such a policy should be developed in a manner that: (1) is consistent with the findings of scientific research; (2) encourages job growth, innovation, and entrepreneurship; (3) combines market-based and other policies to reduce emissions in the most cost-effective manner; (4) recognizes and encourages local and state action to reduce emissions; and (5) will encourage comparable action by other nations that are major trading partners and key contributors to global emissions.
2. The Western Governors urge Congress and the President to form national strategies that enhance state authority and leverage partnerships between national, state, tribal, and local governments, build on states' expertise, and encourage states to continue development and implementation of a range of policies. Both market and complementary policies will be necessary to most effectively achieve emission reduction goals. States are uniquely well-positioned to implement policies that overcome market barriers, mitigate costs to consumers and protect vulnerable populations, accelerate new technologies and engage solutions from farms and forests, and otherwise build on the unique strengths and resources of the United States' diverse regions. States should be encouraged, through the use of emission allowance value from a national cap-and-trade program, to adopt such policies that reduce emissions and accelerate technology to the benefit of the nation.
3. The Western Governors urge Congress and the President to recognize and encourage state action in any national market-based emission reduction policy. Where state, tribal, and local actions achieve greater reductions than national policy alone, a national strategy should ensure the integrity of these reductions and not allow compensating increases elsewhere in the country. Such a policy should protect our national interests by supporting state initiative and avoiding unfair competitive advantages and leakage.
4. Western Governors support national, regional, state-level, and tribal policies on global climate change that are consistent with efforts to develop cost-effective clean energy sources and more efficient use of energy in mobile and stationary sources. Western Governors support the implementation of greenhouse gas mitigation tools such as carbon sequestration that have broad public support and potential economic benefit and can help address the unique conditions of the West.
5. Western Governors support national, regional, state-level, and tribal policies on global climate change which comprehensively address transportation emissions with a multi-faceted approach focusing on vehicle emission standards, low carbon fuels, and land use and transportation planning.

6. Western Governors recognize the need for collaboration among Western states to develop climate change policies that consider the unique conditions of the West and provide consistent approaches to recognize and give credit for actions to reduce greenhouse gas emissions.
7. Western Governors recognize that impacts of climate change are presently observed in Western states, and anticipate greater and different impacts in the future. Adaptation to climate impacts will require a wide range of responses and choosing best strategies will require new information. Adaptation decisions will require highly local knowledge and implementation. Local, state, tribal, and regional organizations are uniquely qualified to implement decisions. The federal government should invest sufficient resources to develop the localized modeling and assessment tools necessary to predict and respond to climate changes and associated impacts, and to develop decision tools for state and local governments to assist in state and local adaptation efforts.
8. Western Governors recognize the need to be able to proactively respond to short-term climate change and variability, e.g. drought, forest fires, significant precipitation events, and extreme heat events. Western Governors support creating at the federal and regional level the information, organization, and funding necessary to proactively respond rather than react to these increasingly frequent events.
9. States maintain various water-related plans including state water plans, watershed plans, state drought plans, reservoir management plans, and flood plans. The federal government should provide support and cooperation so that these plans can be consistently and accurately expanded or enhanced to include climate change scenarios, especially within the context of watershed planning.
10. Federal agencies should invest in research programs to study climate change impacts and address scientific questions relevant to the West at the regional, state, and local levels. The Governors believe research should appropriately emphasize decision support, in order to engender informed discussion of climate change issues by decision makers, stakeholders, the media, and the general public. The Western Governors urge Congress and the President through the Climate Change Science Program to fund research for improving predictive capabilities for climate change and related impacts. Additionally, because of the complex climatology in the West, it is important that climate change modeling be conducted on a much finer resolution, e.g. watersheds and sub-watersheds.
11. Given the global nature of climate change, Western Governors encourage both the U.S. government and the international community to recognize the important role of sub-national governments in crafting responses to climate change. The Governors support explicit inclusion of this role in any international agreements reached, including under the United Nations Framework Convention on Climate Change.
12. Western Governors support a full and vigorous discussion, including all stakeholders, and consideration of all alternatives regarding the reduction and mitigation of greenhouse gases, adaptation policies and other global climate change measures.

C. **GOVERNORS' MANAGEMENT DIRECTIVE**

1. The Western Governors' Association shall post this resolution to its web site to be referred to and transmitted as necessary.
2. The Governors direct WGA staff to work with the appropriate federal, regional and state agencies in implementing this resolution.



Governors' Energy and Climate Coalition

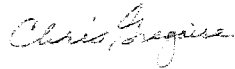
Statement of Principles

May 21, 2009

We, the undersigned Governors, agree to the following principles, and agree to publicly support and seek the implementation of these principles in public policy at every opportunity.

- **The United States urgently needs a comprehensive energy strategy that will generate millions of clean energy jobs, break our dependence on foreign oil, and reduce the threat of global warming. Therefore we support and will lend our voice to Congress to pass legislation that invests in using energy more efficiently and producing more clean energy at home, and sets a cap on greenhouse gases to reduce emissions to levels guided by science to avoid dangerous global warming.**

- States are where the green economy is being built. States are critical to implementing the clean energy policies necessary to help workers, consumers, businesses, and manufacturers prosper in this new economy by accelerating the deployment of energy-efficient and low-emission technologies, assisting industry to retool and workers to retrain, mitigating costs to consumers and businesses, engaging natural solutions from farms and forests, and preparing for the unavoidable impacts of climate change. Therefore we pledge to work with Congress and the Administration to develop a strong state-federal partnership to create and preserve our jobs and industry, keep the United States competitive abroad, and at the same time address climate change threats.



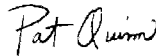
Governor Christine O. Gregoire
Washington



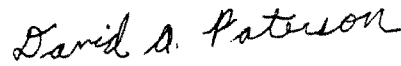
Governor Arnold Schwarzenegger
California



Governor Theodore R. Kulongoski
Oregon



Governor Pat Quinn
Illinois



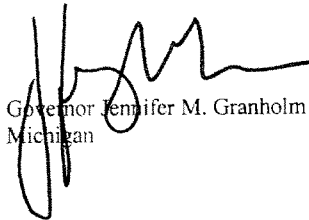
Governor David A. Paterson
New York



Governor Deval Patrick
Massachusetts



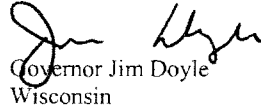
Governor Jack Markell
Delaware



Governor Jennifer M. Granholm
Michigan



Governor M. Jodi Rell
Connecticut



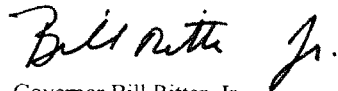
Governor Jim Doyle
Wisconsin



Governor Jon S. Corzine
New Jersey



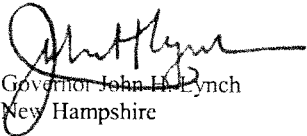
Governor Martin O'Malley
Maryland



Governor Bill Ritter, Jr.
Colorado



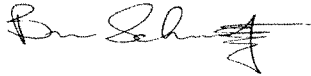
Governor John Baldacci
Maine



Governor John H. Lynch
New Hampshire



Governor Edward G. Rendell
Pennsylvania



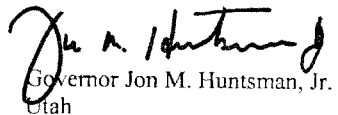
Governor Brian Schweitzer
Montana



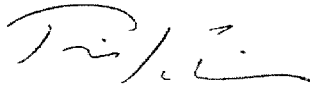
Governor Bill Richardson
New Mexico



Governor Chester J. Culver
Iowa



Governor Jon M. Huntsman, Jr.
Utah



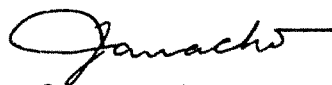
Governor Timothy M. Kaine
Virginia



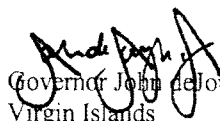
Governor Mark Parkinson
Kansas



Governor Phil Bredesen
Tennessee



Governor Felix P. Camacho
Guam



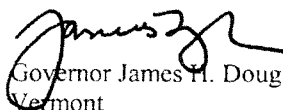
Governor John DeLongh, Jr.
Virgin Islands



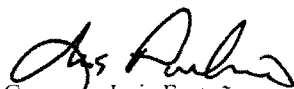
Governor Beverly Perdue
North Carolina



Governor Donald L. Carcieri
Rhode Island



Governor James H. Douglas
Vermont



Governor Luis Fortuño
Puerto Rico



Governor Charlie Crist
Florida



Governor Mike Beebe
Arkansas
(Added May 22, 2009)

Washington State Governor Chris Gregoire
 Follow-Up Questions from July 21, 2009 Senate EPW Hearing

Sen. Boxer Questions

1. *Governor, has private industry responded to your policies to promote green jobs by relocating to your state, increasing investments, or working with the government to develop green job opportunities?*

Our state does not currently have systematic data that specifically ties business relocations to specific policies, but there are clear examples that private industry is responding to our initiatives to move toward a more sustainable and greener economy.

A single policy is unlikely to attract investment across the spectrum, so our approach has been to develop a framework to help advance industry clusters from raw materials to manufacturing, workforce development, utility demand, and incentives for utilities and consumers. The solar industry offers a good illustration of this approach where we have the following policies:

- Renewable Portfolio Standard – requires 15% of large utilities electricity to be renewable by 2020.
- Production incentive for consumer renewables – the more you produce the more you make.
- Incentives for solar hot water heating.
- Investment and operations tax incentives for manufacturing within Washington.

And from these policies flow the following results:

- Increase in residential system installations – increasing business for local installers and manufacturers.
- *REC Solar Grade Silicon* invested in new silicon production capacity in Moses Lake, Washington.
- *Silicon Energy LLC* has opened the first solar module plant in Arlington, Washington.
- Puget Sound Energy has integrated a one-half megawatt solar project with its Wild Horse Wind Farm.
- Solar panels are on every school and on the Performing Arts Center in Wenatchee, Washington.
- Ellensburg, Washington has built a community solar project allowing citizens to invest in solar that serves the local community.

2. *Governor, a July 2009 report by the President's Council of Economic Advisers states: "[A]nalysis suggests that particular areas of 'green' potential (e.g., wind and turbine manufacturing, mass transit, or producing energy-efficient automobiles) pay more on average than otherwise comparable jobs. They are also more likely to be held by primary*

Washington State Governor Chris Gregoire
 Follow-Up Questions from July 21, 2009 Senate EPW Hearing

earners in the household and to be unionized." Do green jobs represent a way to increase job opportunities in this country?

We believe green jobs do provide a way to increase employment opportunities for Washington State citizens. Our 2008 green-jobs survey results showed that the types of industries more likely to be green, on the whole, pay above average wages. For example, transit, turbine manufacturing and automobile industries are all relatively good paying industries with significant numbers of green jobs. However, because the North American Industry Classification System (NAICS) does not draw a distinction between occupations considered to be green and those that are not, it can be difficult to measure the true availability of green jobs. For example, NAICS does not distinguish between wind turbine (a green job) and other types of turbine occupations.

3. *Governor, an April 2009 National Governor's Association document that discusses governors' priorities found that 91 % of governors said that spurring the economy – including the green economy – is a priority, and 81 % said that increasing energy development and conservation – primarily renewable – is a priority. In your opinion, how can the federal government best build on this broad level of support to help states address these types of priorities?*

Governors have an ever-constant eye toward the economy and are always looking for those business opportunities in our respective states that will support job creation and growth. That is why you see the tremendous support you do in the NGA survey information you cite; and the majority of us see a green economy as not only providing those new opportunities that will spur economic growth, but also a means to set our states and country on a path that allows us meet our own energy demands without the need for foreign sources of oil, while also making us stronger stewards of the environment for generations to come.

The American Recovery and Reinvestment Act (ARRA) provides critical investments in our states' and nation's energy infrastructure, so the federal government is already being supportive; but that said, competition is fierce around the globe and for the United States to truly be the world leader in developing and implementing energy technologies, even more substantial federal investments will need to be made with new policies, incentives, and public-private partnerships.

Investments in energy efficiencies and technologies are one thing, but when it comes to growing the economy, all of us – state governments and the federal government – need to simultaneously invest in, and advance, policies in other areas, such as education and job training. In a 10-year economic vision I laid out for Washington in 2007 titled *The Next Washington: Growing Jobs and Income in a Global Economy* (http://www.governor.wa.gov/priorities/economy/next_wa_final.pdf), we identify education

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

as the single most important economic investment we can make and that is an area where ongoing federal support is also imperative.

4. *Governor Gregoire, the Western Governors Association passed a resolution that said: "Appropriate actions are needed to reduce greenhouse gas emissions. Many of these actions could create significant economic benefit for the West, as the United States moves toward new energy sources ... [They urged the federal government] to act decisively to create a national policy to reduce greenhouse gas emissions ... [and] to recognize and encourage state action in any national market-based emission reduction policy." How important are these policies for promoting job growth in your opinion?*

I think a national policy is imperative. While it is difficult to predict exactly how federal policies regarding greenhouse gas emissions will impact job growth, Washington State's efforts to reduce greenhouse gas emissions is instructive in terms of showing how *state* policies can produce positive outcomes on economic development and employment. By way of example, and as indicated earlier, Washington State's Renewable Portfolio Standards have generated increased investments by energy providers in clean energy and energy efficiency. ESD anticipates that these trends will continue, offering continued potential for the creation of new jobs in Washington State that do not currently exist.

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

Sen. Carper Questions

1. *Recently, I've heard some skepticism that "green jobs" are limited in number, highly specialized, and not available to most American workers. From your perspective as a state executive, is there any merit to this concern?*

In 2008, Washington State's Employment Security Department (ESD) conducted a green jobs survey of the private sector. This survey identified over 47,000, or 1.6 percent, of private-sector jobs as green and we believe this is a very conservative estimate. However, the 2008 survey did not measure green jobs in the public sector. ESD believes including the public sector would add thousands of green jobs to the total estimate. We are including these public-sector green jobs in the 2009 green jobs survey currently being conducted, which I will be happy to share with you when it is completed. It may be fair to label the number of green jobs as small, but the types of jobs represented span many sectors of our state's economy. ESD believes that this number is likely to grow and will represent an increasingly larger proportion of employment in the future.

Regarding the assertion that green jobs are specialized and unavailable, the findings of the ESD 2008 survey point in the opposite direction: Green jobs are found across the economy and within a broad range of industry sectors and employers. Since some employers do not draw a distinction between occupations considered to be green from those that are not, it can be difficult to measure the true availability of green jobs. The Employment Security Department is now working to learn how the skills, education and job requirements of employers who provide green products and services are changing so that Washington State's education and training system can provide the programs needed to support the continued "greening" Washington's economy.

Below is a table showing the breakdown of green jobs in Washington State based on education and training levels needed for entry. It shows that Washington State's green jobs span many levels of education and training, with 80 percent requiring less than a four-year degree.

Education /Training Level of Green Jobs in Washington State, 2008

| Description of Education/Training | Number of green jobs | Percentage of total green jobs |
|--|----------------------|--------------------------------|
| BA or Higher | 9,625 | 20% |
| Extensive on-the-job training or some post-secondary | 16,862 | 36% |
| Moderate on-the-job training (1-12 months) | 10,056 | 21% |

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

| | | |
|--|---------------|-------------|
| Short-term on-the-job training (up to one month) | 10,651 | 23% |
| Total | 47,194 | 100% |

2. *No one wants certain regions of the country or segments of the population to benefit disproportionately from the green economy. Could you please provide examples of opportunities for job creation and economic growth in rural communities? What other benefits might accrue to these communities?*

In ESD's 2008 green jobs survey, ESD actually found that green jobs, as a percentage of the labor force, were higher in rural areas than in urban areas. For example, in King County (the Seattle area) only 1.4 percent of employment was considered green. Conversely, in the agricultural regions of North Central Washington, green employment made up 4.4 percent of the total. Specific examples of rural green jobs include organic farm workers, wind turbine technicians and electricians. Continued growth in organic farming and renewable energy will generate new economic growth and employment opportunities in rural communities.

3. *You are showing good leadership with respect to expanding access to green jobs and training opportunities in your state. What can the federal government do from here to promote green jobs and facilitate a smooth transition to a clean energy economy?*

As I mentioned in my response to Senator Boxer, the American Recovery and Reinvestment Act (ARRA) provides critical investments in our states' and nation's energy infrastructure, so the federal government is already being incredibly helpful in laying a foundation to promote green jobs and facilitate a transition to a clean energy economy. However, as you know, competition is fierce around the globe and for the United States to truly be the world leader in developing and implementing energy technologies, even more substantial federal investments will need to be made with new policies, incentives, and public-private partnerships.

Investments in energy efficiencies and technologies are one thing, but when it comes to growing an economy, all of us – state governments and the federal government – need to simultaneously invest in, and advance, policies in other areas, such as education and job training. In a 10-year economic vision I laid out for Washington in 2007 titled *The Next Washington: Growing Jobs and Income in a Global Economy* (http://www.governor.wa.gov/priorities/economy/next_wa_final.pdf), we identify education as the single most important economic investment we can make and it is an area where the federal government needs to continue investing in, as well.

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

4. *As you know, the American Recovery and Reinvestment Act provided \$500 million for green jobs training. This funding, combined with funding infusions for a number of other programs - like Weatherization Assistance - is certainly helping to put people back to work. How can we ensure the sustainability of these jobs over the long term, after Recovery Act funds are expended?*

American Recovery and Reinvestment Act funds provide a great opportunity to jump-start growth in Washington State's – and the nation's – green economy, and we expect to sustain that growth over time. In the short term, we are investing a portion of the Recovery funding as loans for energy efficiency projects that pay for themselves in reduced utility bills. This will extend the availability of those funds over time, for new projects and more jobs. In the longer term, career pathways will help workers identify ways to leverage the skills they develop through these important federal investments and pursue better jobs and higher wages in many sectors of the economy. For example, as our economy rebounds, continued investments in green construction projects that require the use of efficient building materials, smart technologies and other building practices that meet efficiency standards such as LEED, will stimulate new opportunities in many sectors of our state's economy, from manufacturing to engineering companies and the service sector.

5. *Could you elaborate on the roles of apprenticeship and vocational training in the clean energy economy? Why are these pathways to employment so important?*

As I mentioned in my written testimony, apprenticeship as a training model is uniquely positioned to adapt quickly to the needs of the new clean energy economy. It can provide the on-the-job training necessary to prepare workers in new technologies and new skills sets associated with the green economy. Much of what will be done first in our transition to a clean energy economy will happen through the construction of new buildings and the retrofitting of older building as well as in the construction of new wind and solar facilities. Registered Apprenticeships related to building and construction trade occupations comprise over 80% of the registered apprenticeship activity in this state and many are already engaged in educational efforts around green or sustainable practices. Here are some examples of what is currently being done:

- **Electrical:** In 2009 – Southwest Washington Electrical JATC program added a full year to its residential electrician training program in order to include training on Photovoltaic Systems (solar panels). They also included training to teach apprentices Home Technology Integration (Smart House) In addition, their apprentices learn to master building automation systems (key for energy management) and distributive generation – which includes wind, fuel cells, small hydroelectric, etc. They also train apprentices on power quality and lighting efficiency.
- **Machinists:** In Seattle, a local gear manufacturing and repair company called Gearworks has nine apprentices being trained through the Seattle Machinists Apprenticeship Program, sponsored jointly by employers and IAM District 160, who are working on

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

building the gears for wind turbines. (Link to article: <http://apolloalliance.org/new-apollo-program/seattle-machinists-apprenticeships-trains-next-generation-of-windmill-workers/#more-976>)

- **Pipe Trades:** The Seattle Area Pipe Trades Apprenticeship has a class for apprentices to receive a "Green Awareness" certificate. The class covers a vast array of topics including but not limited to high efficiency appliances/fixtures, water conservation, distribution systems, irrigation/reuse systems, and system relevance to LEED.
- **Sheet metal/HVAC:** Western Washington Sheet Metal trains apprentices in heating, cooling and indoor air quality advances in the Sheet Metal and HVAC programs train apprentices on 1) variable speed drives in HVAC applicators 2) geothermal heat pumps 3) green refrigerators (R-410 water etc.) 4) hvac heat recovery 5) fresh air
- **Operating Engineers:** Operating Engineers Local 302 Apprenticeship teaches apprentices about how to maintain water quality as they bulldoze and prepare sites, with techniques for water runoff site containment. They also upgraded to new advanced training simulators for apprentices to learn operating equipment – mastering machine control and function before even firing up an engine and burning fuel.
 - o Their training agents are going green as well - Hos Brothers (employer training agent) has an amazing filtration system to run clean runoff water to near drinking water quality. Another employer training agent, SCI – has all equipment that runs on biodiesel.
- **Cement Masons:** Western Washington Cement Masons, training apprentices in Seattle, teaches apprentices how to construct polished concrete—which reduces lamination of buildings due to reflective surfaces, and also reduces use of linoleum. They also teach apprentices and employers about Pervious concrete – which allows our rain to soak into the ground and reduces harmful run-off to Puget Sound.

Currently, over 6,200 employers provide paid on-the-job training to assure skill development for apprentices in our state. Over the past 12 months, approximately 17,500 Washington workers were actively engaged in registered apprenticeship education.

We are working hard in Washington to increase the number of apprentices in the pipeline by strengthening our vocational education programs in the K-12 system. We have created a program called "Running Start for the Trades" that provides pre-apprenticeship training to students in high school. In some instances, these programs also provide direct entry to apprenticeship programs for successful graduates. These pathways to employment are critical not only because they provide the highly skilled workforce we will need for the green economy, but also because they will lead to good, family wage jobs with benefits.

Washington State Governor Chris Gregoire
 Follow-Up Questions from July 21, 2009 Senate EPW Hearing

Sen. Vitter Questions

1. *Governor, in 2006 you signed into law a requirement to use a blend of not less than 2% beginning June 1, 2006 and reaching a 20 percent blend by June 1, 2009. Can you elaborate as to whether or not Washington State has reached those stated targets?*

Though our state has not yet met those targets, we remain committed to meeting them, and we are convinced they can be reached sooner rather than later.

Initial technical problems with fuel quality have been resolved through clearer standards and monitoring. Production capacity of state-grown biodiesel has been increased significantly, spurred by state investments in oilseed growing, crushing and refining operations.

On September 2, 2009, the state will celebrate the start up of the Inland Empire Oilseeds crusher in Odessa, Washington. The company is owned by agricultural cooperatives that represent 1400 family farms in the state. This final piece of the operation will provide 8 million gallons of high-quality biodiesel, nearly twice the amount needed to meet the state's 20% target.

We are now turning our attention to another significant challenge – the fuel distribution system. We are meeting with the fuels industry in September to work out a plan, which we expect will include retooling the state fuel purchasing contracts to encourage the infrastructure needed to transport and deliver biodiesel from the producers to the consumers.

2. *Governor, in the hearing there was some interruption by a number of individuals celebrating Buzz Aldrin walking on the moon. Can you tell me what Buzz Aldrin's position is on climate change, "global warming" fears, and if he has made any statements in regards to climate change and man-made global warming?*

The hearing took place the day after we marked the 40th anniversary of man walking on the moon, so I believe what we heard was a celebration, yes, of our nation's remarkable achievement – as well as a renewed sense of optimism as to what seemingly impossible challenges we can meet when we work together – not as Democrats, Republicans or Independents, but as Americans.

In order to confront and meet our current energy challenges, we need to tap into the same American ingenuity that put Buzz Aldrin and Neil Armstrong on the moon, and as elected officials, we need to demonstrate the same leadership showed by President Kennedy, members of Congress, and the general public that made that walk on July 20, 1969 possible.

As to Mr. Aldrin's position on climate change and global warming, I cannot tell you what it is, but I would welcome an opportunity to speak with him about it.

Washington State Governor Chris Gregoire
Follow-Up Questions from July 21, 2009 Senate EPW Hearing

Sen. Crapo Questions

1. *In your testimony, you quote the President's Council of Economic Advisors' report saying that occupations in the energy and environment sector are expected to grow by 52% while growth in all the other sectors is 14%. Do you know the types of jobs that make up this statistic? Do you know if this is a net increase in jobs or just a transfer of jobs from one occupation to another?*

The President's Council of Economic Advisors' report projected a 52 percent growth for 2000-2016 in environmental occupations. Those occupations include environmental engineering technicians, environmental engineers, environmental scientists and specialist (including health), and environmental science and protection technicians (including health). The 52 percent growth is the net increase in jobs over the 2000-2016 time periods.

2. *While you have created 47,000 jobs, it is my understanding that during the same time, unemployment nearly doubled from 4.8% to 9.2%. Could you speak to this?*

From July to September 2008, the Washington State Employment Security Department (ESD) conducted a green jobs survey which measured the existing number of green jobs in the statewide labor force. It is also important to note that 2008 green jobs survey focused on establishing a baseline for identifying **current** green jobs, not estimating job creation. The 2009 green jobs survey currently underway should give valuable insight about changes in the number and type of green jobs in our economy and I am happy share that with you when it is complete.

At the end of this survey in September 2008, the unemployment rate was 5.5 percent. Once Washington State began feeling the effects of the recession in early 2009, the unemployment rate began its sharp upward movement. Between March of 2008 and July of 2009, the Washington State seasonally adjusted unemployment rate went from 4.8 percent to 9.3 percent.

3. *Could you talk a little bit more about the algae research being conducted by Blue Marble Energy and Bionavitas?*

I have asked for an overview of both from my state Department of Commerce. Please find that information, attached.

Overview of Blue Marble Energy and Bionavitas
Washington State Department of Commerce

Blue Marble Energy has been developing technologies to convert algae to biogas and various biochemical coproducts for over two years. Their core fermentation process can also handle cellulose, polysaccharides, and high protein content feedstocks.

While most algae technologies are focusing on lipid extraction from micro-algae for biodiesel, Blue Marble Energy considers these approaches infeasible at present due to high financial and energy costs. Anaerobic digestion of biomass to biogas (methane) for transportation fuel and power production is a commercial reality.

Blue Marble is currently processing spent brewers grain, pulp waste from Kimberly Clark, and macro-algae from Puget Sound. They believe the future of biorefining is based on flexible feedstock inputs and diverse co-products across the value spectrum.

Bionavitas' "light immersion technology" incorporates inexpensive, acrylic-like rods that channel sunlight deep into algae propagation systems, allowing algae to grow efficiently in one full meter of water depth. The result is a 10-to-12 fold boost in yields over standard production techniques.

The company has turned its attention first to growing algae indoors for axtaxanthin – a valuable antioxidant food additive. To improve energy efficiency, Bionavitas flashes only those parts of the light spectrum needed for photosynthesis. They are currently raising funds for a pilot-scale manufacturing facility.

The second potential application, bioremediation, is a market Bionavitas sees opening up if carbon cap-and-trade legislation passes. Algae facilities set up near toxic runoffs from mining companies, chemical companies, and major agribusinesses can mitigate selenium, nitrogen and phosphorus and other waste discharges. In time, Bionavitas sees their technology as a key to efficient and effective algae propagation for biofuels production.

Bionavitas has been working with the mining company Agrium to reduce the concentration of selenium leaching from their mines into the local environment. Agrium, along with other members of the Selenium Working Group (Monsanto, Simplot, etc.), have phosphate mines in Southeast Idaho near Pocatello that produce potentially hazardous levels of selenium as a result of mining operations. This leachate has resulted in some animal kills and levels of selenium up to 300 times the amount set for safe human consumption. The waterways from these mines lead directly to the Blackfoot reservoir. These companies have been pursuing a solution for years with very little success.

Bionavitas, under contract with Agrium, has been working with algae species that take up selenium at rates that can accommodate the flow rates from the mines. Even though alpine Idaho is not the optimum location for algae farming, their technology can produce yields that meet the remediation, energy and cost requirements of the project. Bionavitas has developed a process called Transformational Remediation that utilizes the firm's unique technology to

capture the target element (in this case selenium) within the algae biomass, then further processes that biomass through Blue Marble Energy's AGATE system into high-value products. Bionavitas and Blue Marble Energy intend to form a joint venture to provide this solution, which not only reduces environment impacts in a "green" manner but also provides tremendous quantities of biomass, resulting in a revenue flow that can offset or eliminate the cost of the remediation.

This same process can be used in coal mining operations (also selenium leachers), other remediation projects, and wastewater treatment with certain types of algae targeting specific elements including nickel, zinc, iron, cadmium, cyanide, arsenic, and even uranium.

Senator SANDERS. Thank you, Governor.
Governor Hoeven.

**STATEMENT OF HON. JOHN HOEVEN, GOVERNOR,
STATE OF NORTH DAKOTA**

Mr. HOEVEN. Thank you, Madam Chairman, also Chairman Sanders and Ranking Member Inhofe, for inviting me to be with you today.

Our Nation is facing one of the worst economic downturns in decades. In North Dakota, we have a budget surplus, but we are not immune from the national recession. Certainly our continued health, as well as the Nation's continued economic health for the future, depends on the right kind of energy policy. The Waxman-Markey legislation is not the right kind of energy policy.

As a Nation, we must continue to develop all our energy resources, and we must do so with good environmental stewardship. We can do that with a comprehensive energy plan that promotes all of our energy resources.

There are a number of problems with Waxman-Markey. I am going to enumerate some of them, although not all of them.

First, the technology to reduce emissions from coal plants is still in the developmental stage. While there are projects underway to capture carbon and store carbon, we are still in that development process. Instead of penalizing companies, we need to foster the research needed to find more efficient ways to create, transport and store energy.

The reality is that this legislation does penalize, rather than reward, the technological advances that are being made by companies like Basin Electric Power Cooperative in North Dakota. These companies and others have taken preemptive action to reduce their emissions, but these efforts will not be considered in the allowance allocations formula. This penalty also applies to other utility companies in North Dakota and other places that have taken the initiatives to invest in renewable resources.

Also, this legislation will potentially increase greenhouse gases when industries overseas increase production because companies here cannot compete due to higher costs.

This bill will force companies that want to capture and sequester CO₂ to pay twice—once when they pay the carbon tax and again when they pay for the technology to capture and sequester CO₂. And that, ultimately, means a tax on consumers at a time when our economy is struggling.

Instead of Waxman-Markey or similar legislation, Congress needs to implement a comprehensive energy policy that will incentivize industry to develop all of our energy resources, both traditional and renewable energy resources.

The current uncertainty is freezing investment of new technologies on the sidelines—technologies that could help our country produce more domestic energy in environmentally sound, cost-effective ways.

I would like to give you some examples from our State. We have implemented an energy policy called Empower North Dakota to develop all of our energy resources with new technologies, with synergistic partnerships, and with sound environmental stewardship.

Based on the time limit, I am going to submit my comments for the record but just briefly identify three approaches that we are undertaking.

One is in the area of oil production. North Dakota is now the fifth largest oil producing State in the country. Senator, we just passed up Oklahoma, which has historically been a large oil——

Senator INHOFE. [Talking off microphone.] We want it back.

[Laughter.]

Mr. HOEVEN. I understand. Virtually all our wells are directionally drilled. That means one vertical bore, and then we go a mile underground in three different directions. We now produce as much oil from one well as formerly it would have taken 10 or 12 wells to tap. More energy, smaller environmental footprint.

We also take coal, we convert it to synthetic natural gas, we capture the CO₂, carbon dioxide, and we put it down a hole in the oil fields to bring up more oil. Again, less carbon dioxide emissions, more electricity, more oil.

The third example is the biofuels. We now have ethanol plants that are run from the waste steam of power plants, and we are using the gray water, the waste water, from some of our communities like Fargo, North Dakota.

These are just three examples. Understand that we are about better environmental stewardship. But we have got to have a policy that will incentivize the deployment of the technologies to do this.

That is the approach we need to take. That is the kind of energy policy we need from the Federal Government in order to move forward.

Thank you for the opportunity to be here. I appreciate it.

[The prepared statement of Mr. Hoeven follows:]



— State of —
North Dakota
Office of the Governor

John Hoeven
Governor

**Statement of Governor John Hoeven
 State of North Dakota**

**Before the
 Committee on Environment and Public Works
 United States Senate
 July 21, 2009**

Chairman Boxer, Ranking Member Sen. Inhofe and Committee Members: Thank you for the opportunity today to testify before you on the critical issue of energy policy and its effect on North Dakota's economy.

Our nation is facing the worst economic downturn in decades, and while North Dakota retains a budget surplus, we are not immune to its effects. North Dakota's continued economic health and the recovery of the nation's economy depends on a strong, balanced, and comprehensive energy policy, because energy not only drives North Dakota's economy, it drives our national economy. For that reason, it is extremely important we seriously consider the effects that the Waxman-Markey legislation would have on our nation, in a global, competitive economy.

As a nation, we must continue to develop all of our energy resources, and we must also do so with good environmental stewardship, but the Waxman-Markey legislation is not the way to do it:

- The technology to reduce emissions from coal plants is still in the developmental stage. While there are projects underway to capture carbon, commercially deployable technology on a nation-wide scale is still years away. Instead of penalizing companies, we need to foster the research needed to find more efficient ways to create, transport and store energy.
- The reality is, this legislation actually penalizes, rather than rewards, the technological advances that are being made by companies like Basin Electric Power Cooperative and Dakota Gasification Company in North Dakota. These companies have taken preemptive action to reduce their emissions, but these efforts will not be considered in the allowance allocation formula. This penalty also applies to other utility companies in North Dakota that have taken the initiative to invest in renewable resources.

- The legislation will potentially increase greenhouse gases when industries overseas increase production because companies here cannot compete due to the increased costs.
- This bill will force companies that want to capture and sequester CO₂ to “pay twice”—once, when they pay the carbon tax, and then again, when they pay for the technology to capture and sequester the CO₂.

Instead of Waxman-Markey, or similar legislation, Congress needs to implement a comprehensive energy policy that will incentivize industry to develop all of our energy resources—both traditional sources and renewable sources—in an environmentally sound manner. The current uncertainty from Congress’s failure to do so is freezing investment of new technologies on the sidelines – technologies that will help our country produce more domestic energy in environmentally sound, cost-effective ways.

Let me give you some examples from our experience in North Dakota. We’ve implemented EmpowerND, a comprehensive energy policy designed to spur development of all our energy resources with new technologies, synergistic partnerships, and sound environmental stewardship. This is transforming how energy is developed throughout North Dakota.

Efficiency and innovation play a large role in our energy development efforts. For example, at the Blue Flint Ethanol facility in western North Dakota, waste heat from an adjacent coal plant is recycled to produce 50 million gallons of ethanol per year, resulting in one of the most energy efficient, environmentally friendly facilities in the industry. Another example, Tharaldson Ethanol in Casselton located in eastern North Dakota is recycling waste water from the City of Fargo to produce 120 million gallons of ethanol per year.

Also, new technological advances have changed the way oil is drilled in North Dakota. Recently, North Dakota passed the state of Oklahoma in oil production, and we are now the fifth largest oil producing state in the nation. With horizontal drilling techniques, we can now tap as much oil with one well as traditional drilling techniques produced with ten. We’re also implementing tertiary recovery using advances in carbon capture and sequestration. Both methods in oil recovery allow us to access new formations and produce more oil while leaving a smaller environmental footprint.

We’re also making tremendous progress in the implementation of clean-coal technologies. In fact, North Dakota is home to the largest carbon sequestration project in the world. This project, operated by Dakota Gasification Company (DGC), converts lignite coal into synthetic natural gas and delivers that natural gas to market via pipeline. In the process, the plant also captures and sequesters about 3 million tons of CO₂ per year. As of Dec. 31, 2008, DGC has captured more than 16 million tons of CO₂, and that CO₂ is piped to the oilfields where it is used for tertiary oil recovery.

In addition, Basin Electric Power Cooperative’s Antelope Valley Station, a coal-based power plant, is participating in another large-scale CO₂ capture and sequestration demonstration project in cooperation with the state of North Dakota and the Department of Energy (DOE). This project was recently approved for \$100 million from the DOE, and is part of PCOR (the Plains CO₂ Reduction Partnership). Antelope Valley Power Station will be the first commercial-scale coal-fired electric plant in the nation to capture and sequester CO₂ on a

post-combustion basis. This means more energy from coal-fired production, a reduction in CO2 emissions, and more oil produced through tertiary recovery.

In our last legislative session, North Dakota passed comprehensive legislation making it the first state in the nation to create a legal and regulatory framework for carbon capture and sequestration. This legislation established a permitting process and the environmental requirements for geological storage of CO2. We also passed legislation that provides a partial exemption from the coal conversion tax for energy conversion facilities that capture and store CO2. This legal and regulatory framework provides predictability and incentives to companies looking to start or expand carbon capture and sequestration operations in the state. We need this same legal and regulatory certainty at the federal level to encourage the use of carbon capture and sequestration to reduce carbon emissions throughout the nation.

These and other cases show there is a better alternative than Waxman-Markey. The right approach is creating a comprehensive energy policy to empower energy development without taxing consumers. Through a comprehensive energy plan, our country can spur development of all of our energy resources with good stewardship while still promoting energy efficiency and conservation. The result will be more jobs, a stronger, more vibrant economy, good environmental stewardship, and greater energy independence and security for our nation.

**Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission**

Questions for Hoeven

Questions from:

Senator Thomas R. Carper

- 1. Recently, I've heard some skepticism that "green jobs" are limited in number, highly specialized, and not available to most American workers. From your perspective as a state executive, is there any merit to this concern?**

North Dakota does not have any specific statistics on the number of green jobs; however, according to a study by Pew Charitable Trusts, jobs resulting from the development of renewable sources of energy and energy efficiency in North Dakota grew by an average of 3.2 percent annually over the past 10 years. However, we are also growing in traditional energy jobs. It is important to note that we need them both, and we need them working together.

For example, in my testimony, I explained how Blue Flint Ethanol is using waste heat from an adjacent coal plant to produce 50 million gallons of ethanol per year, resulting in one of the most energy efficient, environmentally friendly facilities in the industry. Tharaldson Ethanol is recycling waste water from the City of Fargo to produce 120 million gallons of ethanol per year. We have wind producers working side by side with lignite coal utilities to advance transmission lines and meet environmental standards that benefit all of us. Through these and many other partnerships, we are making traditional energy cleaner.

In addition, we can also make these traditional energy jobs "green jobs" by investing in the research and technology that will allow us to recover and use that energy in a cleaner, more efficient and environmentally sound manner as we have done with horizontal drilling and carbon capture and sequestration here in North Dakota.

Again, it is important to develop our entire energy sector to promote growth in both our economy and of jobs, and it is important we provide the incentives to do so as we have done in North Dakota.

- 2. No one wants certain regions of the country or segments of the population to benefit disproportionately from the green economy. Could you please provide examples of opportunities for job creation and economic growth in rural communities? What other benefits might accrue to these communities?**

Aggressive economic development has been at the center of our strategy to grow our economy in North Dakota, and we've seen positive results, not only in our larger cities, but in our rural communities as well. Rural communities have benefited from the development of wind farms and biofuels plants across the state. In addition, our farmers are benefiting from new value-added agriculture opportunities resulting from the growth in ethanol and biodiesel production capacity.

Similarly, small communities throughout Western North Dakota are seeing growth from the development of the Bakken Formation, and we intend to see that growth continue as companies tap into the Three Forks Formation that lies below the Bakken Shale. It's important to note that this is being done with state-of-the-art technologies like horizontal drilling and carbon sequestration. With horizontal drilling techniques, we can now tap as much oil with one well as traditional drilling techniques produced with ten. We're also implementing tertiary recovery using advances in carbon capture and sequestration. Both methods in oil recovery allow us to access new formations and produce more oil while leaving a smaller environmental footprint.

- 3. You are showing good leadership with respect to expanding access to green jobs and training opportunities in your state. What can the federal government do from here to promote green jobs and facilitate a smooth transition to a clean energy economy?**

The first thing the federal government can do – and could do fairly quickly – is implement an E-15 fuel standard. Second, as I pointed out in my testimony, North Dakota's growth in energy of both renewable and traditional resources is largely the result of a strategic, comprehensive energy plan, EmpowerND, that we created in 2002. A national plan like EmpowerND would provide the production, marketing, finance, and tax incentives that would best develop all our energy resources. But again, we need to develop all our resources – traditional and renewable – to lead our country toward energy independence and economic recovery.

- 4. As you know, the American Recovery and Reinvestment Act provided \$500 million for green jobs training. This funding, combined with funding infusions for a number of other program – like Weatherization Assistance – is certainly helping to put people back to work. How can we ensure the sustainability of these jobs over the long term, after Recovery Act funds are expended?**

Creating a comprehensive energy plan on the federal level is crucial to ensuring long-term growth and job creation. In addition, rather than taxing energy companies, we need to provide the incentives for them to invest in research and technologies that will result in new ways to utilize all our energy resources with good environmental stewardship, and this ultimately means more jobs and a stronger economy. In other

words, we need to have a tax, regulatory and legal framework nationally that ensures our industries remain competitive.

- 5. Could you elaborate on the roles of apprenticeship and vocational training in the clean energy economy? Why are these pathways to employment so important?**

According to the U.S. Department of Labor, up to half of the energy industry's workforce – or more than 500,000 workers – will retire within the next five to ten years. In North Dakota, we are already seeing a labor shortage in these areas, and we've worked to help train and educate our workers to help fill some of these positions, many of which are highly specialized. This includes training and education available through the National Energy Center of Excellence in Bismarck, the Petroleum Safety and Training Center in Williston and the wind energy technician classes available through the Lake Region State College in Devils Lake. We have also provided incentives for companies through our Operation Intern program to provide internships and apprenticeships so our young people can gain the experience and on-the-job training they need.

**Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission**

Questions for Hoeven

Questions from:

Senator James M. Inhofe

1. **Being a state that is heavily reliant on the energy and agricultural industries, what have you been hearing from your constituents regarding cap and trade or Waxman Markey?**

North Dakota is a very energy-intensive state, and constituents know that they will see a dramatic increase in their energy prices. A recent study by the National Association of Manufacturers (NAM) and the American Council for Capital Formation (ACCF) shows that North Dakota will experience a decrease in jobs, gross domestic product, and disposable income while seeing a steep rise in electricity and gas prices.

2. **Since your state ranks 4th on a per capita energy basis according to EIA, Waxman Markey has the potential to impact your state and its rate paying constituents in a much more disproportionate manner than a state with a more temperate climate. Do you believe this is a fair and equitable manner to reduce emissions?**

As I pointed out, North Dakota is an energy-intensive state, not only because many of our industries – agriculture, manufacturing and energy – require large quantities of energy, but also because of our climate. Studies have shown that North Dakota will see a disproportionate increase in its energy prices compared to other parts of the nation, and the North Dakota Public Service Commission estimates this will cost North Dakotans \$400 more per year on average. This will hit lower earners or those on fixed income the most. The best way to reduce emissions is to invoke certainty in the market through the implementation of a comprehensive energy plan like EmpowerND that encourages the development of all our energy resources and incentivizes the research and technology to use our traditional sources like oil and coal efficiently and with good environmental stewardship.

**Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission**

Questions for Hoeven

Questions from:

Senator David Vitter

- 1. Governor, can you discuss briefly the Bakken Shale in terms of its history and resource potential, as well as the quality and pay of jobs in North Dakota's burgeoning oil industry?**

In 2006, the North Dakota Geologic Survey conducted a study that showed more than half a billion barrels in reserve in the Bakken Formation. This was confirmed two years later when the U.S. Geological Service completed a study showing reserves of up to 4.3 million barrels of recoverable oil in the Bakken Formation. Oil development has helped spur growth in our rural communities and has helped increase wages and income across the state. For example, Slope County, which is the smallest county in North Dakota, has the highest annual average wages in the state. Slope County is followed by Oliver County with the second highest wages. Oliver County is situated in an area abundant with coal. North Dakota's oilfields and coalmines are significant sources of jobs that not only pay well, but boost wages at other jobs because they help create competition for employees.

- 2. Can you provide any examples of "green jobs" in North Dakota that are providing similar salaries and benefits as the oil industry in North Dakota?**

We are creating green jobs with the development of wind farms and biofuels facilities that provide good wages just like the good jobs we have in traditional energy. It is important to note, however, that we are also growing in traditional energy jobs. We need the development of both renewable energy and traditional energy to create good jobs, and we need them working together.

- 3. Governor, both India and China have made pretty clear that they have no intention of joining the U.S. with mandatory caps on carbon emissions. Can you share your thoughts on how this would affect U.S. competitiveness in a global economy?**

If we continually constrain our industries without similar regulation in foreign countries, we are tying the hands of U.S. industry, encouraging further investment

overseas, and promoting greater dependence on foreign sources of energy. That is both an economic and security risk for our country.

Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission

Questions for Hoeven

Questions from:

Senator Mike Crapo

1. **Senator Dorgan recently penned an op-ed in favor of a cap and dividend approach where the government would use the majority of revenue from a plan that caps CO2 to provide refund payments to citizens who would experience increased energy costs. Do you support this approach for North Dakota?**

I don't have enough information about his cap and dividend approach to answer your question, but I favor the approach outlined in my testimony.

2. **Do you believe a cap-and-dividend approach will create barriers to production of the Bakken field and jobs for North Dakotans?**

Again, I don't have enough information about this approach, but I favor a comprehensive energy policy on a federal level like I outlined in my testimony.

Senator SANDERS. Thank you, Governor.
Governor Corzine.

**STATEMENT OF HON. JON S. CORZINE, GOVERNOR,
STATE OF NEW JERSEY**

Mr. CORZINE. Thank you, Mr. Chairman and Madam Chairwoman. It is great to be back with all of you, the Ranking Member and others.

This whole topic of climate change, energy and green jobs is at the heart of economic policy of many of the States, and certainly in the State of New Jersey.

In partnership with President Obama and the leadership of this committee and others in Congress, and through the efforts of State and local governments across the country, we are in the midst of a real revolution right in front of our very eyes. It is happening. It is positive. It is creating jobs. It is addressing many of our challenges. We want to make it better, and I think that is what this debate is about.

It is a revolution that addresses the clear and present challenges of climate change and its impact on our stability in a lot of different areas, national security, economic security and, obviously, environment. This revolution requires, in my view, transformational actions. I think you are hearing some of those kinds of things from my other colleagues, when we think about both production and consumption and certainly about transmission as well.

Transformation is and will produce tens of thousands of jobs. It already has in New Jersey. You heard Senator Lautenberg talk about the 25,000 jobs and 2,000 companies that have been framed up in this decade in New Jersey. I actually think we have larger numbers than that in our calculations. But there is a substantial amount taking place. New skills are being established every day, training programs in our community colleges, as we have heard from others. There is a lot going on, and it is important at this time of recession.

Rising energy demand, peak level peak loads, price volatility, rising prices, greenhouse gas emissions, all require a comprehensive approach. That is what we are doing in New Jersey, and I am proud of our efforts there. Let me outline, briefly, some of our approaches. Again, there is more complete information on those approaches included in the record.

First, I think the fundamental necessity which is part of this whole discussion is that you need mandated, measurable and achievable objectives for change. Many of us talked about the setting of these objectives: 20 percent reductions in greenhouse gases by 2020 and 80 percent by 2050. We have set those in stone, as have many other places, reduction of energy consumption by 20 percent for the State of New Jersey by 2020. We have set that as a mandated requirement, reducing peak demand by 20 percent by 2020. Playing off of some of the things that I heard the Senator from Tennessee talk about, that 30 percent renewable portfolio standard, you have to have measurable, mandated objectives.

We have taken aggressive steps to meet those. We are part of the 10 States that have implemented a cap-and-trade program that has

effectively been implemented over the last year. It will continue to put pressure to reduce carbons.

We have laid out a comprehensive energy master plan that is really complete in both conservation efficiency and making sure that our renewable standards are in place. And it is pushing forward with mandated efforts to get these things done.

We have established a clean energy program which uses market-based techniques to establish support and grant making the possibilities, both for consumers and business, and making sure that we are implementing efficiency standards. We are seeing the product of that. A lot of those 2,000 companies that I mentioned are getting support in establishing their business plans and moving forward.

And I would say in a fourth area, we are making substantial investments in mass transit and lowering our carbon standards by joining with California to make sure that we are not putting more carbon into the air through the use of cars, particularly in the most densely populated States in the Nation.

So, we have substantial results in New Jersey. We have the most solar panels installed in the country other than in the State of California. We have had a 100 percent increase in the last 3 years in that. We have added energy efficiencies, and we are moving in all areas of weatherization, solar installation, cogeneration, smart grid. All of these areas come together with those other policies.

I congratulate Congress on taking action to move this forward in a national format as opposed to regional formats. So, I hope you will move forward and the Governors have a lot to add.

Thank you.

[The prepared statement of Mr. Corzine follows:]

**Governor Jon S. Corzine,
State of New Jersey
Testimony to the Senate Committee on Environment and Public Works
Committee
Chair, Senator Barbara Boxer
Ranking Member, Senator James M. Inhofe**

Tuesday, July 21, 2009

Thank you to the Chair and the members of the committee for the invitation to speak to you today.

Under the leadership of President Obama, this body, your colleagues in the House, and states across this country, we are on the verge of a green revolution. This revolution will require a new way of thinking about our energy supply, energy demand and our impacts on the global environment.

It will require the creation of new jobs across virtually every sector of our economy. From financial institutions that are investing in the next innovation in solar energy technology, to the construction firms that will be modernizing our aging energy infrastructure, to the scientists at Rutgers University who are developing ways to convert algae into a renewable energy fuel - skill and ingenuity of many kinds will be needed.

We face serious challenges that need to be met with serious solutions. Some of the challenges include:

- rising energy demands
- rising peak demands for electricity
- rising and volatile energy prices
- and the rising amount of greenhouse gas emissions attributed to our current energy practices

These challenges if not met will compromise the reliability of our energy supply, burden our homes and businesses with spiraling energy prices and threaten our global environment.

Today, I am proud to say that New Jersey is at the forefront of leading this green revolution, and meeting the challenges that threaten our economic and environmental security.

Through efforts such as our Energy Master Plan, the Regional Greenhouse Gas Initiative, and our efforts under our Global Warming Response Act, we have fashioned responsible, comprehensive and aggressive strategies necessary to meet these challenges.

To address the energy challenges facing us, we have set aggressive targets for New Jersey.. These include:

- Reducing greenhouse gas emissions to 1990 levels by 2020 and 80% below 2006 levels by 2050.
- Reducing energy consumption 20% by 2020.
- Reducing peak demand for electricity by 5,700 megawatts by 2020.
- Having 30% of our electricity supply come from renewable energy by 2020, this includes:
 - 3,000 megawatts from offshore wind, and
 - 2,000 megawatts from solar energy

We have prioritized several programs that will realize these goals at the lowest cost to the consumers.

- New Jersey has one of the most aggressive Renewable Portfolio Standards in the country. We currently require our electricity suppliers to purchase a specified percentage of their electricity from renewable energy each year. Currently, they are required to have 22.5% of their electricity

come from renewable energy by 2020, but we are in the process of modifying this amount to 30% by 2020.

- New Jersey participates in the Regional Greenhouse Gas Initiative, which is the first mandatory carbon cap and trade program in the country. Here we cap carbon dioxide emissions at current levels through 2014 and then reduce emissions 10 percent by 2018. The electricity generators are required to purchase these allowances through an open auction design.

We reinvest the revenue from the auction into renewable energy, energy efficiency, and other efforts that reduce greenhouse gas emissions.

New Jersey's Energy Master Plan is our road map to meeting our State energy challenges. This includes aggressive goals in both energy efficiency and renewable energy, often grouped together under the title of "Clean Energy".

Specifically, we have set aggressive targets for both solar energy and offshore wind developments that are some of the most aggressive in the country.

New Jersey's policies, market-based Solar Renewable Certificates, and solar Renewable Portfolio Standard all help assure the solar industry that it will always be welcome in this state. This is market based solution that has helped to make New Jersey the home to more solar energy installations than every other state in the country, except California. We currently have 4,000 installations totaling more than 90 MW.

New Jersey is also on its way to citing the first offshore windmills off of the Atlantic Coast. We are not working to host one offshore wind project, but three totaling more than 1,000 megawatts by 2013. We are developing programs similar to our successful solar programs, to ensure these projects become

realities. These projects will require workers from electrical engineers to steel workers and long-shoremen.

Clean energy resources represent new industries and new jobs for New Jersey.

Over the next 11 years we will:

- Create a 21st century energy infrastructure for NJ, through projects such as smart grid modernizations to our energy infrastructure.
- Achieve estimated \$30 billion in total energy savings for consumers between 2010 and 2020
- Stimulate \$33 billion worth of investment in the State energy infrastructure
- Enhance the reliability of the system by reducing overall demand and the peak demand for electricity.

In order to implement these goals we estimate that approximately 20,000 direct jobs will be created between now and 2020. These jobs will include:

- Energy Efficiency – weatherization and retrofits
- Solar Energy – solar installations with renewed focus on manufacturing
- Wind Energy – installation, assembly and hopefully manufacturing of the wind turbines that will be located off of our shore
- Cogeneration – construction and plant management jobs
- Smart grid – construction and possible IT jobs

New Jersey's energy and clean energy policies set for the next two decades will continue to drive demand for a diverse range of temporary jobs to high-tech careers.

Other policies that provide incentives related to zero-waste, water conservation, open space, will also result in significant expansion of "green" employment in New Jersey.

In October 2008, my administration embarked on its own stimulus plan aimed at helping us to rebuild our traditional energy infrastructure, and through a

partnership with our public utilities to provide an energy efficiency program to New Jersey home and business owners. Collectively, these efforts will include over \$1.2 billion in investment and have the potential of creating over 2,000 jobs from entry-level energy auditors to traditional construction trades.

To prepare New Jersey's workforce to meet the demands for workers in the "green" economy, our Department of Labor and Workforce Development is leading the way to identify these emerging job opportunities and address the existing skill gaps in the workforce.

We intend to meet the near-term green industry workforce needs – identifying essential education, training and worker development programs that are not yet in place and creating them – and to focus our efforts on meeting the longer-term needs of key, clean-energy and clean-technology businesses.

Therefore, our Department of Labor and Workforce Development has created programs such as our Green Jobs Partnership Training Program that is teaching entry-level workers the energy efficiency skills necessary to meet our short-term energy efficiency needs. This program will graduate 300 qualified workers over the next year, and the State's largest utility company has already committed to hire 100 program graduates.

After the training, the participants will be placed in jobs with industry partners. We will then reimburse the employers for up to 50% of the minimum \$15 hourly wage paid during these three to six month internships.

We also provide customized training for incumbent workers at energy-related employers. Over the past three years, these training programs have provided matching grants to 12 employers to provide job training to their existing workforce in energy-related occupations.

Through our public policy that solidly cultivates the clean energy industry, partnerships are being built among state agencies, employers, labor unions, educational institutions, community-based organizations, and other stakeholders to ensure that New Jersey is able to respond effectively to the evolving workforce needs of the energy industry.

Whether it is training at risk-youth to become skilled in energy efficiency measures or supporting clean energy incubators at our universities - New Jersey's workforce is set to respond.

In New Jersey we are also deeply invested in cultivating the clean energy supply chain so that we're not only leading in solar installations and energy efficiency but stimulating economic development by having the parts built in New Jersey. New Jersey's Edison Innovation Clean Energy Manufacturing Fund offers financial assistance in the form of zero interest loans and grants to support Class I renewable energy or energy efficiency companies entering or expanding their manufacturing operations in New Jersey.

We recently made the first award of this incentive to a company which manufactures solar panel smart grid technology on utility poles, the kind of innovation that begins to create a niche market in New Jersey and will lead to an additional 150 new jobs in that one company alone.

These are all excellent policies and promising developments. However, I must emphasize that the aggressive actions that states like New Jersey is only the beginning. If we do not have technology innovation, we will not be able to meet the challenges we face. Current technologies do not provide us with the affordable, reliable, and environmentally neutral technologies that our economy and environment needs.

In New Jersey we are doing our part, working aggressively with our universities and the private sector to support research and development in the fields of clean energy. However, the efforts of New Jersey are a mere drop in the bucket when compared to the amount of research that needs to take place to provide us with the energy future we need.

Solar and wind are great technologies, but we must find ways to build it cheaper, and make the electricity these technologies supply less intermittent. Plug-in hybrids are promising, but we must perfect the battery and charging technologies. Biofuels such as cellulosic ethanol and algae offer great promise, but we must perfect these technologies and enable them to be commercialized.

There's great potential here. But to realize all of this potential, we need national leadership to dedicate the resources necessary to provide the United States and the world with the silver bullets necessary to fully meet the challenges we presently face.

In closing, I would like to emphasize the importance of a national approach to enable the financing of clean energy technologies.

One such mechanism could be a Green Bank. It would operate as a federally-owned, independent corporation providing low-cost financial support to private clean energy projects. It is my opinion that this concept can be part of a solution that will:

1. Spark deployment of clean energy and energy efficiency projects and shrink greenhouse gas emissions while spurring jobs and lending;
2. Drive down the costs of – and broaden support for – addressing climate change; and

3. Help us to compete with Europe and Asia which continue to increase their investments in clean energy, even during this global recession.

With the flexibility to work with the full range of private sector financing tools, and at the proper scale, with a minimum funding level of \$10 billion, and ideally \$50 billion, the Green Bank would serve as the Marshall Plan for an emerging, low-cost, low-carbon energy economy.

This needs to be part of a larger national strategy to support technology research and development, innovation, and the deployment of renewable energy resources that will provide us with solutions to our energy challenges.

I endorse concepts such as the Green Bank, also known as the Clean Energy Deployment Administration in the Waxman-Markey bill. I respectfully urge that Congress create the necessary financial mechanisms that provide the independence, flexibility, and funding necessary to support the development of clean energy, stimulate job growth, shrink harmful emissions, and spark our global competitiveness.

In 1879 New Jersey was home to Thomas Edison's discovery of the incandescent light bulb. In 1883, Roselle, New Jersey was the first village in the world to be lighted by Thomas Edison's incandescent light bulb. It was an experiment to prove that a town could be lighted by electricity from a single generating station.

Therefore, it is fitting that more than 120 years later, New Jersey is leading the way in practices and technology developments that provide our State and this nation with the revolutionary energy solutions that we so desperately need during this time.

The efforts of my administration will not wane until we can proudly say, *"We make it, We fix it, We install it, We support it, We teach it and We live green in New Jersey."*

Thank you again for the invitation and attention to this key economic development and environmentally responsible issue.

Response to Senate EPW from Governor Jon S. Corzine, New Jersey

Questions from Senator Barbara Boxer:

1. Governor, has private industry responded to your policies to promote green jobs by relocating to your state, increasing investments, or working with the government to develop green job opportunities?

Proposed Response

New Jersey's strategic advantages and long history of supporting innovation have helped make the state a destination for businesses of all industry sectors. To further strengthen our position as a leader in the clean energy sector, New Jersey has recently enacted various measures that are improving the energy environment in our state and creating green jobs.

The anticipated State investment in New Jersey energy infrastructure as a result of the Energy Master Plan is estimated to result in the creation of 20,000 jobs between now and 2020. These jobs will consist of operations and maintenance jobs, and construction jobs directly related to the State's energy infrastructure.

As these efforts get underway, the State, through the Department of Labor and Workforce Development (LWD), has developed industry recognized green job training programs that will provide training to underserved urban residents and also include the retraining of existing workers to upgrade their skills. This program will graduate 300 qualified workers over the next year. After their training, the participants will be placed in jobs with industry partners. We are pleased that over the past three years, 1,953 New Jersey workers have been trained in the emerging green energy sector through more than \$1 million in Customized Training Grants provided by LWD and matched by funds from their employers.

Additionally, as part of New Jersey's economic stimulus plans, the state Board of Public Utilities (BPU) approved infrastructure spending proposals in April for five of New Jersey's major utilities. The approved plans will not only expedite spending on infrastructure projects to ensure the state's energy security, safety, and reliability, but they also will result in approximately 1,300 new hires and an estimated 14,000 new, indirect jobs.

The New Jersey Economic Development Authority (EDA), in partnership with the BPU and the Department of Environmental Protection (DEP), has also introduced a suite of products that supports the state's Energy Master Plan. These new green programs have enhanced the state's capacity to provide funds to encourage the creation of green collar jobs in New Jersey.

The Clean Energy Manufacturing Fund (CEMF) was designed to support companies looking to site a Class I renewable energy or energy efficiency product manufacturing facility in New Jersey. Petra Solar, Inc. became the first business to be awarded funding under CEMF in July as part of the Fund's first solicitation. Petra Solar received a total of \$3.3 million to support the purchase of equipment and machinery and the planning/design process. This project will result in a total public/private investment of more than \$7.6 million and the company expects to create 164 new jobs. We are encouraged that the second CEMF solicitation, which ended July 15, drew 31 applications, which is twice the demand of the first solicitation.

In July, PSE&G received approval from the BPU to invest \$515 million in 80 megawatts of solar projects, doubling the state's solar capacity and creating green jobs. Under an agreement reached in its Solar 4 All filing, the utility expects to complete the installations by the end of 2013. PSE&G awarded the contract for the supply of the 200,000 pole-attached units to New Petra Solar. As a result, Petra Solar has committed to make the solar units in New Jersey and expects to hire more than 100 employees to meet the needs of the contract. The Solar 4 All

program is one of several PSE&G initiatives that are helping to reduce carbon emissions that contribute to climate change while creating new jobs. In August, New Jersey became second in the nation for solar and renewable advancement with the number of solar installations totaling over 4,000 with more than 90 MW state-wide. Seven years ago, the state had only six solar installations.

Another new program that has excited private industry is the Clean Energy Solutions Capital Investment (CESCI) Loan/Grant Program, which supports commercial, institutional or industrial entities advancing energy-efficient end-use projects, combined heat and power (CHP or cogeneration) production facilities, or construction of state-of-the-art, efficient electric generation facilities. We have seen an overwhelming demand for this program, which is capitalized through the Regional Greenhouse Gas Initiative (RGGI). To date, the EDA has received 36 intake forms from companies seeking to benefit under CESCI, including 23 related to solar, 10 related to CHP, two related to biomass and one related to wind. These applicants are seeking a total of \$123.1 million in assistance, which is expected to leverage over \$650 million in total public/private investment. We hope to announce the award of the first recipient in the next two months.

While it is difficult to quantify the impact of these newer programs, the State has found enormous success in attracting and supporting the green economy over the past few years. Carlstadt-based Hycrete, Inc. is a company that develops water based admixture that acts as waterproofing and corrosion protection when added to regular concrete. This company is part of the growing green building materials market, which NextGen Research estimates will grow about 5-percent per year globally to reach \$571 billion by 2013. Hycrete received a grant from the EDA and has grown from a staff of 25 to 40 over the last year. Pennington-based Ocean Power Technologies is a pioneer and a world leader in wave-energy technology that harnesses ocean wave resources to generate reliable, clean and environmentally-beneficial electricity. This company received a total of \$1.25 million from the EDA, the BPU and the New Jersey Commission on Science and Technology (CST) and expects to expand its staff of 42 in the near future. TerraCycle, a Trenton-based company that makes affordable, eco-friendly products from a wide range of different non-recyclable waste material, has recently grown from a staff of two to 55 and was supported by the State of New Jersey through the innovative Technology Business Tax Certificate Transfer Program. The company expects to double its current workforce within the next two to three years. Finally, Princeton Power Systems, which was formed in a Princeton University dormitory room in 2001, developed a grid-tied inverter that allows raw electricity produced by a group of solar panels to flow easily into the main power grid, leading to higher levels of efficiency. The company has received nearly \$2 million in support since 2006 from the EDA, the BPU and the CST.

New Jersey's commitment to investing in clean energy has ensured our state is able to attract and develop companies like Petra Solar, Hycrete, Inc., Ocean Power Technologies, TerraCycle and Princeton Power Systems. We are confident that the new programs unveiled in support of the Energy Master Plan will help to ensure even greener job opportunities and increased investment in New Jersey.

2. Governor, a July 2009 report by the President's Council of Economic Advisers states: "[A]nalysis suggests that particular areas of 'green' potential (e.g., wind and turbine manufacturing, mass transit, or producing energy-efficient automobiles) pay more on average than otherwise comparable jobs. They are also more likely to be held by primary earners in the household and to be unionized."

Do green jobs represent a way to increase jobs opportunities in this country?

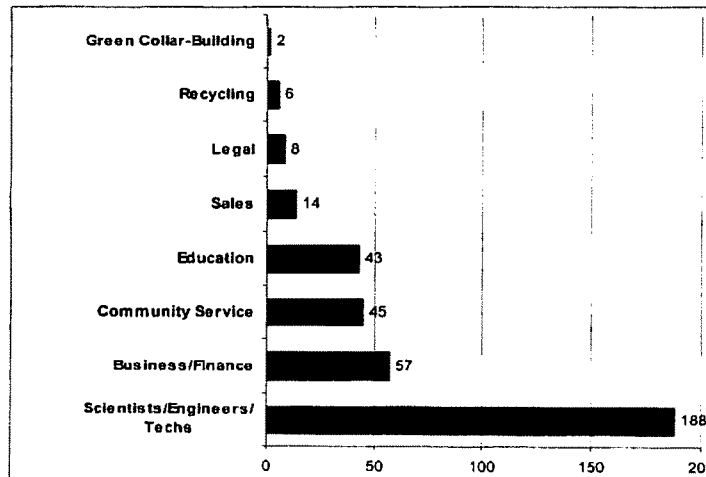
Proposed Response:

Developing good jobs in the green economy is one of the highest priorities of my Administration. From establishing renewable energy standards in law and state policy, to the cleaning up industrial areas including superfund sites; from moving to local sustainable agriculture to retrofitting and weatherizing energy-inefficient older housing stock, we are taking action, and these actions are creating a strong and growing demand for "green" jobs.

Employment impact studies suggest that there are significant growth opportunities in green employment. Last fall, New Jersey finalized its Energy Master Plan, a long-term strategic plan for the State's energy needs through 2020. Implementation of this plan is expected to create between 7,000 and 10,000 green jobs per year in energy efficiency and alternative energy sectors. Many of these jobs are suitable for high-skill dislocated workers with short-term skill enhancement training.

We have already seen significant increases in the number of green job openings. Using data collected by "spidering software" which queries all job openings posted on websites, newspaper boards, and company boards, we found that 300 to 400 "green" jobs were posted during the last eight months. These are jobs whose job titles have specific "green" keywords, such as solar, wind, energy efficiency, biofuel, renewable energy, and retrofitting. Most of these job postings to date seek "white-collar" workers concentrated in the fields of professional/technical services and business finance. The following chart provides information on the types of "green" jobs posted during the last eight months:

Average Monthly Green Jobs Openings, December 2008 to July 2009



Specific business/finance job openings included project managers in renewable energy and business developers. Listings for professional/technical positions included a variety of engineers (civil, environmental, solar/electrical), technicians, and drafters. The third largest group was comprised of community service positions; these workers will be performing the necessary outreach functions to educate the public regarding the environment and how to save on energy consumption (including through weatherization assistance). The following table provides more details regarding the types of jobs that were posted during the last eight months.

| Green Job Openings in New Jersey December 2008-July 2009 | | |
|---|-------------------------------------|---|
| Occupational Group | Types of Jobs | Total # of Openings Dec 08 to Jul 09 |
| Scientists/Engineers/ Techs | Climate/Environmental Engineer | 459 |
| | Environmental Research | 133 |
| | Environmental Safety | 134 |
| | HVAC Engineer/Technician | 140 |
| | Hydrologist/Geologist | 303 |
| | Photonics | 22 |
| | Power Engineer | 163 |
| | Biochemical Engineers/Scientists | 98 |
| | Bioenergy Engineers/Scientists | 4 |
| | Hydrocarbon Engineers/Scientists | 3 |
| | Solar Engineers/Scientists | 18 |
| | Thermal Energy Engineers/Scientists | 9 |
| | Power Technician | 16 |
| Business/Finance | Business Development | 6 |
| | Energy Audit | 11 |
| | Energy Management/Analysis | 110 |
| | Energy-Accounting/Billing | 18 |
| | Environmental Compliance | 2 |
| | Environmental Underwriting | 13 |
| | Project/Program Management | 293 |
| Community Service | Environmental Protection | 26 |
| | Outreach Services | 331 |
| Education | Environmental Educator | 342 |
| Recycling | Waste Engineering/Management | 67 |
| Sales | Sales | 108 |
| Green Collar-Building | Building/Installation | 12 |
| Legal | Environmental Law | 45 |

Although "green" state and national investments have not yet been fully implemented, there are already about 4,000 green job openings posted every year. The new investments coming online will result in significant increases in job demand and will result in significant job creation, including in mid-skill and lower-skill jobs.

3. Governor, an April 2009 National Governor's Association document that discusses governors' priorities found that 91 % of governors said that spurring the economy -- including the green economy -- is a priority, and 81% said that increasing energy development and conservation -- primarily renewable -- is a priority.

In your opinion, how can the federal government best build on this broad level of support to help states address these types of priorities?

Proposed Response

The Federal government has spurred the economy and increased renewable energy and energy efficiency programs since the release of the National Governor's Association document in April and my testimony before the Senate's Committee on Environment and Public Works in July. In August the House of Representatives passed the Waxman-Markey bill, the first time either house of Congress has ever approved a bill meant to curb the heat-trapping gases scientists have linked to climate change. This bill follows up on last winter's stimulus package that included substantial funding for energy efficiency and renewable energy programs.

The federal government should continue its financial support of infrastructure investments that support renewable energy and energy efficiency. The Stimulus bill funded the Weatherization Assistance Program, the Smart Grid, energy efficiency research, loan guarantees for renewable energy and other programs that improve the nation's energy infrastructure. This federal funding follows years when states acted as incubators implementing unique and locally appropriate approaches since both federal funding and leadership was lacking on clean energy initiatives.

I also applaud Energy Secretary Chiu and the US Department of Energy's efforts to develop more energy efficient energy appliance standards, efforts to promote stronger building code adoption around the country and initiatives to develop National Standards on Smart Grid deployment. The Federal government has both the resources and the responsibility to set the bar higher for the nation and to create those standards and codes needed to reduce our energy consumption.

The Department of Energy should also aggressively establish efficiency standards for appliances and homes so that the places we live and work along with the appliances in them are as efficient as cost effective. State governments should not have to provide incentives for people to purchase more efficient appliances and homes because there are cheaper alternatives on the market but are more expensive on a life cycle cost basis.

The federal government should not provide additional tax payer subsidies to support transmission facilities for remote wind farms. The coastal states are looking to develop their offshore wind resources and such a subsidy would put these projects at a competitive disadvantage. Offshore wind, while more expensive to build than onshore is much closer to the demand centers that will use the electricity and should be allowed to compete with onshore wind on a level playing field.

The Federal government should also review the feasibility of accelerating capital depreciation investments for installing energy efficient systems in both new facilities and more importantly retrofitting existing buildings. Likewise additional efforts are needed in basic research around the country to fund clean battery development, the linchpin for the development of Plug-In Hybrid electric vehicles and to help transform our older, relatively inefficient, larger centralized electric generating facilities into a smaller, more efficient fleet of combined heat and power plants that are built closer to energy loads. We look forward to these additional initiatives by the Federal government. Building a better future will require long-term actions, but also immediate investments that will ease our short-term energy costs, create jobs, grow clean energy businesses, and help propel the Green economy and the United States into the 21st Century.

Six years ago, at a time when oil and gasoline prices were much lower, there was little public discourse on greenhouse gases and global warming. The entire state of New Jersey had just six

solar installations. Six years later, New Jersey has become a leader in the developing green economy. New Jersey now has 15 to 20 percent of the U.S. solar market—the second largest number of installations in the United States and among the top five in the world. Our energy efficiency programs are looked to as a national model, consistently rating among the top ten energy efficiency programs in the country. Over the life of energy efficiency and renewable energy measures implemented in the Clean Energy Program so far, New Jersey homeowners and businesses will save over \$2.3 billion in energy costs and over 15,000,000 tons of avoided greenhouse gas emissions over the next 15 years. This demonstrates that if we work together and engage the public, we can achieve incredible things. Thank you for the opportunity to give perspective on this critical issue.

Questions from Senator Thomas R. Carper:

1. Recently, I've heard some skepticism that "green jobs" are limited in number, highly specialized and not available to most American workers. From your perspective as a state executive, is there any merit to this concern?

Proposed Response

New Jersey's energy and clean energy policies set for the next two decades will continue to drive demand for a diverse range of temporary jobs to high-tech careers. NJ's state-sponsored Green Jobs Training Program is preparing a workforce largely based on at-risk and disadvantaged youth specifically for the energy efficiency skills. In fact, the State's largest utility has already committed to hire 100 program graduates to help meet the upcoming demand. New Jersey's policies, our inter-connection standards and net metering, market-based Solar Renewable Certificates, and solar Renewable Portfolio Standard all help create assurance that solar industry will continue to be welcome in this State which will require unique technical skill sets. New Jersey is also on its way to citing windmills off the Atlantic coast that will require workers from electrical engineers to steel workers and long-shoremen.

More recently, this Administration embarked on its own stimulus plan that included efforts to rebuild our traditional energy infrastructure, and another to partner with our public utilities to provide an energy efficiency program to New Jersey home and business owners. Collectively, these efforts will include over \$1.2 billion in investment have the potential of creating over 2,000 jobs from entry-level energy auditors to traditional construction trades.

2. No one wants certain regions of the country or segments of the population to benefit disproportionately from the green economy. Could you please provide examples of opportunities for job creation and economic growth in rural communities? What other benefits might accrue to these communities?

Proposed Response

New Jersey is committed to ensuring that communities throughout the state are able to benefit from the green economy. The state is supporting job creation and economic growth in rural communities in various ways, including the advancement of landfill gas to energy projects. Landfill gas is composed of approximately 50% methane and 50% carbon dioxide and is produced by the decomposition of organic waste under anaerobic conditions. An increasing number of landfill operators, with support from the state, have found ways to convert a liability into an asset by using landfill gas to produce energy for sale. These projects, which are generally more prevalent in rural communities, are supported through the BPU and help to create jobs and strengthen the local economy.

Additionally, the state has targeted a wide variety of financial resources to return New Jersey's economically underutilized sites to productive use and encourage redevelopment of older urban, suburban and rural communities in the state. Financial assistance provided by the state helps to cover costs associated with planning and predevelopment, remediation and redevelopment. The state also provides incentives for business attraction and expansion on redeveloped properties. This more traditional form of assistance provided by the state has helped to support the growth of the green economy in New Jersey's rural communities. A Business Employment Incentive Program (BEIP) grant, administered by the EDA, was critical to attracting iPPsolar a PV Manufacturer to the rural community of Millville in Cumberland County. iPP, currently headquartered in New York, will open a new solar thin film manufacturing plant with an attached solar generating farm on 300 acres in Millville. The new facility will create 260 new jobs over the next two years with average wages of \$50,000. Sites in Pennsylvania and Virginia were also under consideration, however, the BEIP grant, worth approximately \$2.4 million over 10 years, helped draw the company to New Jersey.

Further, New Jersey's Urban Enterprise Zones (UEZ) Program was created to foster an economic climate that revitalizes designated urban and rural communities and stimulates their growth by encouraging businesses to develop and create private sector jobs through public and private investment. The UEZ Program offers participating businesses many incentives that encourage business growth and stimulate local economies. Administered by the EDA, the UEZ Program supports nearly 150,000 full-time jobs and has attracted more than \$24 billion in private investment. There are almost 7,000 businesses of all sizes and types participating and benefiting from the advantages of the UEZ Program, which include a number of tax and other financial incentives. Since the program's inception, over 26,000 businesses have enjoyed UEZ Program benefits. Under the program, sales tax revenues generated by UEZ businesses are dedicated for use within the zones for economic development projects. To date, over 2,248 such projects have been approved at a value of over \$763 million. Businesses participating in the UEZ Program can charge half the standard sales tax rate on certain purchases. In addition, UEZ businesses may enjoy tax exemptions on certain purchases and manufacturers may qualify for sales tax exemption on their energy and utility consumption when they meet specified employment and other criteria. For each new permanent full-time employee hired, businesses may receive a one-time \$1,500 tax credit. Employers may also benefit from subsidized unemployment insurance costs for certain employees who earn less than \$4,500 per quarter. The UEZ Program allows a tax credit against the Corporate Business Tax up to eight percent of qualified investments within the zone. Also, businesses may be eligible for priority financial assistance. UEZ manufacturers with at least 250 employees, over 50% of who are involved in a manufacturing process, may apply for sales tax exemption on energy and utility services (natural gas and electricity). From the initial 10 UEZ's that were designated in 1984, the program has grown to 32 zones in 37 municipalities throughout the state. We are confident that the UEZ program will help to ensure green companies and resulting jobs locate in New Jersey's rural communities.

Additionally, LWD, through its New Jersey Youth Corps program, is developing a green corps training component designed to train out-of-school youth ages 16-25 years in various aspects of the "green" industry. The focus is to train youth to target energy efficient and/or environmental improvements in their communities. Training will be provided in energy audits, conducted for low-income households, environmental technician training, which includes Brownfields job development, and arboriculture, which includes jobs in the tree-care industry, landscape and environmental restoration. Salem County Vocational Technical Schools, which serves students from the largely rural county of Salem, has been awarded a one year grant to create new registered apprenticeship occupations relating to the growing energy sector, including power plant equipment operators, instrument technicians, and electrical technicians. Energy sector partners that will be involved in the creation of these new apprenticeship programs include Atlantic City Electric, PSE&G Nuclear and South Jersey Gas.

Finally, the Obama Administration recently appointed Howard Henderson to the position of State Director with the U.S. Department of Agriculture, Rural Development in New Jersey. Rural Development administers and manages over 40 housing, business and community infrastructure and facility programs, according to the USDA. These programs are designed to improve the economic stability of rural communities, businesses, residents, farmers and ranchers and improve the quality of life in rural America. The State looks forward to working with Mr. Henderson to help drive the growth of the green economy in New Jersey's rural communities.

3. You are showing good leadership with respect to expanding access to green jobs and training opportunities in your state. What can the federal government do from here to promote green jobs and facilitate a smooth transition to a clean energy economy?

Proposed Response:

The federal government should continue to provide funding to the states to support and expand current initiatives underway at the state level. Additionally, the federal government should coordinate agencies at the federal level (e.g., Department of Education, Department of Labor, Department of Energy, Environmental Protection Agency, etc.) in a way that translates to coordination at the state level.

These efforts, however, must also be sure to tap into the enormous creativity and potential of the private sector, including entrepreneurs. The federal government should work to stimulate the private sector with a program of incentives and supports that encourage business development and job expansion, which will assist state-level efforts to connect jobseekers with jobs.

4. as you know, the American Recovery and Reinvestment Act provided \$500 million for green jobs training. This funding, combined with funding infusions for a number of other programs -like Weatherization Assistance - is certainly helping to put people back to work. How can we ensure the sustainability of these jobs over the long term, after Recovery Act funds are expended?

Proposed Response:

Many surveys indicate that employers retain jobs in New Jersey and relocate to our state due to our abundance of qualified workers. We expect to sustain jobs created, post-ARRA funding, in two ways:

- 1) By providing supports to assist the individuals we train in staying in their job, gaining experience, developing skills and increasing the likelihood of progressing along a career path through higher levels of training and education leading to expanded skills and higher income levels. As many of these individuals require training tailored to industry-specific needs, these types of supports may serve as an incentive to keep the industry and jobs in NJ; and
- 2) By ensuring a steady pipeline of trained workers at all levels for green job opportunities. The educational continuum must be structured to provide the training and education to meet employers' needs, from high school and vocational schools through community college and four-year institutions. By providing trained workers at every level, business can take advantage of opportunities to expand and develop new capabilities in green sectors.

Establishing supports for specific "green" sectors will be important in keeping businesses and jobs in New Jersey after the ARRA funding has expired. As we have seen in other fields, it is essential for government to act as a partner in creating the infrastructure required for specific industries to thrive, including items such as research and development initiatives, facilitating a pipeline of qualified workers, and enabling businesses to transport and distribute their products.

5. Could you elaborate on the roles of apprenticeship and vocational training in the clean energy economy? Why are these pathways to employment so important?

Proposed Response:

Apprenticeships and vocational training provide individuals with exposure to a job during training, through on-the-ground work that develops specific technical skills necessary for a job. Apprenticeship and vocational training offer options that are often best for individuals to earn while they learn, and frequently provide built-in support systems to ensure success. New Jersey established the Pathways Leading Apprentices to a College Education (NJ PLACE) to better connect apprenticeships to higher education, by recognizing the rigorous training that takes place in apprenticeships and facilitating the conversion of apprenticeship learning into college credit leading to community college Associate's degrees. Vocational training can also be very closely aligned with the specific skills and competencies of an individual ensuring a higher likelihood of success in completing training, achieving and maintaining employment. These pathways are also

important because they offer learning alternatives for individuals with obstacles or limited resources which lead to successful careers.

Questions from Senator James M. Inhofe:

1. In your testimony you state that you estimate approximately 20,000 jobs will be created between now and 2020. How many of these jobs will be new, permanent jobs, as opposed to temporary or retread jobs and how many jobs do you anticipate being lost by the increased price of basic utilities, such as electricity, that could force businesses to shutdown?

Proposed Response

Meeting the 2008 New Jersey Energy Master Plan's (EMP) aggressive targets for energy efficiency, renewable energy, demand response, and new generation will require green jobs in sectors such as solar manufacturing, energy auditing, HVAC installation, and smart grid technology installations as well as design, manufacture, installation, operation, and/or maintenance of new renewable energy and energy efficiency technologies. The \$33 billion of investment into the NJ energy infrastructure stemming from the 2008 EMP is estimated to result in the creation of over 20,000 jobs between now and 2020. At peak creation, approximately 8,300 will come from installation and construction jobs; another 7,400 in operations and maintenance jobs and over 4,000 in ancillary jobs. There are two main types of jobs included in the assumptions: One-Time, 12-month installation jobs, including construction; and Annual (permanent) operation and maintenance jobs, including plant maintenance, energy efficiency audits, and energy efficiency installations. These jobs include: Solar manufacturing; energy audit contractors/building analysts; HVAC installers; Smart grid technology technicians.

In order to maintain the employment levels and continued business growth New Jersey is also expanding efforts that encourage the development of clean energy technologies by expanding the Edison Innovation Fund to invest in innovative clean energy technologies and provide support to business incubators that support clean energy business development. We are also developing timely and industry recognized job training programs to ensure that sufficient numbers of New Jersey workers have the skills demanded by industry to fill the jobs that are created from the action items in this Energy Master Plan. On the academic level we are establishing the Energy Institute of New Jersey to support the basic and applied energy research efforts at the colleges and universities in the State. These efforts combined will help grow the energy sector in such a way that is sustainable once the goals of the EMP have been achieved.

2. Essentially, the cap and trade bill is allowing Wall Street to set and collect the tax from carbon emissions through a commodities market. In your opinion if this cap and trade system is implemented, how should the parameters be set up to ensure that large corporations, such Goldman Sachs, do not unduly reap the benefits of this carbon tax?

Proposed Response

The final Waxman-Markey bill was amended to include oversight of the carbon markets from the Commodity Futures Trading Commission (CFTC) as well as from the Federal Energy Regulatory Commission. Under Waxman-Markey, the Federal Energy Regulatory Commission (FERC) will regulate the cash market in allowances and offsets while CFTC will regulate and oversee the derivatives market. The addition of the CFTC creates a stronger regulatory framework that increases confidence in the trading mechanisms by limiting positions in auctions and derivatives markets and aggressively punishing market manipulation.

Waxman-Markey would prohibit over-the-counter trading of derivatives, which is the source of potential market-abuse. These provisions, along with other proposed US legislation would require greater disclosure of derivative trading activities and may also impose quantitative limits on non-commercial derivative positions.

Large corporations, whether its financial institutions like Goldman Sachs or multi-national organizations like General Electric and Walmart, are already implementing and addressing carbon issues through their European businesses and clients. The European Union (EU) instituted a carbon cap-and-trade program in 2005 as the cornerstone of its efforts for reducing greenhouse gas emissions. The EU system develops market prices for emission allowances and serves as an incentive for achieving cost effective reductions in greenhouse gas emissions. It is currently effectively reducing emissions at 12,000 sources and enabling cost-effective compliance through the trading of millions of EU allowances.

3. New Jersey participates in the Regional Greenhouse Gas Initiative, which is a mandatory cap and trade system, much like the Waxman Markey bill under discussion in this committee. On July 16, 2009, K YW Newsradio out of Philadelphia reported that New Jersey unemployment rates have reached its highest percentage in 31 years. Further, a recent report by the New Jersey Sierra Club has been extremely critical of your environmental record. Could you please explain how implementing a system which increases energy costs to consumers with a minimal positive environmental impact have helped put more citizens to work?

Proposed Response

There is no connection between the Regional Greenhouse Gas Initiative and New Jersey's unemployment rate. Tennessee is suffering its highest unemployment rate since the early 1980s. The same is true of South Carolina. Florida is suffering its highest unemployment rate since the mid-1970s. Nevada has an unemployment rate of 12.5 percent, its highest ever. None of these states currently has a greenhouse gas cap-and-trade program.

The total annual retail cost of electricity in New Jersey is in the neighborhood of \$11 billion. The annual cost of RGGI is in the range of \$60 million, about 1/2 of 1 percent; in exchange, the revenues from the sale of RGGI allowances are being invested largely in energy efficiency, saving New Jersey electricity customers money on their bills. In comparison, a new electricity capacity market that the Federal Energy Regulatory Commission approved in 2006 is costing New Jersey customers between \$1 billion and \$2 billion annually; this expenditure has brought no benefit to New Jersey electricity customers.

RGGI is helping to encourage energy efficiency and the development of clean electric power generation. Those developments will help to insulate New Jersey from the effects of volatile fossil fuel prices, and make our state more competitive in the future.

Questions from Senator David Vitter:

- 1. Governor, you have a Valero refinery in Paulsboro, New Jersey. That refinery gave out \$1.2 million last year in charitable contributions. The refinery employs:**
- a. 530 Valero employees PLUS 250 daily contractors that work in the plant.**
 - b. A typical operator that has been at the plant for 10 years makes about \$86k.**
 - c. Each employee gets roughly \$40k more from Valero in payroll taxes and benefits. So total compensation for that Union employee is around \$126k.**

By your estimate, if Waxman-Markey were to be implemented, what would happen to that refinery and those employees?

Proposed Response

Valero Energy, with 15 refineries, is the nation's largest independent refinery and New Jersey with a total of 6 refineries, including Valero's unit in Paulsboro, is major refinery center. According to the Energy Information Administration, the New Jersey / New York Harbor area has a refined product storage capacity of over 40 million barrels, making it the largest petroleum product hub in the country. A Perth Amboy, NJ facility is also the largest Northeastern Heating Oil Reserve site as part of the US Department of Energy's Strategic Petroleum Reserve. New Jersey is connected to the Midwest, Gulf Coast and the Eastern Seaboard through the Colonial and Buckeye pipelines and receives petroleum product imports by tanker from Canada, the Caribbean, South America, and Europe. The Valero Refinery, like other New Jersey refineries and petroleum facilities around the country, is part of the international oil market.

I can't predict, and I'm not sure who really can predict, what will happen in the international oil market, the world's largest traded commodity, over the next 5 years, 5 months or even 5 days, and how these events as well as the potential passage of Waxman-Markey will impact Valero. But as a former Wall Street executive I believe the nation needs to hedge its bets. Our nation's oil import costs have increased from \$100 billion in 2002 to over \$400 billion recently. These lost dollars should be invested into economic activity within the United States and not overseas.

The Waxman-Markey bill puts a cap on total US greenhouse gas emissions beginning in 2012 and seeks to reduce the nation's overall dependence on oil and greenhouse gas emitters by making these options less attractive financially. Every refinery, power plant, factory, and other regulated entity will either be allocated allowances (rights to emit), or be made to purchase these allowances, or some combination of the two. Oil refiners would be given about 2% of the free emission permits under Waxman-Markey while industry experts calculate the total CO2 footprint of the oil and gas industry – including exploration and production, terminals, pipelines and refineries – is about 4% of total US emissions.

Some suggest that Waxman-Markey would place a greater burden on refiners, like Valero, than on other industries that would be getting more free allowances upfront under Waxman-Markey. This burden could increase prices on gasoline, heating oil and other refinery products. While a more equitable allocation of allowances could help alleviate price increases to consumers, the United States must not continue to ignore this petrodollar exchange and the global political and policy implications of climate change. Even the Pentagon and the State Department now consider the effects of climate change in their long-term planning documents.

So for Valero, the other refiners and ultimately for every American, the Waxman-Markey bill recognizes that greenhouse gas emissions are no longer free and begins including these emissions costs within a product's overall cost. I also applaud Valero since it "understands the importance of investing in alternative-energy opportunities and latest technologies to protect the

environment. From the company's wind farm in the Texas Panhandle to its ethanol plants, Valero is leading the way" according to its own website.

Questions from Senator Mike Crapo:

1. Could you talk a little bit more about the algae research conducted at Rutgers?

Proposed Response

Algae are about 50 percent oil and can be grown in places that do not compete with agricultural crops. To date there is no economically feasible way to process the oil in algae. Dr. Paul Falkowski, director of the Rutgers Energy Institute, is working on ways to make the production process commercially viable. He is developing optimization schemes for extracting the algae from the water and for extracting the oil from the algae.

According to current research, producing a large volume of algae would not be difficult. Algae can be grown in sewage, swamps, and industrial ponds. Enough algae could be grown on just 15,000 square miles of desert to accommodate nearly all of our nation's diesel requirements.

Processing all of this algae is also an attainable goal. With enough large centrifuges, it could be done today, but not economically. The challenge is finding ways to harvest the algae to make this a profitable venture.

The United States imports most of its transportation fuels from other nations. America can become energy independent—but to do so will require scientific breakthroughs to enable the United States to produce alternative forms of energy.¹

2. You have a very aggressive energy plan, 30% renewable by 2020. That is very high considering the national renewable energy use is below 10%. How has that affected existing industries?

Proposed Response

New Jersey's Renewable Portfolio Standard (RPS) is a key component of our Energy Master Plan which is designed to meet our greenhouse gas reduction goals. As part of the Energy Master Plan we modeled the macroeconomic impacts on the State from implementing the plan. While meeting the RPS of course costs industry and citizens more than conventional supplies, coupling the development of renewable energy with energy efficiency will provide a net benefit to industry and our citizens of over \$30 billion over the next decade. The RPS has also resulted in the development of new industries that did not exist previously, specifically solar installation companies now number over 100 and four offshore wind developers are located in New Jersey.

3. I noted that you said New Jersey purchases renewable electricity to meet the standard. Where do electricity suppliers go to purchase the renewable electricity, and how does that affect ratepayers?

Proposed Response

Suppliers use the Generation Attributes Tracking System (GATS) managed by PJM-EIS to purchase the Renewable Energy Certificates (RECs) and must document compliance. The website www.pjm-eis.com has more detail on the GATS program. Suppliers in NJ can procure RECs for their Class I obligation from the entire PJM area. Solar RECs (SRECs) for a supplier's solar Renewable Portfolio Standard (RPS) obligation must be produced by solar electric systems connected to the distribution system serving NJ.

¹ Source: Rutgers, the State University of New Jersey. <http://sebs.rutgers.edu/research/archive.asp?10>

As set forth in the Economic Impact Analysis of New Jersey's proposed 20% RPS, the RPS would increase electric rates by 3.7% in 2020 when the Class I requirement including solar is 20%. This past reporting year (ending May 31, 2009) RPS requirements included 4% Class I and 2.5% Class II for a total renewable energy requirement of 6.5%. This percentage requirement increases for this reporting year (ending May 31, 2010) to 0.221% solar, 4.684% all other Class I and 2.5% Class II.

For reporting year 2009, assuming 80,000,000 MegaWatts per Hour (MWh) of retail electric sales statewide, the amount of renewables required would be 128,000 MWh of solar RECs, 3,072,000 MWh of all other Class I and 2,000,000 MWh of Class II for a total of 5,200,000 of the 80,000,000 MWhs of electricity sold and used in NJ.

When looking at actual dollars, assuming the cost for Class II RECs were \$4 per MWh, this totals approximately \$8 million. The Class I RECs are currently selling at \$12 per MWh and the cost for this is about \$37 million. SRECs are selling at on average \$450 per MWh so the cost for solar is approximately \$58 million. The total renewable energy cost was approximately \$103 million. With the total retail sales cost being approximately \$11 billion, the total renewable energy cost was approximately 0.93% of the total retail sales.

In the modeling done for the NJ Energy Master Plan (EMP) the business as usual case has electric costs increasing by 60% between now and 2020. When the EMP goals are implemented including renewable energy, energy efficiency and demand response implementing the EMP goals for renewable energy, energy efficiency and demand response will reduce these cost increases by 26%.

Senator SANDERS. Thank you very much, Governor.
Let us begin the questioning.

Senator Boxer.

Senator BOXER. Thank you, panel, all of you, for your positive contribution.

Week after week, we come here. We have had so many dozens of hearings on this. Essentially, what is happening is, we can predict that the Democrats are anxious to move forward on a climate change bill, and the Republicans are predicting doom and gloom. It is just the way it is. Just listen to both sides, and decide who you believe.

I thought today that the surest way to kill the American dream is to foster fear and doom and gloom. I think back. What if, when our grandmas and grandpas were sleeping on the streets before Social Security, everybody said well, we just cannot do anything about it, just walk away? And I thought about it when our rivers were on fire, and people said we have got to do something about the pollution. And when our, you know, endangered species were just going to become extinct. I think this is one of those moments.

Now, I also have to say, my colleagues have brought up the Spanish report. It has been debunked, the one that says there will be disaster if they move forward. I would like to place in the record the response from the Governor of Spain pointing out the flaws in the study, as well as the fact that the study's author was a Senior Fellow at an Exxon-funded institute. I think those things are important, because we want impartial information.

Senator Barrasso is very eloquent on bashing our President, time after time. If it is not our President, it is Carol Browner, or it is somebody else. He has the right to do it. I support his right. We are very good friends.

But I have to say, it took us 8 years to get into the economic ditch, to get into this fiscal mess. Eight years of taking a surplus and turning it into a deficit. This recession started in 2007. And now Senator Barrasso has declared the stimulus a failure when less than 10 percent of it has been given out.

I would ask unanimous consent to place in the record some examples. Here is one from Idaho of where the stimulus has gone. Nordic Windpower received \$16 million through the DOE, and the company will hire 100 workers. Minnesota, Minnesota's Low Income Weatherization Program is getting \$131 million, 13 times what it usually gets. It is going to put people to work. There are many examples in California, Nebraska, in Arizona solar companies are getting funded, Montana, and it goes on, West Virginia, Massachusetts, and on and on. So, we will put those in the record. Things are happening, and you cannot erase 8 years of problems in 4 months.

What I would also like to do is place in the record the soda ash issue which my good friend brought up. The fact is it was addressed in the Waxman-Markey bill, and they say the House recognizes that soda ash mining is very energy intensive and they give them allowances. And that is taken care of.

I also want to place in the record a very important report on kids' lower IQ scores linked to prenatal pollution. Now, this shows that the kind of pollution that our kids are facing in some of our

cities today and areas where there are heavy industry is having the same impact as lead had on our kids. So, we need to move forward to protect our kids from pollution. And that is what we are trying to do.

[The referenced documents follow:]



MINISTERIO
DE MEDIO AMBIENTE,
Y MEDIO RURAL
Y MARINO

Teresa
Ribera Rodríguez
SECRETARIA DE ESTADO
DE CAMBIO CLIMÁTICO

Madrid, 20 de mayo de 2009

Mr. Henry A. Waxman
Chairman of the US House of Representatives
24204 Rayburn
House Office Building
Washington, D.C. 20515

Dear Mr Waxman,

Here in Spain, we are following with great interest, the leading role of the new US administration on climate change, both at domestic and international levels. We are also paying great attention to the works taking place in the House of Representatives on this topic. Regarding the last point, we are surprised by the echoes that a paper signed by Gabriel Calzada on the effects on employment due to the promotion of renewable energy ("*Study of the effects on employment of public aid to renewable energy sources*") is having in the House of Representatives and the US Media.

This note affirms that the Spanish policy on renewable energy destroys employment in the rest of the Spanish economic sectors. Although there are several studies of different sources that have analysed the positive impact of renewable energy policies in terms of employment, and that would serve as answer, the Spanish Government would like to express its views.

First of all, the Calzada's thesis is based on a simplistic, reductionist and short-term view of the problem. The aim of the policies promoting renewable energy has to do with the necessity of changing our energy model to cope with two of the main challenges in the medium and long-term: universal energy access at reasonable costs and energy supply with low carbon technologies to fight against climate change. Having in mind the benefits of renewable energies in environmental terms, the foreseeable cost reductions of these technologies, and also other very relevant benefits like the reduction of energy dependency, an active policy promoting renewable energies is not only fully justified but also needed to be urgently implemented in those places where it have not.

Moreover, these policies with medium and long-term objectives entail other benefits in the short and medium term like job creation, as it has been proved in the reality and shown by different observers. In Spain, according to the last data of the Ministry of Industry, Tourism and Trade the sector employs 73.900 direct workers, while other report by ISTAS-CCOO (labour union institute of work, environment and health) estimates 89000 direct jobs plus 99681 indirect jobs, against de 52200 direct and indirect jobs of the Calzada's figures (unknown source). According to data of the Ministry of Industry, Tourism and Trade and of the

Pl. San Juan de la Cruz, s/n
28071 Madrid

wind power business association, the wind power sector employed 37730 people instead of the 15000 jobs considered in the Calzada's paper. Moreover, the ISTAS-CCOO report foresees 270.788 direct jobs in 2020 considering a 2% annual growth for energy demand and assuming we meet our 20% target of renewable energy in the primary energy consumption. Thus, not only because of the definitive previous arguments, but also because of these other short and medium term benefits, the necessity to urgently put into practice these policies have been reinforced given the current economic situation, not only to establish the basis of the future energy model, but also to accelerate economic recovery in the short term promoting a sector that has clearly helped to create jobs.

Taking into account the current state of the art of these technologies, a policy promoting them must use a support mechanism that allows accelerating unitary costs' reduction to make them competitive. This situation is not new in the energy sector, where other sources of energy have also been benefited by similar reasons in the past.

Calzada not only does not take into account the commented reasons focusing just on one of the short term benefits, the employment, but also the **analysis he makes uses a pretty low reliable and non rigorous methodology**. The conclusions are based on two static and simplistic ratios, from which it is difficult to draw valid conclusions as they compare non-comparable elements. The first ratio compares the economic support given to renewable energies in Spain per job with the average capital per job in Spain. Just to point out one of the wrong concepts under this ratio: it cannot be forgotten, that energy non-supplied by renewable energies, should be supplied by other energy sources and thus, the comparison with the rest of the economy as a whole makes no sense in this case. Within the energy sector, there are different studies showing that the comparison of the employment intensity in the renewable energy sector with respect to other energy sectors, does not reveal at all the conclusions of the mentioned ratio.

With regard to the second ratio, similar conclusions can be drawn. In this case, the annual support for renewable energies per job is compared against the average productivity per job in Spain. It goes without saying, that this comparison has no value, or at least the value given by this study, as incentives and productivity, are terms that do not have relation conceptually.

Support policies for renewable energies generate welfare beyond the direct received incentives, and they contribute to the creation and improvement of industrial fabric. The analysis of the impact on net employment is a complex analysis that cannot be reduced to the elaboration of two simplistic ratios. Numerous studies already analyse the impact of renewable energy in terms of net jobs in economy, with positive results, using methodologies that take into account the inherent complexity. It must be pointed out also, that these ratios are based in data of the recent past period, without taking into account for example, probable evolutions in the medium and long-term of relevant variables like energy prices, the price of CO₂, the reduction on the costs of renewable energy technologies or the foreseeable increase of jobs due to the growth targets for renewable in the medium term.



Last but not least, although the commented reasons are enough to cast doubt on the results of Calzada's note that contradicts most of the previous studies carried out by different researches, it is necessary to highlight an additional and relevant aspect: **data used in his analysis are totally out of keeping with the current reality of the sector.** Even with the doubtful methodology used, results would be very different using more realistic data as the ones commented previously.

On other hand, some partial data of the current evolution of the Spanish sector are used here to point a possible instability in the jobs created by the renewable energy sector. In this point, it must be said that, although the reality of the solar photovoltaic sector in the last year meant some instability in this sector, this is not the reality of the whole renewable energy sector. Moreover, this instability helped to carry out a needed "fine tuning" in the regulatory framework of that sector in order to achieve a sustainable growth of the installed capacity and employment. The stability of the employment in the renewable energy sector will depend on the potential future market, and is quite probable that this market will be growing and stable, not only in the EU and Spain, but also in other regions of the world given the commitments of different countries, the challenges we have to face in the medium-term from an economic and an environmental point of views; the benefits of renewable energies in this respect and the probable evolution of technology costs. Stability on renewable energy employment cannot be questioned because of a punctual fact, on a particular moment and on a concrete non-mature technology in terms of costs, that has known causes that have been corrected.

Finally, it blames renewable energy for the possible relocation of Spanish companies in other countries caused by the increase in energy prices. Firstly, it must be said that electricity prices are influenced by multiple factors, not only renewable energy costs. Moreover, renewable energies do contribute in the short-term to reduce the pool price as they are substituting more expensive sources (in terms of bid-prices), so their impact in the final price is not only negative but positive. On the other hand, in view of current data, it cannot be said that renewable energy has had a negative influence in the employment of other energy-intensive sectors; moreover, current electricity prices in Spain are under the EU average. It cannot be forgotten also, that relocation can depend also in multiple factors other than the electricity price. Lastly, it must be pointed out that relocation has been a factor that has been taken into account carefully in the elaboration of the green EU package, which shapes in part our energy model for the next years.

Reactions from trade unions, from companies and from other observers and scientists are taking place these days stressing that Spanish renewable energy policy, is a policy to be proud of, that has established the pillars of the transformation of our energy model to face the future challenges; that has generated important benefits in environmental terms; that has created net jobs; that has created and improved a powerful industrial fabric, helping the rise of leading companies, not only at a national level but also at an international one, with great export and innovation capacity. In the renewable energy field, Spain is an example to be followed.

A handwritten signature in black ink, appearing to read "Miguel Ángel".

Council on Environmental Quality

Weekly Energy and Environment Recovery Act Success Stories From the Field: Week of May 4-May 8, 2009

Examples of how the American Reinvestment and Recovery Act is providing jobs to transition the country to a clean energy economy, protect our natural resources, and clean up pollution



The Interior Department Is Directing Stimulus Funds to the Bureau of Land Management for 650 Approved Projects Which Include Updating Facilities and Jump-Starting Renewable Energy Projects Across the Country. "The Interior Department is directing more than \$300 million in federal economic stimulus money to the Bureau of Land Management to update its facilities, roads and trails and jump-start renewable energy projects across the country, Interior Secretary Ken Salazar announced Saturday. Salazar said the 650 approved projects will 'restore our landscapes and our watersheds' and help fulfill the Obama administration's target for renewable energy development. Salazar made the announcement at the Red Rock Conservation Area outside Las Vegas. The desert area's fire station was one of several facilities slated to receive solar panels under the effort... The largest chunk of the funding - roughly \$143 million - will go toward new construction, deferred maintenance and energy efficiency upgrades on existing facilities, the department said. The spending also will include \$37 million in habitat restoration, \$53.4 million in abandoned mine cleanup and \$15 million to construct and repair recreational trails... The secretary was quick to focus on one element of the BLM spending - a \$41 million allocation to be spent on reducing a backlog of pending applications for new solar and wind energy projects on BLM land." [[The Associated Press, 5/4/09](#)]

KANSAS

Siemens Energy Head: Encouraged that "Obama's Stimulus... Production Tax Credits" Signal "The Nation's Commitment to Renewable Energy," Siemens Will Build Wind Turbine Plant in Hutchinson KS, Hire 400 Workers. "Siemens Energy announced today that it has selected Hutchinson, Kansas, for its first U.S. nacelle production facility. The 300,000-square-foot nacelle facility and an adjacent 80,000-square-foot service and repair facility will be built on more than 100 acres in Reno County, which is located northwest of Wichita on the Arkansas River. The operation is expected to create an estimated 400 green-collar jobs and will be the first major wind turbine equipment factory in Kansas, which is ranked third in the U.S. for its wind energy resource potential. The new Siemens facilities in Hutchinson will allow Siemens to better meet the strong demand for wind turbines in the Americas... 'The U.S. will require a diverse mix of environmentally compatible power generation sources to ensure energy security. President Obama's stimulus package, which included a three-year extension of the Production Tax Credits, sends an important market signal of the nation's commitment to renewable energy as part of the overall energy mix. By working together with former Kansas Governor Kathleen Sebelius and current Governor Mark Parkinson, the Kansas Department of Commerce, the officials of Reno County and the cities of Hutchinson and South Hutchinson, Siemens is increasing its already substantial commitment to the U.S. energy sector. As a result, we will be able to create hundreds of jobs within Siemens, and potentially hundreds more through our procurement of goods and services along the entire supply chain,' said Randy Zwirn, head of Siemens Energy in the Americas. 'This is a win-win-win for Siemens, Kansas and our customers.'" ([PRNewswire Story, 5/5/09](#))

OREGON

Solar Company Expanding Factory in Oregon, Expecting Stimulus Incentives to Boost Green Industry. “BEHIND a giant solar factory here, backhoes are digging away, preparing for a new wing that will quintuple production. Inside, an outspoken German executive named Boris Klebensberger is fretting about the color of the new carpet... Expanding a factory? ... Did anyone tell him that there’s a recession? Buoyed by the potential promise of a green economy, Mr. Klebensberger, who heads the American branch of SolarWorld AG, a company based in Bonn, Germany, is ramping up production of solar cells in a retrofitted factory that had its grand opening last October — in the teeth of the financial crisis... SolarWorld’s plant here, which makes enough cells to fit 1,700 solar panels a day, is the biggest of its kind in the United States. For the residents of Hillsboro, and for the Oregon economy, SolarWorld’s presence is a welcome boon. Its employees enjoy being in start-up mode, while others like the cachet of working for a renewable-energy company — which goes down well in outdoorsy Oregon... At first glance, the timing of SolarWorld’s decision to invest \$500 million in the new site during a recession, in a state with an unemployment rate second only to Michigan’s, couldn’t have been worse... But new federal incentives to encourage renewable energy in the United States will give the industry a boost, analysts say. The recent stimulus package included grants for businesses and utilities that install solar energy systems... Makers of renewable energy equipment also received help in the stimulus package, signed by President Obama. ‘I think the writing on the wall is the U.S. is going to be the big market,’ says Jesse Pichel, a solar analyst at Piper Jaffray. The message for solar companies, Mr. Pichel says, is ‘get your butt over to the U.S. if you want to participate and get some of that stimulus package money.’” [NY Times, 5/3/09]

MISSISSIPPI

Hinds County Will Use Stimulus Funds to Weatherize Homes, Mississippi Will Spend Stimulus Money to Develop Alternative Energy. “In addition to the funds it will receive directly from the federal government, Jackson stands to collect stimulus funds through state agencies, including the Mississippi Development Authority and the Department of Human Services. DHS is administering a \$51 million home weatherization program, \$3.3 million of which will go to Hinds County. The program pays the full cost of weatherizing a house for homeowners whose income puts them under two times the national poverty line. Sollie Norwood, DHS director of community services, said that DHS will review applicants for weatherization assistance on a first-come, first-serve basis, but it will give priority to elderly and disabled applicants. Notice Bruce, director of MDA’s Energy Division, said that the state will receive \$40 million for alternative-energy development and energy conservation.” [Jackson Free Press, 5/6/09]

DELAWARE

Delaware National Guard Will Receive Over \$1.9 Million For Five Energy Improvement Projects. "In a move to create jobs, boost the local economy, and help the Delaware Army National Guard achieve energy savings through greater efficiency, Gov. Jack Markell joined Sens. Tom Carper and Ted Kaufman on May 1 to announce that the Delaware Army National Guard will receive \$1.96 million in stimulus funding. This new infusion of money, provided by the American Recovery and Reinvestment Act of 2009, will help the guard finance some overdue improvements. 'This funding will help our economy by getting Delawareans back to work and help the Delaware Army National Guard in their critical mission to serve our state's citizens and the nation,' Markell said. 'This one-time investment will pay dividends for years in cost savings from greater energy efficiencies' ...The Recovery Act funds received by the Delaware Army National Guard will go to five energy projects. Three of the projects require a 25% State match of funds. If the state invests \$311,825, the amount of federal dollars received will be \$1,960,462. This results in a combined total of \$2,272,287. Without the required state match, Delaware could not accept or use the federal funding." [[Sussex Countian](#), 5/4/09]

NEW JERSEY

Stimulus Funds Will Supplement Superfund Money for NJ Cleanup; Will Add Up to 50 Jobs, Draw More Tourist Business to the Area. "The economic stimulus bill passed earlier this year has some added benefits in places like New Jersey. The bill included \$600 million in new money for an old job - cleaning up dozens of polluted Superfund sites - while adding badly needed new jobs in economically hard hit areas, as CBS Evening News Saturday anchor Jeff Glor reports... Since the late 90s, the Vineland plant has been classified as a Superfund site, which means the Environmental Protection Agency gets taxpayer money to clean up the mess. But considering the scope of the damage, the \$9.5 million a year the EPA received meant slow progress. Now the EPA says the economic stimulus will provide a booster shot of up to \$25 million more to speed up clean-up and, as a bonus, add up to 50 jobs. The stimulus money is 'very important,' said Ron Namen, the Vineland site manager for the EPA. 'We're hoping to, actually perhaps double the amount of staff we have here and expedite this project by as much as two years.' ... Cheryl Fox, who runs a canoe and kayak business, says cleaning up the wetlands is bringing tourists back to the area. 'We are growing,' she said. 'We more people gravitating to this area.' ... Some environmental groups hope that when the stimulus money expires two years from now, the old tax will be restored. But new chemical companies are opposed, saying they shouldn't have to pay for old sites they didn't pollute." [[CBS News](#), 5/2/09]

Council on Environmental Quality

Weekly Energy and Environment
Recovery Act Success Stories
From the Field:
Week of May 11-May 15, 2009

Examples of how the American Reinvestment and
Recovery Act is providing jobs to transition the country to
a clean energy economy, protect our natural resources,
and clean up pollution



OHIO

Stimulus Incentives for Weatherization Encourage Several Ohio Companies To Hire More Workers to Meet Growing Demand. "Home weatherization is one of the first areas where federal stimulus dollars will result in actual job creation. Agencies such as the Mid-Ohio Regional Planning Commission, Ground Level Solutions Inc. and Impact Community Action Agency in Columbus have added employees and expect to hire more to meet the surge in weatherization projects funded with stimulus dollars. In addition, heating and cooling contractors and insulation companies hurt by the national home building slump may be able to keep workers busy with weatherization jobs." [[Columbus Business First](#), 5/15/09]

TENNESSEE

Tennessee Governor Announced Plans To Build Stimulus-Funded Solar Power Generation Facility, Solar Research Institute. "Gov. Phil Bredesen is announcing plans for Tennessee to spend \$62 million in federal stimulus money on a solar power generation facility near Brownsville and his proposed solar research institute at Oak Ridge. The Democratic governor says the five megawatt solar plant in Haywood County would be among the largest in the eastern United States. Bredesen calls the plant a "solar farm," because he wants to use proceeds from selling the electricity to the Tennessee Valley Authority to add solar generation capacity in the future. The governor first proposed the Tennessee Solar Institute in an address to lawmakers earlier this year seeking to spur green energy jobs and affordable technology. The U.S. Department of Energy would have to approve Tennessee's plans before the projects could get under way." [[WKRG News](#), 5/13/09]

MASSACHUSETTS

Massachusetts Will Receive \$25 Million In Recovery Funds To Jumpstart Construction Of A Wind Blasting Testing Center In Charlestown; Project Will Create Hundreds Of new Jobs. "Massachusetts is set to begin receiving \$25 million in federal stimulus dollars to help jumpstart construction of a wind blade testing center in Charlestown. U.S. Energy Secretary Steven Chu said the project will help create hundreds of new jobs while speeding the next generation of turbine blades to the marketplace. The state had originally been selected by the federal Department of Energy as a site for the testing center in 2007. The Wind Technology Testing Center will test commercial-sized wind turbine blades with the goal of reducing costs and making technical advancements. Construction is set to begin in September, and could be finished by the end of 2010. The state is now wrapping up the final design for the center." [[Boston Herald](#), 5/12/09]

COLORADO

Stimulus Tax Incentives For Green Energy Encouraged Nestle Purina To Hire REC Solar To Set Up Solar Energy System At Denver Plant. “Nestlé Purina ... has taken many steps during the past several years to make its Denver plant more energy efficient. Now, thanks to a new pilot solar energy array developed by REC Solar (www.recsolar.com), the plant is manufacturing pet food in an even more environmentally responsible way. Colorado Gov. Bill Ritter led a dedication ceremony at the plant today announcing the new 467-panel photovoltaic (PV) system ... ‘We are proud to partner with Nestlé Purina, a company that understands the commercial and environmental benefits of solar,’ said Angiolo Laviziano, REC Solar CEO & President. ‘We expect that the focus of the federal stimulus package on renewables will spur more and more Colorado businesses and organizations to find ways to increase their sustainability and reduce their carbon footprint. In addition, we are proud to contribute to the local economy by creating more solar jobs in Colorado.’ The Purina PetCare project is the latest in a series of successes for REC Solar in Colorado. The company plans to expand employment by 10 to 20 percent due to the new opportunities for clean energy provided by the \$787 billion American Recovery and Reinvestment Act. The stimulus spending is expected to have a significant impact on solar installations in Colorado.” [[Nestle Purina Release](#), 5/15/09]

NEW JERSEY

LEADS Community Action Agency Expects to Weatherize 200 Homes Using Stimulus Funds; In Anticipation of the Work, LEADS Hired Eight More Workers. “More than \$2 million of stimulus money pouring into the community could mean energy-efficient homes for more than 200 area residents this year. Already, Deena Lane has seen the effects in her own home. With her husband gone for part of 2008, Lane said she was unsure where to turn when water started dripping through her roof into her dining room. She had worked with LEADS Community Action Agency previously, and officials there suggested she get her name on the waiting list for its home-weatherization program. LEADS has operated the weatherization program locally for about 30 years, evaluating low-income households to determine the energy efficiency of their homes, then making needed improvements. In recent years the program has received about \$500,000 each year to inspect homes and conduct improvements. With about \$2.3 million provided by the American Recovery and Reinvestment Act to work with for the next two years, the agency anticipates helping a lot more families. In Lane's case, what started out as a leaky roof led to improvements throughout her house earlier this month. ‘I was surprised when they told me I could be eligible for a whole new furnace,’ she said. ‘Last year, I almost lost my home. I couldn't afford a new furnace.’ In addition to the furnace and roof, the agency covered her water heater, serviced the dryer, sealed up a basement window and cleaned out her registers, Lane said... The stimulus dollars also have provided jobs. In anticipation of the increased workload, LEADS hired eight local individuals. Mike Hayes, a local resident and a recent hire, said he has worked in the heating and cooling industry for more than a decade but was unemployed when he got the job at LEADS.” [[Newark Advocate](#), 5/14/09]

Council on Environmental Quality

Weekly Energy and Environment

Recovery Act Success Stories

From the Field:

Week of May 18 - May 22, 2009

Examples of how the American Recovery and Reinvestment Act is providing jobs to transition the country to a clean energy economy, protect our natural resources, and clean up pollution



NEBRASKA

The Nebraska Department Of Environmental Quality Will Use Stimulus Funds To Enhance The Quality And Management Of Surface And Ground Water In The Platte River Basin. "The U.S. Environmental Protection Agency has awarded more than \$200,000 of federal stimulus money to the Nebraska Department of Environmental Quality. Brian McManus of the Nebraska DEQ says his agency and the state Department of Natural Resources will use the money to enhance the quality and management of surface and ground water in the Platte River Basin. The grant comes from \$39 million of stimulus funds to be awarded nationally to states for water quality management planning." [[The Associated Press](#), 5/20/09]

SOUTH CAROLINA

ARRA Funds Will Pay to Redevelop, Detoxify Brownfields Across South Carolina. "An estimated \$3.6 million in grants were bolstered by funds from the American Recovery and Reinvestment Act of 2009 to help communities in South Carolina clean up brownfields in the state. The grants, which include \$1.6 million from the Recovery Act and \$2 million from the U.S. Environmental Protection Agency brownfields general program funding, will help to revitalize former industrial and commercial sites, turning them from problem properties to productive community use. Applicants selected to receive Recovery Act funds are Aiken—\$200,000 for the Avondale Mill Assessment along with \$400,000 of community-wide assessment funds and Columbia—\$1million in assessment coalition funds... The grants will help to assess, cleanup and redevelop abandoned, contaminated properties known as brownfields. Brownfields are sites where expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. In addition, the Small Business Liability Relief and Brownfields Revitalization Act of 2002 expanded the definition of a brownfield to include mine-scarred lands or sites contaminated by petroleum or the manufacture of illegal drugs. Grant recipients are selected through a national competition. The Brownfields Program encourages development of America's estimated 450,000 abandoned and contaminated waste sites." [[Environmental Protection Online](#), 5/19/09]

ARIZONA

Solar Companies Growing Thanks to Stimulus; Tempe-Based Evolution Solar Corp CEO: "Three Months Ago There Was No Stimulus Bill And Markets Were Coasting Downward. Now The Landscape Has Changed." "The solar energy sector posted gains in recent weeks as confidence begins to return to the market. Driven by expected increases in demand for solar energy supported by funding from the \$800 billion US stimulus bill and other government initiatives, solar has again gained strength in the alternative energy space. Evolution Solar Corp., as noted in recent weeks, is aiming to participate in government funded solar projects both through strategic relationships with other industry partners and through financing available under the stimulus bill. "Evolution

is evolving to meet the changing needs of the marketplace,' stated Robert Kaapke, CEO of Evolution Solar Corp. 'Three months ago, there was no stimulus bill and markets were coasting downward. Now the landscape has changed as large amounts of investment are anticipated for the solar industry in the United States.' Other industry leaders such as Sun Power, First Solar, Trina Solar Ltd, and LDK Solar Co. Ltd are also expected to benefit from these programs." [[CyberMedia India Online](#), 5/17/09]

OHIO

Car-Manufacturing Communities Will Receive \$50 million In Recovery Funds To Train Laid-Off Auto Workers For Jobs In The Energy Efficiency And Renewable Energy Sectors. "The federal government will give car-manufacturing communities \$50 million in grants to train laid-off workers for jobs in the energy efficiency and renewable energy sectors, the White House's auto recovery leader said Thursday. The funds also will provide job counseling and placement services. 'American workers are the best in the world, and they have been hard hit by changes in the auto industry,' said Ed Montgomery, President Barack Obama's director of recovery for auto communities and workers. 'This funding will help workers gain new skill sets that build upon their manufacturing experience.' The \$50 million is part of \$500 million provided by the federal stimulus law." [[The Associated Press](#), 5/21/09]

OKLAHOMA

Stimulus Will Pay for Tulsa's Buses To Be Replaced: Switch to Environmentally Friendly Compressed Natural Gas in Buses Will Save Money, Create Jobs for Those Converting Maintenance Shop to CNG. "The Tulsa Transit Authority is expecting more than \$13 million in stimulus money, which will be used to begin converting the fleet to compressed natural gas. MTTA officials say the plan is coming at the perfect time. All 62 buses in the Tulsa Transit fleet run on diesel, but officials are going after economic stimulus money to replace the diesel with compressed natural gas. 'CNG is something we've been looking at for a while now,' Tulsa Transit CEO Bill Cartwright said. Cartwright says CNG is cleaner than diesel and the switch will help save money on fuel... The stimulus money will replace 13 buses over the next two years. Cartwright says it will also pay to convert the transit authority's maintenance shop and build a CNG fueling station. He says the plan makes good use of stimulus money. 'First of all, someone's got to build these buses,' Cartwright said. 'Now these buses will not be built in Oklahoma. They'll be built elsewhere in the United States, but it's going to employ people directly building these vehicles. It's going to employ people here in Oklahoma, directly converting our maintenance shop to a CNG facility and building a fueling station.' Cartwright says the transit authority will be using a mixed fleet of diesel and CNG buses for at least the next 10 years." [[KOTV Channel 6 News](#), 5/21/09]

Council on Environmental Quality

Weekly Energy and Environment
Recovery Act Success Stories
From the Field:
Week of May 25 - May 29, 2009

Examples of how the American Recovery and Reinvestment Act is providing jobs to transition the country to a clean energy economy, protect our natural resources, and clean up pollution



NATIVE AMERICANS

Secretary Donovan Announced \$250 Million In Stimulus Housing Grants For Native Americans To Buy Land, Build New Homes Or Make Their Existing Homes More Energy Efficient. "Housing Secretary Shaun Donovan says the government will offer more than \$250 million in housing grants to American Indians and native Alaskans as part of the federal stimulus package. The competitive grants can be used to purchase land, build new homes and retrofit existing homes to make them more energy efficient. The money comes from the \$787 billion stimulus plan signed into law Feb. 17 by President Obama. Donovan said Wednesday the money could reduce crowding on reservations and improve living conditions for Native Americans across the country." [[Associated Press](#), 05/28/09]

SOUTH DAKOTA

SD Received Stimulus Funding for Water and Sewer Projects. "Gov. Mike Rounds says South Dakota has been awarded \$38.7 million for water and sewer projects as part of the American Recovery and Reinvestment Act (ARRA) of 2009. 'The federal stimulus funds will help create jobs and boost local economies as the funds are forwarded to local government entities and rural water systems,' the Governor said. "The money will finance improvements to aging water and wastewater systems that are essential to protecting public health and the environment.' The U.S. Environmental Protection Agency (EPA) awarded the funds this week to the state Department of Environment and Natural Resources. The South Dakota Board of Water and Natural Resources will disburse the funds for eligible drinking water, wastewater, and storm water projects. The Clean Water State Revolving Fund Program received \$19.2 million in stimulus funds. The program provides low-interest loans for wastewater and storm sewer projects. The Drinking Water State Revolving Fund Program, which provides low-interest loans for public drinking water systems, received \$19.5 million from EPA. ARRA requires at least 50 percent of the EPA State Revolving Funds to be given out in the form of increased subsidization. The Board of Water and Natural Resources has chosen to apply principal forgiveness of at least 10 percent to qualifying loans from those funds. An additional requirement is that at least 20 percent of the funds be used for green infrastructure, water and energy-efficiency improvements, and other environmentally innovative projects." [[KSFY News](#), 05/22/2009]

MISSOURI

Stimulus Funds Will Be Made Available In Missouri To Restore Fish And Wildlife Habitats On Private Lands. "Secretary of the Interior Ken Salazar announced that \$80,000 has been made available in Missouri to restore fish and wildlife habitat on private lands through the American Recovery and Reinvestment Act. The funding will support voluntary habitat improvement projects completed through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife program in partnership with private landowners... In Missouri, ARRA funds through the Partners program will go toward restoring habitat along Tavern Creek in the southern part of the state. The work will benefit the Niangua darter, a federally endangered fish. Partners program projects are typically constructed by local contractors, channeling dollars to the local economy." [[Kansas City InfoZine](#), 5/27/09]

MINNESOTA

Bemidji Insulation Installer Anticipates Hiring More Workers Since Stimulus Will Pay for Weatherization Projects Across Minnesota. "Construction contractor Milo Winans, who has been weatherizing homes in northern Minnesota for 25 years, could soon become a very busy man. Federal stimulus money is set to arrive this summer to make the homes of people with modest means more energy efficient, and people like Winans hope it means steady work in otherwise difficult times. 'It will mean that we can probably add one or two more guys and basically keep busy,' Winans said. 'Things have been a little slow lately, so hopefully that will change it around.' Minnesota's low-income weatherization program is getting \$131 million from the federal government — about 13 times what it usually gets. Winans said he expects the number of low-income weatherization jobs he takes this year to increase because of the extra money. The weatherization program is administered by 32 community action programs around the state. Those programs normally arrange work for about 4,000 homes. The funding boost could mean 20,000 homes are weatherized. The work mainly includes beefing up insulation and tuning up or replacing furnaces and boilers. After stuffing insulation into walls at a home near Blackduck recently, Winans said that work plus a furnace tuneup would likely cut heating costs down by about 20 percent. "They'll really notice it, because there was nothing in there in the first place, other than some newspaper," Winans said. Besides construction contractors like Winans, the weatherization program will also need home energy auditors to find out where a homeowner can improve efficiency." [AP, 05/24/2009]

CALIFORNIA

Recovery Act Funds Will Repair Exigent Santa Maria River Levee. "Today the City of Santa Maria was informed that the U.S. Army Corps of Engineers will make available \$40.231 million for the Santa Maria River Levee repair project. Combined with the previously approved \$6.7 million for repairs, this means the project is fully funded over its two-to-three-year construction period. "This is just tremendous news for the City of Santa Maria,' Mayor Larry Lavagnino said, after receiving the notification shortly before noon in a personal call from Rep. Lois Capps. The Congresswoman earlier received a phone call from Col. Thomas Magness of the U.S. Army Corps of Engineers informing her of this exciting announcement. The funding is part of the American Recovery and Reinvestment Act (ARRA), which President Barack Obama signed into law on Feb. 17, 2009, to help in the recovery of the U.S. economy. 'It is a wise use of Federal recovery funds because this project is shovel-ready and will improve safety for tens of thousands of people in the Santa Maria Valley,' the Mayor said. 'This has been a top priority for the City, the Army Corps, and the County for several years, and we look forward to construction commencing this fall. This project will protect 20,000 parcels in the City and create hundreds of jobs." [City of Santa Monica, 05/28/09]

NEW MEXICO

First Albuquerque Stimulus Projects Set To Begin. "Albuquerque Mayor Martin Chavez says over the next couple of months residents will begin to see the first phase of the city spending federal stimulus dollars. Of the \$150 million Albuquerque is expected to get initially, more than \$5 million will come from energy block grants. Those are the projects that will likely be seen first. Chavez said Monday, 'People should start to feel the money, start to see the money being spent in construction here in the next eight weeks.' Those projects include solar panels being added to parking structures and bus shelters. Outlets will also be added in the garages to charge up hybrids. The city hopes to see more hybrid and electric cars not only on the road, but also in its own garages." [KOB_NM, 05/26/09]

Council on Environmental Quality

Weekly Energy and Environment Recovery Act Success Stories From the Field: Week of June 1 - June 5, 2009

Examples of how the American Recovery and Reinvestment Act is providing jobs to transition the country to a clean energy economy, protect our natural resources, and clean up pollution



WEST VIRGINIA

\$37.5 Million In Recovery Funds Will Allow West Virginia To Expand Weatherization Two-Fold; With New Resources, State Government's Objective Now To Weatherize 2,756 Homes. "Nearly twice the usual number of West Virginia households will benefit this year from the government's weatherization program, which helps insulate, plug leaks and replace heating units in homes. Last year, 1,389 West Virginia households received home repairs paid for by public weatherization funds. The state is aiming much higher this year with a goal to weatherize at least 2,756 homes, thanks largely to \$37.5 million provided by the American Recovery and Reinvestment Act of 2009, also known as the federal stimulus. The funding should trickle into the state over the next two years, said Ed Harper, director of the Governor's Office of Economic Opportunity, which oversees the low-income weatherization assistance program in West Virginia. Harper said the office usually operates on an annual budget of \$7 million, meaning the stimulus dollars provide a considerable 'shot in the arm.'" [Charleston Daily Mail, 6/5/09]

MASSACHUSETTS

Recovery and Reinvestment Act Monies Play Crucial Role In Creation Of Research Lab Dedicated To Environmentally Friendly Lithium-Ion Batteries, Creating 600 New Jobs. "While talking about the opening of a new research lab near Boston-Power Inc.'s Westboro headquarters in March, Chief Executive Officer Christina Lampe-Onnerud envisioned her company manufacturing rechargeable lithium-ion batteries for the growing number of hybrid and battery-electric vehicles in Central Massachusetts. The four-year-old battery company had just scored a major breakthrough with laptop giant Hewlett-Packard Co. adopting Boston-Power's Sonata battery for use in many of its laptop models. Today Boston-Power will announce its plans to establish a 455,000-square-foot battery manufacturing facility in the former Filene's Basement warehouse and distribution facility at 26 Millbury St. The manufacturing plant, contingent on \$100 million in federal stimulus funds, would create 600 new jobs, Ms. Lampe-Onnerud said. Gov. Deval L. Patrick, Lt. Gov. Timothy P. Murray and several state and local officials will participate in a noon press conference at the Auburn site. 'We've said for a long time that we want to bring manufacturing back to the U.S.,' Ms. Lampe-Onnerud said. 'This is an opportunity to do this with the help of the federal government and the state.'" [Worcester Telegram & Gazette, 06/01/09]

IOWA

Secretary of Agriculture Tom Vilsack Announced That Iowa Will Receive Over \$24 Million For Construction Of Perpetual Flood Plain Easements To Protect Against Future Floods; Plains Will Also Protect Ecosystems And Increase Water Quality. "Iowa will get more than \$24 million in federal stimulus money to develop perpetual flood plain easements on 4,200 acres to mitigate future flood damage. Secretary of Agriculture Tom Vilsack announced the funding and \$755,000 for a watershed project on Bear Creek in northeast Iowa on Tuesday as part of the American Recovery and Reinvestment Act. Vilsack, a former Iowa governor, said the 41 easements in Iowa will restore flood-prone areas to their natural state 'to protect against future floods, improve water quality, enhance wildlife habitat and reduce the need for future disaster assistance.' The projects in 21 Iowa counties range from one parcel of land to several parcels, said Rich Simms, state conservationist with the USDA's Natural Resources Conservation Service-Iowa. In some cases, he added, a number of flood plains will be joined to form a larger, more uniform flood plain to improve flood plain management, he said. By changing the land use from cropland to flood plain, he said, damage to both upstream and downstream property can be reduced by allowing floodwaters to slow down and spread out, Simms said." [Cedar Rapids Gazette, 06/3/09]

FLORIDA

Tampa Bay Will Receive A \$23 Million Low Interest Loan And A \$2.55 Million Grant For A 9 Mile Water Pipeline Replacement. "Stimulus funding will soon flow through the Tampa Bay area in the form of funding for water pipelines replacement. The city of Tampa will receive a \$2.55 million grant and a \$23 million low-interest loan from the Florida Department of Environmental Protection. The city will use the funds to replace nine miles of water pipelines in downtown and Davis Islands. The pipelines are between 80 and 100 years old and beyond their useful life, said Brad Baird, director of the city's water department. To obtain the stimulus funding, the city filled out a request for inclusion with the state's Clean Water State Revolving Fund program. 'We were just completing the design last month, so the timing was very good,' Baird said." [Tampa Bay Business Journal, 6/5/09]

HAWAII

Weatherization Assistance Program Awarded \$3.7 Million In Stimulus Monies To Improve Energy Efficiency And Sustainability Of Hawaiian Homes. "The State Department of Labor and Industrial Relations, along with the State Department of Business, Economic Development and Tourism, has awarded more than \$3.7 million in federal stimulus funds under the American Recovery and Reinvestment Act-Weatherization Assistance Program to help make homes of low-income Hawaii residents more energy-efficient. The total award consists of two separate grants, with Maui Economic Opportunity receiving \$2.5 million to serve the counties of Maui, Hawaii and Kauai, and the Honolulu Community Action Program Inc. receiving more than \$1.2 million to serve Honolulu." [Hawaii Star-Bulletin, 06/04/09]

Council on Environmental Quality

Weekly Energy and Environment
Recovery Act Success Stories
From the Field:
Week of June 8 - June 12, 2009

Examples of how the American Recovery and Reinvestment Act is providing jobs to transition the country to a clean energy economy, protect our natural resources, and clean up pollution



WISCONSIN

30% Federal Tax Credit Provided Through Recovery And Reinvestment Act Causes Interest In Geothermal Upgrades To Burgeon. "Installing energy-efficient appliances and systems can help homeowners with short-term tax breaks and long-term energy savings. The American Recovery and Reinvestment Act of 2009 — the stimulus bill signed into law by President Barack Obama — included a number of changes to the energy-efficiency tax credits. Federal tax credits for energy-efficiency improvements have been raised from 10 percent to 30 percent, plus a maximum credit of \$1,500 for improvements done in 2009 and 2010. Caps on tax credits for installing efficient windows and furnaces have been eliminated. 'The 30 percent tax credit has promoted some definite interest with geothermal,' said Mike Alf, sales and business manager for Van's Refrigeration in Oneida. The company installs between 50 and 60 geothermal systems each year in both new and existing homes. Geothermal systems use the earth's warmer temperatures to extract and distribute heat through homes using a system of tubes. The initial cost of the system — often more expensive than conventional heating and cooling systems — can be mitigated by the 30 percent tax credit. The result: an almost immediate savings in energy costs." [Greenbay Press-Gazette, 6/8/09]

MONTANA

University Of Montana Will Use Stimulus Funds to Upgrade School Building to Be More Energy-Efficient. "One of Dillon's signature buildings will undergo a major renovation after holding strong for more than 100 years. Now, the next hundred look very bright on the campus of University of Montana Western. The university's Main Hall is the beneficiary of a boost in funds from the American Recovery and Reinvestment Act, also known as the nation's 'stimulus package.' Montana Western receives \$6 million in funding from the stimulus and will use an additional \$4.5 million from the state for a variety of upgrade projects. 'We'll refurbish floors and walls. We'll do all kinds of things with the infrastructure in terms of heating and ventilation, air flow, energy projects to make it a much more energy efficient building. We'll modernize it with technology so we can do a better job with our students and faculty in teaching. If you think about it, this is a model of small town America taking advantage of the stimulus package. We're doing exactly what the federal government intended,' University of Montana Western Chancellor Dick Storey said. The university's Vice Chancellor Susan Briggs says bidding opened in Helena Wednesday for the first phase of the project, which includes infrastructure construction and programming for all projects. The state has 30 days to award the low bidder with a contract." [Montana's News Station, 6/10/09]

ARIZONA

Arizona Will Receive \$22.8 Million In Stimulus Funds For Its Weatherization Program. "Arizona won approval Monday for its weatherization plan under the federal stimulus program, which will bring the first installment of \$22.8 million to the state. A total of more than \$57 million is available to enhance energy efficiency through home improvements, if federal officials are satisfied with the state's implementation of the first phase. And the state is applying for another \$65 million in federal energy funding. Gov. Jan Brewer said the State Energy Office at the Arizona Department of Commerce should be receiving the money any day. Brewer's office said Arizona was the first state to apply for the weatherization assistance grant April 28, and among the first to receive funding. 'The timing is tremendous for both the workers and the citizens that will benefit,' Brewer said in a statement. 'Being among the first means we get a jump start on putting Arizonans back to work, and it comes at a time when consumers really need the help with summer cooling bills.'" [The Arizona Guardian, 6/8/09]

DELAWARE

Stimulus Funds Will Pay for Dover to Upgrade Street Lights with Energy-Efficient LEDs. "The federal government has passed along \$180,000 requested by the city of Dover to further its energy-saving pursuits, including the installation of 64 LED light fixtures along Division Street. The money was made available under the Obama administration's economic stimulus package. At a news conference hosted by Mayor Carleton E. Carey Sr., Sen. Tom Carper, D-Del., described the grant as one more step toward creating green jobs as quickly as possible to help mitigate the economic crisis. 'When we come out of it,' Carper said, 'we'll have a new segment to our economy, and that's green jobs.' Jeremy Johnson, the city's electrical engineer and author of its successful grant proposal, said the new fixtures would replace less-efficient high-pressure sodium lights. He said the new lights were expected to account for \$200,000 in 'cost-of-ownership savings' -- a measurement that reflects lower maintenance and replacement costs, as well as energy savings -- over the anticipated 20-year life of the fixtures. Typically, sodium lights last about 10 years." [The News Journal, 6/6/09]

OREGON

Stimulus Funds Will Allow Oregon Community Groups To Weatherize 4,635 Homes. "The Obama administration today announced \$15 million in economic stimulus money for home weatherization programs in Oregon that are intended to boost job creation while improving energy efficiency. Oregon, Arizona, Kansas and Mississippi are the first four states to receive the latest round of weatherization funding. The new chunk of money means Oregon has received 50 percent of its stimulus money for a weatherization program aimed at helping the low-income, elderly and families with young children... After the state shows successful implementation of its program, Oregon should receive another \$19 million, for a total \$38 million from the stimulus bill, known as the American Recovery and Reinvestment Act. It received \$4 million earlier this year for training and ramp-up activities. The \$15 million awarded today will weatherize 4,635 homes in Oregon. The state is granting the money to 17 community groups and five Native American tribes with experience in getting energy efficiency measures to low income households." [The Oregonian, 6/8/09]

Columbia Center for Children's Environmental Health
 MSPH Logo <<http://www.mailman.hs.columbia.edu/>>
 Web & Directory Search Go <[javascript: submitform\(\)](#)>
 People MSPH CUMC

CU

Home <<http://www.mailman.hs.columbia.edu/>> | News & Information
 <<http://www.mailman.hs.columbia.edu/news/index.html>> | Headlines
 <<http://www.mailman.hs.columbia.edu/news/newsitems.html>> | Archive
 <<http://www.mailman.hs.columbia.edu/news/news-archives.html>>

Contact:

Stephanie Berger
 212-305-4372
 sb2247@columbia.edu <<mailto:sb2247@columbia.edu>>

Children's IQ Can Be Affected by Mother's Exposure to Urban Air Pollutants

July 20, 2009 -- Prenatal exposure to environmental pollutants known as polycyclic aromatic hydrocarbons (PAHs) can adversely affect a child's intelligence quotient or IQ, according to new research by the Columbia Center for Children's Environmental Health (CCEH) at the Mailman School of Public Health. PAHs are chemicals released into the air from the burning of coal, diesel, oil and gas, or other organic substances such as tobacco. In urban areas motor vehicles are a major source of PAHs. The study findings are published in the August 2009 issue of *Pediatrics*.

The study, funded by the National Institute of Environmental Health Sciences (NIEHS), a component of the National Institutes of Health, the U.S. Environmental Protection Agency and several private foundations, found that children exposed to high levels of PAHs in New York City had full scale and verbal IQ scores that were 4.31 and 4.67 points lower, respectively than those of less exposed children. High PAH levels were defined as above the median of 2.26 nanograms per cubic meter (ng/m³).

"These findings are of concern because these decreases in IQ could be educationally meaningful in terms of school performance," says Frederica Perera, DrPH, professor of Environmental Health Sciences and director of the CCEH at Columbia University Mailman School of Public Health and study lead author. "The good news is that we have seen a decline in air pollution exposure in our cohort since 1998, testifying to the importance of policies to reduce traffic congestion and other sources of fossil fuel combustion byproducts."

The study included children who were born to non-smoking Black and Dominican American women age 18 to 35 who resided in Washington Heights, Harlem or the South Bronx in New York. The children were followed from in utero to 5 years of age. The mothers wore personal air monitors during pregnancy to measure exposure to PAHs and they responded to questionnaires.

At 5 years of age, 249 children were given an intelligence test known as the Wechsler Preschool and Primary Scale of the Intelligence, which provides verbal, performance and full-scale IQ scores. The researchers developed models to calculate the associations between prenatal PAH exposure and IQ. They accounted for other factors such as second-hand smoke exposure, lead, mother's education and the quality of the home caretaking environment. Study participants exposed to air pollution

Columbia Center for Children's Environmental Health levels below the average were designated as having "low exposure," while those exposed to pollution levels above the average were identified as "high exposure." A total of 140 children were classified as having high PAH exposure.

"The decrease in full-scale IQ score among the more exposed children is similar to that seen with low-level lead exposure," noted Dr. Perera. "This finding is of concern because IQ is an important predictor of future academic performance, and PAHs are widespread in urban environments and throughout the world. Fortunately, airborne PAH concentrations can be reduced through currently available controls, alternative energy sources and policy interventions."

Mailman School of Public Health's Li Zhigang, Robin Whyatt, Lori Hoepner, Shuang Wang, David Camann, and Virginia Rauh were co-authors of the study.

"The Columbia Center for Children's Environmental Health" is part of the Mailman School of Public Health at Columbia University. It is a leading research organization dedicated to understanding and preventing environmentally related disease in children. Founded in 1998, the Center conducts research in New York City, including the study of mothers and children in Northern Manhattan and South Bronx, a World Trade Center Study, as well as Krakow, Poland, and Chongqing, China. Its mission is to improve the respiratory health and cognitive development of children and to reduce their cancer risk by identifying environmental toxicants and conditions related to poverty that increase their risk of disease. In NYC, the Center collaborates with residents and partner organizations in Washington Heights, Harlem and the South Bronx to share research findings with the local communities in ways that are meaningful and usable in daily life. (www.ccceh.org)

*About the Mailman School of Public Health
 *The only accredited school of public health in New York City and among the first in the nation, Columbia University Mailman School of Public Health pursues an agenda of research, education, and service to address the critical and complex public health issues affecting millions of people locally and globally. The Mailman School is the recipient of some of the largest government and private grants in Columbia University's history. Its more than 1000 graduate students pursue master's and doctoral degrees, and the School's 300 multi-disciplinary faculty members work in more than 100 countries around the world, addressing such issues as infectious and chronic diseases, health promotion and disease prevention, environmental health, maternal and child health, health over the life course, health policy, and public health preparedness. www.mailman.columbia.edu <<http://www.mailman.columbia.edu/>>

Home <<http://www.mailman.hs.columbia.edu/>> | Columbia University
 <<http://www.columbia.edu/>> | CUMC <<http://www.cumc.columbia.edu/>>
 | Jobs <<http://www.columbia.edu/cu/jobs/>> | Contact Us
 <<http://www.mailman.hs.columbia.edu/resources/contactus.html>> |
 webmaster <<http://www.mailman.hs.columbia.edu/resources/webmaster.html>>
 | Administrative Resources
 <<http://www.mailman.hs.columbia.edu/resources/>> | © 2009 Mailman School

Effect of Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons on Neurodevelopment in the First 3 Years of Life among Inner-City Children

Frederica P. Perera,¹ Virginia Rauh,¹ Robin M. Whyatt,¹ Wei-Yann Tsai,^{1,2} Deliang Tang,¹ Diurka Diaz,¹ Lori Hoepner,¹ Dana Barr,³ Yi-Hsuan Tu,¹ David Camann,⁴ and Patrick Kinney¹

¹Columbia Center for Children's Environmental Health, Mailman School of Public Health, Columbia University, New York, New York, USA; ²Department of Statistics, National Cheng Kung University, Taiwan, Republic of China; ³Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences, Atlanta, Georgia, USA; ⁴Department of Analytical and Environmental Chemistry, Southwest Research Institute, San Antonio, Texas, USA

Our prospective cohort study of nonsmoking African-American and Dominican mothers and children in New York City is evaluating the role of prenatal exposure to urban pollutants, including polycyclic aromatic hydrocarbons (PAHs), environmental tobacco smoke (ETS), and pesticides, in the pathogenesis of neurobehavioral disorders. We used the Bayley Scales of Infant Development to evaluate the effects on child mental and psychomotor development of prenatal exposure to airborne PAHs monitored during pregnancy by personal air sampling. Behavioral development was assessed by the Child Behavior Checklist. We adjusted for potential confounders including sociodemographic factors and prenatal exposure to ETS and chlorpyrifos. Prenatal exposure to PAHs was not associated with psychomotor development index or behavioral problems. However, high prenatal exposure to PAHs (upper quartile) was associated with lower mental development index at age 3 [$\beta = -5.69$; 95% confidence interval (CI), -9.05 to -2.33 ; $p < 0.01$]. The odds of cognitive developmental delay were also significantly greater for children with high prenatal exposure (odds ratio = 2.89; 95% CI, 1.33 to 6.25; $p = 0.01$). General estimated equation analysis showed a significant age \times PAH effect on mental development ($p = 0.01$), confirming the age-specific regression findings. Further adjustment for lead did not alter the relationships. There were no differences in effect sizes by ethnicity. The results require confirmation but suggest that environmental PAHs at levels recently encountered in New York City air may adversely affect children's cognitive development at 3 years of age, with implications for school performance. **Key words:** air pollution, neurodevelopment, polycyclic aromatic hydrocarbons, prenatal. *Environ Health Perspect* 114:1287–1292 (2006). doi:10.1289/ehp.9084 available via <http://dx.doi.org/> [Online 24 April 2006]

The impact of environmental toxicants on children's health is increasingly recognized as significant (Faustman 2000; Greater Boston Physicians for Social Responsibility 2000; Landrigan et al. 1999; Perera et al. 2002). Human and experimental studies indicate that the fetus and infant are more sensitive than adults to diverse environmental toxicants, including lead, mercury, environmental tobacco smoke (ETS), polycyclic aromatic hydrocarbons (PAHs), and pesticides (National Research Council 1993; Neri et al. 2006; Perera et al. 2005b; Whyatt and Perera 1995; World Health Organization 1986). Urban minority populations represent high-risk groups for adverse health and developmental outcomes (Claudio et al. 1999; Federico and Liu 2003; New York City Department of Health 1998; Perera et al. 2002). Although urban air pollution crosses geographic and socioeconomic boundaries, these same populations are likely to be more heavily exposed to indoor and outdoor air pollution and pesticides (Breysse et al. 2005; Olden and Poje 1995; Perera et al. 2002). As reported previously, the present study cohort has had substantial although variable exposure to multiple contaminants during pregnancy, with 100% of subjects having exposure to PAHs and pesticides in the air during pregnancy and 40% reporting

ETS exposure (Perera et al. 2003; Rauh et al. 2004; Whyatt et al. 2002). PAH exposure in this urban cohort of nonsmokers is largely due to traffic sources and ETS (which was controlled for in analyses).

To our knowledge, there have been no prior human studies of the effect of prenatal exposure to airborne PAHs on child development. However, prenatal exposure to ETS has been associated with reduced fetal growth and cognitive functioning (Martinez et al. 1994; Rauh et al. 2004; Schuster and Ludwig 1994; Sexton et al. 1990; Windham et al. 1999; Yoltan et al. 2005). Associations have been observed between prenatal exposure to the pesticide chlorpyrifos (CPF) and neurodevelopmental outcomes in experimental systems (Aldridge et al. 2005). Lead and mercury are known developmental toxicants affecting fetal development (Agency for Toxic Substances and Disease Registry 1999; Canfield et al. 2003; Grandjean et al. 1997; Lanphear et al. 2000).

In addition to being genotoxic and carcinogenic, PAHs such as benzo[a]pyrene (BaP) are endocrine disruptors (Boström et al. 2002; Bui et al. 1986; Kazeto et al. 2004). Prior laboratory and human studies in Central Europe and in our New York City cohort indicate that transplacental exposure to PAHs is associated with adverse birth outcomes (Barbieri et al.

1986; Bui et al. 1986; Dejmeek et al. 2000; Legraverend et al. 1984; Perera et al. 1998, 2005a). In the present analysis, we evaluated the effects of prenatal exposure to airborne PAHs, estimated by personal air sampling of the mother during pregnancy, on mental and psychomotor development of children through 36 months of age, controlling for physical, biologic, and psychosocial determinants of these outcomes.

Materials and Methods

Study subjects. The present cohort study is being conducted by the Columbia Center for Children's Environmental Health (CCCEH) (Perera et al. 2003). The study was approved by the Institutional Review Board (IRB) of Columbia University. Dominican and African-American women (ethnicity classified by self-report) residing in Washington Heights, Central Harlem, and the South Bronx, New York, who registered at the obstetrics/gynecology clinics at New York Presbyterian Medical Center and Harlem Hospital by the 20th week of pregnancy were approached in the clinics for consent. At that time, the women agreeing to participate in the prospective cohort study signed the IRB-approved consent form. Eligible women were nonsmokers during the

Address correspondence to F.P. Perera, Columbia Center for Children's Environmental Health, Mailman School of Public Health, Columbia University, 60 Haven Ave., B-109, New York, NY 10032 USA. Telephone: (212) 304-7280. Fax: (212) 544-1943. E-mail: fpp1@columbia.edu

We acknowledge H. Andrews, R. Garfinkel, Y.H. Jiu, L. Qu, J. Zhou, A. Reyes, and M. Borjas at the Columbia Center for Children's Environmental Health, and E. Needham, T. Bennett, R. Jones, and K. Caldwell at the Centers for Disease Control and Prevention.

This study was supported by the National Institute of Environmental Health Sciences (5P01ES09600, 5R01ES08977, R01ES111158, R01ES012468, ES09089), the U.S. Environmental Protection Agency (R827027, 8260901, RR00645), Educational Foundation of America, Horace W. Goldsmith Foundation, the Irving A. Hansen Memorial Foundation, Gladys & Roland Harriman Foundation, the New York Community Trust, the Bauman Family Foundation, the Beldon Fund, and the John Merck Fund.

The authors declare they have no competing financial interests.

Received 10 February 2006; accepted 27 April 2006.

current pregnancy; were free of diabetes, hypertension, and known HIV; had no documented or reported drug abuse; and had resided in the area for at least 1 year. At the time of this report, of 648 consenting and eligible mother-infant pairs, 536 were still participating in the cohort study; 271 children had reached 3 years of age. The retention rate for the full cohort was 83% at the 3-year follow-up. There were no significant differences between women retained in the study versus those who were lost to follow-up, on maternal age, ethnicity, marital status, education, income, gestational age, or birth weight of the newborn.

In this report we focus on the 183 children 3 years of age who had valid prenatal PAH monitoring data, all three annual developmental assessments, prenatal questionnaire data on ETS, measurements of cotinine in maternal and cord blood samples ≤ 25 ng/mL (to exclude the possibility that the mother was an active smoker), and CPF level in cord blood. This group did not differ in any of the maternal or infant characteristics or prenatal exposures in Table 1 from the 80 children 3 years of age excluded from the analysis because of missing data. Of these, 64 children were excluded because of missing developmental testing data.

Personal interview. A 45-min questionnaire was administered by a trained bilingual interviewer during the last trimester of pregnancy (Perera et al. 2003). The questionnaire elicited demographic information, residential, health, and environmental history, including active and passive smoking [household members who smoke and estimated cigarettes smoked per day by smoker(s)], and socioeconomic information related to income and education. Postnatal

interviews were administered at 6 months, annually, and every 3–6 months in between to determine any changes in residence, exposure to ETS, and other health or environmental conditions.

Prenatal personal PAH assessment. During the third trimester of pregnancy, personal monitoring was carried out as previously described (Perera et al. 2003). Vapors and particles ≤ 2.5 μ m in diameter were collected on a pre-cleaned quartz microfiber filter and a pre-cleaned polyurethane foam cartridge backup. The samples were analyzed at Southwest Research Institute (San Antonio, TX) for benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, BaP, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[g,h,i]perylene as described by Tonne et al. (2004). For quality control, each personal monitoring result was assessed as to accuracy in flow rate, time, and completeness of documentation. All of the 183 subjects had samples of acceptable quality.

Biologic sample collection and analysis. A sample of umbilical cord blood (30–60 mL) was collected at delivery by syringing blood into a heparinized syringe to avoid clotting. A sample of maternal blood (30–35 mL) was collected within 2 days postpartum into heparinized Vacutainer tubes (BD Medical, Franklin Lakes, NJ) by hospital staff. Samples were processed at the CCEH laboratory, and portions were sent to the Environmental Health Laboratory at the Centers for Disease Control and Prevention (CDC; Atlanta, GA) for analysis of cotinine, heavy metals, and pesticides. Plasma cotinine was analyzed using high-performance liquid chromatography atmospheric-pressure ionization tandem mass

spectrometry as described by Bernert et al. (1997, 2000). Plasma levels of CPF were analyzed using isotope-dilution gas chromatography–high-resolution mass spectrometry as described by Barr et al. (2002). In a subset ($n = 135$) of subjects, lead was analyzed by inductively coupled plasma mass spectrometry (CDC 2003).

Information on pregnancy outcomes. Information was abstracted by the research workers from mothers' and infants' medical records after delivery, including gestational age at birth, infant sex, birth weight, length, head circumference, infant malformations, and pregnancy complications. Gestational age was based on medical records for almost all subjects. Where those data were missing, gestational age was calculated from the last menstrual period.

Measures of child behavior and neurodevelopment. We used the Bayley Scales of Infant Development–Revised (BSID-II) to assess cognitive and psychomotor development at 12, 24, and 36 months of age (Bayley 1993). The BSID-II is the most widely used norm-referenced developmental test for young children, can be used to diagnose developmental delay, and is known to be sensitive to the developmental effects of toxic exposures such as low-level intrauterine lead. The stability of cognitive assessments during the first few years of life is limited, but the predictive power increases after 2 years. When administered at 3 years of age, the BSID-II has moderate predictive power for subsequent intelligence and school performance and is clinically useful for the identification of children performing in the subnormal range (Bayley 1993; Burchinal et al. 2000; Sternberg et al. 2001). Each test yields a developmental quotient (raw score/chronologic age), which generates a mental development index (MDI) and a corresponding psychomotor development index (PDI). In addition, children are classified as normal (> 85), moderately delayed (> 70 and ≤ 85), or severely delayed (≤ 70) based on standardized cut-points. Each child was tested under controlled conditions at the CCEH by a bilingual research assistant, trained and checked for reliability. In the present study, the interrater reliability for the 24-month MDI was $r = 0.92$, based on double scoring of a random 5% of the sample (Rauh et al. 2004). One hundred eighty-one children had complete MDI at 1, 2, and 3 years of age; 181 had complete data on PDI, and 183 had either complete MDI or PDI.

Behavior problems were measured by maternal report on the 99-item Child Behavior Checklist (CBCL) for children 1.5–5 years of age, which collects information on child behaviors occurring in the past 2 months (Achenbach and Rescorla 2000). The CBCL is well validated, easy to administer, and useful as a screen for behavior problems. The Total Problems (T) score is the sum of the scores on

Table 1. Characteristics of the study population by PAH exposure level ($n = 183$)^a

| Characteristic | Prenatal PAH exposure level | |
|--|---|---|
| | High exposure ^b ($n = 42$) | Low exposure ^b ($n = 141$) |
| Maternal characteristics | | |
| Ethnicity (%) | | |
| African American | 40.5 | 47.5 |
| Latino | 59.5 | 52.5 |
| Age (years) | 25.03 \pm 4.79 | 24.89 \pm 5.53 |
| Married (%) | 11.9 | 15.1 |
| No high school degree (%) | 47.6 | 31.9 |
| Maternal intelligence quotient | 84.37 \pm 10.27 | 86.27 \pm 13.45 |
| Caretaking home environment | 37.55 \pm 5.58* | 39.82 \pm 5.82* |
| Infant characteristics | | |
| Birth weight (kg) | 3,367.44 \pm 529.69 | 3,413.16 \pm 462.47 |
| Birth length (cm) | 50.73 \pm 2.72 | 50.79 \pm 3.85 |
| Birth head circumference (cm) | 34.01 \pm 1.69 | 34.34 \pm 1.95 |
| Gestational age (weeks) | 39.17 \pm 1.25 | 39.40 \pm 1.38 |
| Percent male | 47.6 | 45.4 |
| Prenatal exposure | | |
| ETS [at least one smoker in house (%)] | 38.1 | 39.7 |
| CPF (pg/g) | 5.94 \pm 11.44 | 3.56 \pm 4.45 |
| Cord lead (μ g/dL) ^c | 1.01 \pm 0.69 | 1.08 \pm 0.79 |

Values are mean \pm SD or percent.

^aIncludes subjects with MDI and/or PDI ($n = 183$). ^bHigh exposure was defined as the fourth quartile of PAH; low exposure was defined as all others (quartiles 1, 2, 3). There was no difference between the two exposure groups with respect to any of the characteristics, except for the home environment. ^cCord lead was available in a subset of 135. * $p < 0.05$, by Wilcoxon rank-sum test.

the specific problem items plus the highest score on any additional problems entered by the respondent for the open-ended item 100, and is computed by summing the scores for the problems. T scores > 63 (> 90th percentile) represent the clinical range, and T scores between 60 and 63 (83rd to 90th percentile) represent the borderline range. The CBCL also yields scales derived from the *Diagnostic and Statistical Manual of Mental Disorders* (2000) that are intended to approximate clinical diagnoses, including affective, anxiety, pervasive developmental, attention deficit/hyperactivity, and oppositional defiant problems. All subscales are scored continuously and also categorized using a borderline or clinical cut-point corresponding to the 98th percentile for each domain. One hundred sixty-eight children of the children with Bayley scores also had CBCL data.

Maternal nonverbal intelligence was measured by the Test of Non-Verbal Intelligence, second edition (Brown et al. 1990), a 15-min, language-free measure of general intelligence, relatively stable and free of cultural bias. The test was administered when the child was 3 years of age. The quality of the proximal caregiving environment was measured by the Home Observation for Measurement of the Environment (Caldwell and Bradley 1979), administered at 3 years of age. The instrument assesses physical and interactive home characteristics (Bradley et al. 1989), is predictive of developmental scores in early childhood, and has been widely used in studies of neurotoxicity (e.g., Bellinger et al. 1988).

Statistical analysis. As in prior analysis (Peters et al. 2003), a composite PAH variable was computed from the eight intercorrelated PAH air concentration measures (*r* values ranging from 0.54 to 0.94; all *p*-values < 0.001 by Spearman's rank). This variable was dichotomized at the fourth quartile (4.16 ng/m³) to obtain a measure of high/low exposure that is more robust than the continuous variable. The CPF variable was also dichotomized at the fourth quartile as previously described (Whyatt et al. 2004). The concentration of lead in cord blood was treated as a continuous variable.

We estimated the associations between prenatal PAH exposure (high/low) and developmental scores (cognitive and psychomotor) for 12, 24, and 36 months of age using multiple linear regression for continuous outcomes (MDI and PDI) and logistic regression for categorical outcomes (likelihood of being classified as developmentally delayed). We estimated associations between prenatal PAH exposure (high/low) and behavior problems in the clinical range at 36 months of age using logistic regression. We used general estimated equation (GEE) (Liang and Zeger 1986) to estimate the size of the PAH effect over time (through

36 months) and at specific time points. To evaluate trends over time, the model compares the two exposure groups in terms of the difference in MDI scores obtained at 1 year of age (baseline) versus 2 years and 1 year versus 3 years, respectively. GEE has the advantage of requiring fewer assumptions than other methods; thus, the results of GEE are more robust. All effect estimates, 95% confidence intervals (CIs), and *p*-values (*α* = 0.05) were generated using SPSS (version 11.5; SPSS Inc., Chicago, IL) and SAS (version 9.0; SAS Institute Inc., Cary, NC). Covariates were retained in the models as potential confounders if they exhibited a relationship (*p* ≤ 0.1) with motor or mental development, regardless of their association with PAH exposure. The final models included an indicator for PAH exposure, the child's exact age at test administration, child's sex, ethnicity, gestational age at birth, quality of the home (caretaking) environment, and prenatal exposure to ETS and CPF measured as described above. In addition, the possible confounding of prenatal exposure by lead was tested in the subset of 135 children with available data. Interactions of PAH exposure with other independent variables were tested as appropriate.

We assessed potential mediation of the association between PAH exposure and development over time by including those fetal growth parameters previously shown to be affected by prenatal PAH exposure (birth

weight and head circumference) in the models. If the estimate of the PAH effect on neurodevelopment was attenuated in the presence of a fetal growth parameter, mediation was considered to be present.

Results

Table 1 describes the characteristics of the sample stratified by level of PAH exposure. There were no significant differences between high- and low-exposure groups except for the home environment, which was less favorable in the high-exposure group. Prenatal PAH exposures averaged 3.49 ng/m³, with a range of 0.65–36.47 ng/m³; 39.3% of children had prenatal ETS exposure. Table 2 shows the mean ± SD or proportion for the developmental outcomes. These include the indices of performance on the BSID-II, including MDI, PDI, proportion moderately delayed on the mental index, and proportion moderately delayed on the motor index for each of the exposure groups at 12, 24, and 36 months of age. Table 2 also shows the mean ± SD for the CBCL score for total behavior problems.

In univariate analysis of children with all three developmental measures, prenatal exposure to PAHs was significantly associated with MDI at age 3 (β = -4.68; 95% CI, -8.13 to -1.24; *p* = 0.01; *n* = 263) but not MDI at 1 or 2 years of age nor with PDI. Table 3 shows the age-specific parameter estimates for prenatal

Table 2. Mean ± SD and proportion for developmental and behavioral outcomes at 12, 24, and 36 months.

| Domain | Age at assessment | | |
|---|-------------------|---------------|----------------|
| | 12 months | 24 months | 36 months |
| MDI ^a | 94.25 ± 9.45 | 85.01 ± 12.59 | 89.66 ± 11.21 |
| PDI ^b | 85.85 ± 12.17 | 87.40 ± 11.59 | 100.80 ± 13.21 |
| Total behavior problems ^c | NA | NA | 50.20 ± 10.47 |
| Moderate mental development delay (%) ^{d,e} | 14.9 | 48.1 | 33.1 |
| Severe mental development delay (%) ^{d,e} | 0.6 | 9.4 | 2.8 |
| Moderate psychomotor development delay (%) ^{d,f} | 14.4 | 13.3 | 10.5 |
| Severe psychomotor development delay (%) ^{d,f} | 1.7 | 1.7 | 1.7 |

NA, not applicable.

^a*n* = 181 with all 3 years of MDI data. ^b*n* = 181 with all 3 years of PDI data. ^c*n* = 168 with all 3 years of MDI and/or PDI and behavioral data (T score). ^dMDI < 85. ^eMDI < 70. ^fPDI < 85. ^gPDI < 70.

Table 3. Multiple linear regression models testing effects of prenatal PAH exposure at 12, 24, and 36 months using MDI and PDI^a (*n* = 181).

| | Model 1: 12 months | | Model 2: 24 months | | Model 3: 36 months | |
|--|--------------------|----------------|--------------------|----------------|--------------------|----------------|
| | β | <i>p</i> Value | β | <i>p</i> Value | β | <i>p</i> Value |
| MDI | | | | | | |
| Constant | 74.52 | < 0.01 | 37.73 | 0.16 | 52.79 | 0.02 |
| PAHs | 0.48 | 0.78 | -1.73 | 0.41 | -5.69 | < 0.01 |
| Ethnicity (1 = African American; 0 = others) | 0.24 | 0.89 | 6.66 | < 0.01 | 6.34 | < 0.01 |
| Sex (1 = male) | -2.09 | 0.14 | -4.51 | 0.01 | -2.20 | 0.13 |
| Gestational age | 0.38 | 0.49 | 0.95 | 0.16 | 0.41 | 0.44 |
| Home environment | 0.13 | 0.30 | 0.28 | 0.08 | 0.54 | < 0.01 |
| PDI | | | | | | |
| Constant | 95.34 | < 0.01 | 109.77 | < 0.01 | 54.00 | 0.06 |
| PAHs | 1.32 | 0.55 | -2.08 | 0.32 | -0.97 | 0.68 |
| Ethnicity (1 = African American; 0 = others) | -2.79 | 0.16 | 1.87 | 0.32 | 4.45 | 0.03 |
| Sex (1 = male) | 1.12 | 0.54 | 0.52 | 0.76 | -1.24 | 0.52 |
| Gestational age | 0.15 | 0.82 | -0.52 | 0.43 | 0.95 | 0.19 |
| Home environment | -0.10 | 0.56 | 0.16 | 0.30 | 0.25 | 0.15 |

^aModels were also adjusted for prenatal ETS and CPF. Further inclusion of maternal IQ and maternal education as covariates did not alter the results.

PAH exposure effects on mental and motor development, by multiple regression adjusting for the covariates as described in statistical analysis ($n = 181$). There was a significant effect of prenatal PAH exposure on MDI at age 3 ($\beta = -5.69$; 95% CI, -9.05 to -2.33 ; $p < 0.01$) but not 1 or 2 years of age. PDI was not associated with PAH exposure at any age. Altogether, the exposures and covariates accounted for approximately 31.2% of the variance in MDI scores at 36 months. None of the interaction terms of PAHs and the sociodemographic or exposure variables was significant. There was no significant interaction between PAH exposure level and home environment, suggesting that the magnitude of the 36-month prenatal PAH effect is not affected by the quality of the caretaking environment.

In univariate logistic regression analysis, the likelihood of a child experiencing moderate mental developmental delay at 3 years of age was significantly increased as a function of prenatal PAH exposure (odds ratio = 2.05; 95% CI, 1.15–3.63; $p = 0.01$), but again, the relationship was not seen at 1 or 2 years of age nor with psychomotor developmental delay. Table 4 shows the results of the logistic regression analysis adjusting for the relevant

covariates as described in statistical analyses. The odds ratio for delayed mental development at 36 months of age was 2.89 (95% CI, 1.33–6.25; $n = 181$). PAH exposure was not a significant predictor of psychomotor development. There were no significant interactions between PAHs and the other covariates in logistic regression.

Table 5 and Figure 1 show the results of the GEE analysis of PAH effects on cognitive development over the 3-year follow-up period. The significant age \times PAH effect on mental development ($p = 0.01$) confirms the age-specific regression findings showing that an adverse impact of prenatal PAH exposure on this developmental domain was seen only over time. For motor development, there was no significant relationship (Table 5). At 3 years of age, the decrease in MDI from baseline was significantly greater for high-exposed compared to low-exposed children ($p = 0.01$), whereas the difference was not significant at 2 years of age. The results of analyses using the continuous measure of PAHs were generally similar but less significant. Inclusion of fetal growth parameters (birth weight or head circumference) did not alter the effect of PAHs on 36 month MDI. Inclusion of cord lead as a

covariate did not materially alter the association between PAHs and development. The results of regression of total CBCL behavior problems on prenatal PAH exposure were not significant, nor were any of the subscales significantly related to PAH exposure.

Discussion

Previous results from this cohort have indicated that exposure to PAH air pollutants during pregnancy has produced DNA damage and impaired fetal growth (Perera et al. 2003, 2005a, 2005b). The present analysis suggests a further impact of prenatal PAH exposure on cognitive development. The infants who had been exposed prenatally to the highest PAH levels scored significantly lower on MDI at 3 years of age than did those with lower levels of PAH exposure. Although the adjusted mean MDI scores of the high- and low-exposed PAH groups differed by only 5.69 points, among the highly exposed children the odds of having MDI scores < 85 at 3 years of age (indicating moderate delay) were 2.89 times greater than the odds among unexposed children. This suggests that more exposed children are potentially at risk for performance deficits (language, reading, and math) in the early school years. In fact, developmentally delayed children are eligible for early intervention services designed for children who are at possible risk for early school failure. The observed magnitude of the PAH effect on early development in this study is comparable to that reported for low-level lead exposure (Schwartz 1994). In this study, there was no effect of PAHs on cognitive development at 1 and 2 years of age, nor were psychomotor development and behavioral problems associated with PAHs. The impact of PAHs on mental development at 3 years of age does not appear to be mediated by birth weight or head circumference, fetal growth parameters previously shown to be associated with prenatal PAH exposure in this cohort (Perera et al. 2003). The children are being followed to 7–8 years of age, so subsequent testing will

Table 4. Logistic regression models testing effects of prenatal PAH exposure on the odds of mental and psychomotor development delay at 12, 24, and 36 months* ($n = 181$).

| Dependent variable: moderate delay (MDI < 85) | Model 1: 12 months | | | Model 2: 24 months | | | Model 3: 36 months | | |
|--|--------------------|---------|----------------|--------------------|---------|----------------|--------------------|---------|----------------|
| | β | p Value | Exp(β) | β | p Value | Exp(β) | β | p Value | Exp(β) |
| Constant | 2.65 | 0.67 | 14.12 | 3.04 | 0.53 | 20.92 | 6.08 | 0.24 | 799.33 |
| PAHs | -0.19 | 0.71 | 0.82 | -0.16 | 0.88 | 0.86 | -1.66 | 0.01 | 2.69 |
| Ethnicity (1 = African American, 0 = others) | 0.32 | 0.50 | 1.37 | -0.90 | 0.01 | 0.41 | -0.77 | 0.06 | 0.46 |
| Sex (1 = male) | 0.65 | 0.12 | 1.94 | 0.04 | 0.01 | 2.31 | 0.50 | 0.16 | 1.65 |
| Gestational age | -0.07 | 0.67 | 0.93 | -0.02 | 0.89 | 0.98 | -0.10 | 0.47 | 0.90 |
| Home environment | -0.05 | 0.19 | 0.95 | -0.06 | 0.03 | 0.94 | -0.10 | < 0.01 | 0.90 |
| Dependent variable: moderate delay (PDI < 85) | | | | | | | | | |
| Constant | -1.50 | 0.62 | 0.22 | -1.11 | 0.87 | 0.33 | -2.30 | 0.79 | 0.10 |
| PAHs | -0.92 | 0.16 | 0.40 | 0.41 | 0.41 | 1.51 | -0.22 | 0.72 | 0.80 |
| Ethnicity (1 = African American, 0 = others) | 0.39 | 0.41 | 1.48 | -0.21 | 0.67 | 0.81 | -0.65 | 0.28 | 0.52 |
| Sex (1 = male) | -0.18 | 0.68 | 0.83 | -0.42 | 0.35 | 0.66 | 0.01 | 0.98 | 1.01 |
| Gestational age | -0.01 | 0.97 | 0.99 | -0.02 | 0.89 | 0.98 | 0.04 | 0.05 | 1.04 |
| Home environment | -0.01 | 0.88 | 0.99 | 0.01 | 0.86 | 1.01 | -0.05 | 0.25 | 0.95 |

*Models were also adjusted for prenatal ETS and CPF. Further inclusion of maternal IQ and maternal education as covariates did not alter the results.

Table 5. Cognitive mental development in children 12 months through 36 months of age by GEE ($n = 543$ measurements).^a

| | MDI | | PDI | |
|--|---------|---------|---------|---------|
| | β | p Value | β | p Value |
| Intercept | 60.46 | < 0.01 | 84.76 | < 0.01 |
| 12 months | -9.87 | < 0.01 | -2.12 | 0.29 |
| 24 months | -4.29 | 0.01 | 3.53 | 0.08 |
| 36 months | 0.69 | 0.66 | 1.89 | 0.35 |
| 24 months \times PAHs | -1.12 | 0.02 | -3.14 | 0.16 |
| 36 months \times PAHs | -5.57 | 0.01 | -4.65 | 0.03 |
| Ethnicity (1 = African American, 0 = others) | -0.23 | 0.88 | -3.38 | 0.07 |
| 24 months \times ethnicity | 6.80 | < 0.01 | 5.71 | 0.01 |
| 36 months \times ethnicity | 7.14 | < 0.01 | 7.91 | < 0.01 |
| Sex (1 = male) | -2.80 | 0.01 | 0.08 | 0.35 |
| Gestational age | 0.56 | 0.16 | 0.23 | 0.62 |
| Home environment | 0.31 | < 0.01 | 0.11 | 0.39 |

^aModels were also adjusted for prenatal ETS and CPF.

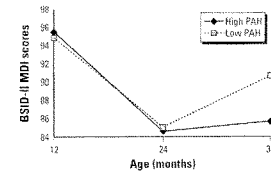


Figure 1. Estimated effects of prenatal PAH exposure on cognitive development in children 12 months through 36 months of age by GEE. The model was adjusted for the child's exact age at test administration, child's sex, ethnicity, gestational age at birth, quality of the (caretaking) home environment, and prenatal exposure to ETS and CPF.

provide a picture of the developmental trajectory of this group.

To our knowledge, there have been no prior studies of the role of prenatal exposure to airborne PAHs in child neurodevelopment. However, a study in the Czech Republic reported that schoolchildren in the district of Teplice, which had higher levels of PAHs and other air pollutants from coal burning than did the district of Prachatice, had a significantly higher teacher referral rate for clinical assessment compared to Prachatice, although most objective performance measures did not differ (Šrám et al. 1996).

The mechanisms by which PAHs might affect the developing brain are not known. However, fetal toxicity may be caused by antiestrogenic effects (Bui et al. 1986) binding to the human aryl hydrocarbon receptor to induce P450 enzymes (Manchester et al. 1987), DNA damage resulting in activation of apoptotic pathways (Meyn 1995; Nicol et al. 1995; Wood and Youle 1995), or binding to receptors for placental growth factors resulting in decreased exchange of oxygen and nutrients (Dejmek et al. 2000).

In the present cohort, the mean developmental scores are below average for the normed population, reflecting the low-income nature of the catchment area in this study (e.g., Bradley and Corwyn 2002; Burchinal et al. 1997; Luster and McAdoo 1996). In addition, children from homes with low levels of stimulation and mother-child interaction had significantly lower scores on the Bayley cognitive scales, independent of PAH exposure.

This study has the advantage of being based on individual prenatal exposure data from personal monitoring and biomarker analyses, as well as extensive medical record and questionnaire data. However, it is limited by the modest sample of subjects for whom data from all relevant domains are currently available. Moreover, relationships observed in low-income minority women might be different in women of other races or ethnic, cultural, or socioeconomic backgrounds. Further, it is possible that high levels of PAHs may be associated with living near an exposure source such as a bus route or garage leading to some uncontrolled confounding by socioeconomic status even within our low-income population.

Another limitation is that we lacked air monitoring data for all three trimesters and were therefore not able to compare exposures across these three periods. We also lacked postnatal personal air monitoring data for PAHs and were unable to control directly for postnatal PAH exposure. However, when we controlled for change in residence as a proxy for variation in PAH exposure between the pre- and postnatal periods, the effects of prenatal PAHs remained. We also lacked postnatal environmental lead exposure data, which may

have been a critical period of exposure to this known developmental toxicant. Additional studies are needed to tease apart the effects of prenatal and postnatal exposure to PAHs and to confirm the present findings.

Conclusion

This study provides evidence that environmental PAHs at levels recently encountered in the air of New York City may adversely affect cognitive development of children. The results require confirmation but are of potential concern because compromised mental performance precursor of subsequent educational performance deficits. PAHs are widespread in urban environments worldwide largely as a result of fossil fuel combustion. Fortunately, airborne PAH concentrations can be reduced through currently available pollution controls, greater energy efficiency, and the use of alternative energy sources (Wong et al. 2004).

REFERENCES

- Achenbach T, Rescorla L. 2000. *Child Behavior Checklist for Ages 1 1/2-5*. 7-28-0 ed. Burlington, VT: Achenbach System of Empirically Based Assessment (ASEBA).
- Agency for Toxic Substances and Disease Registry. 1999. *Toxicological Profile for Mercury*. Atlanta, GA: Agency for Toxic Substances and Disease Registry.
- Aldridge JE, Meyer A, Sidler FJ, Slotkin TA. 2005. Alterations in central nervous system serotonergic and dopaminergic synaptic activity in adulthood after prenatal or neonatal chlorpyrifos exposure. *Environ Health Perspect* 113:1027-1033.
- Barbieri D, Oganio E, Rossi O, Astigliano S, Rossi L. 1986. Embryotoxicity of benz[a]pyrene and some of its synthetic derivatives in Swiss mice. *Cancer Res* 46:94-96.
- Barr DB, Barr JR, Maggio VL, Whitehead FD, Sadowski MA, Ohvatt RM, et al. 2002. A multi-analyte method for the quantification of contemporary pesticides in human serum and plasma using high resolution mass spectrometry. *J Chromatogr B Anal Technol Biomed Life Sci* 778:99-111.
- Bayley N. 1993. *Bayley Scales of Infant Development*. 2nd ed. San Antonio, TX: Psychological Corp.
- Bellinger D, Leviton A, Waterman C, Needleman H, Rabinowitz M. 1988. Low-level lead exposure, social class, and infant development. *Neurotoxicol Teratol* 10:497-503.
- Bernert JT, McGuffey JE, Morrison MA, Pirkle JL. 2000. Comparison of serum and salivary cotinine measurements by a sensitive high-performance liquid chromatography-tandem mass spectrometry method as an indicator of exposure to tobacco smoke among smokers and nonsmokers. *J Anal Toxicol* 24:333-339.
- Bernert JT, Turner WE, Pirkle JL, Soszyni GS, Akins JR, Waddley MK, et al. 1997. Development and validation of sensitive method for determination of serum cotinine in smokers and nonsmokers by liquid chromatography/atmospheric pressure ionization tandem mass spectrometry. *Clin Chem* 43:2281-2289.
- Bostom CE, Gerde P, Hanberg A, Jarrettström B, Johansson C, Kyrikland T, et al. 2002. Cancer risk assessment, indicators, and guidelines for polycyclic aromatic hydrocarbons in the ambient air. *Environ Health Perspect* 110:461-488.
- Bradley RH, Caldwell B, Rock S, Ramey C, Barnard K, Gray C, et al. 1993. Home environment and cognitive development in the first 3 years of life: a collaborative study involving six sites and three ethnic groups in North America. *Dev Psychol* 25:217-235.
- Bradley RH, Corwyn RF. 2000. Moderating effect of perceived amount of family conflict on the relation between home environmental processes and the well-being of adolescents. *J Fam Psychol* 14:349-364.
- Breyssa PN, Buckley TJ, Williams D, Beck CM, Jo SJ, Merriam B, et al. 2005. Indoor exposures to air pollutants and allergens in the homes of asthmatic children in inner-city Baltimore. *Environ Res* 96:157-176.
- Brown L, Shvedchenko RJ, Johnson SK. 1990. *Test of Non-Verbal Intelligence: A Language-Free Measure of Cognitive Ability*. 2nd ed. Austin, TX: PRO-ED Inc.
- Bui QQ, Tran MB, West WL. 1986. A comparative study of the reproductive effects of methadone and benzo[a]pyrene in the pregnant and postpartum rat. *Toxicology* 42:195-204.
- Burchinal MR, Campbell FA, Bryant DM, Wask BH, Ramey CT. 1997. Early intervention and mediating processes in cognitive performance of children of low-income African American families. *Child Dev* 68:939-954.
- Burchinal MR, Roberts JE, Knoper S, Zoisel SA. 2000. Cumulative risk and early cognitive development: a comparison of statistical risk models. *Dev Psychol* 36:793-807.
- Caldwell BM, Bradley RH. 1978. *Home Observation for Measurement of the Environment*. Little Rock, AK: University of Arkansas Press.
- Canfield RL, Henderson CR, Cory-Slechta DA, Cox C, Jusko TA, Langheir BP. 2003. Intellectual impairment in children with blood lead concentrations below 10 µg per deciliter. *N Engl J Med* 348:1517-1521.
- CDC. 2003. *Whole Blood Lead, Cadmium and Mercury Determined Using Inductively Coupled Plasma Mass Spectrometry. DLS method code 2003-01/02. CLIA Methods*. Atlanta, GA: Centers for Disease Control and Prevention, Division of Laboratory Science.
- Claudio L, Tullon L, Boucette J, Lindrigan PJ. 1989. Socioeconomic factors and asthma hospitalization rates in New York City. *J Asthma* 36:343-350.
- Dojmek J, Solarsky J, Benčí L, Laviček J, Šrám RJ. 2000. The impact of polycyclic aromatic hydrocarbons and fine particles on pregnancy outcome. *Environ Health Perspect* 108:1159-1164.
- Diagnostic and Statistical Manual of Mental Disorders. 2000. 4th ed. Arlington, VA: American Psychiatric Publishing.
- Faustman EM. 2000. Mechanisms underlying children's susceptibility to environmental toxicants. *Environ Health Perspect* 108:13-21.
- Federico MJ, Lu AH. 2003. Overcoming childhood asthma disparities of the inner-city poor. *Pediatr Clin North Am* 50:655-675.
- Grandjean P, Wahe P, White R, Debes F, Arak S, Yokoyama K, et al. 1997. Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury. *Neurotoxicol Teratol* 20:1-12.
- Greater Boston Physicians for Social Responsibility. 2000. *In Harm's Way: Toxic Threats to Child Development*. Cambridge, MA: Greater Boston Physicians for Social Responsibility.
- Kazuo Y, Place AR, Trant JM. 2004. Effects of endocrine disrupting chemicals on the expression of CYP19 genes in zebrafish (*Danio rerio*) juveniles. *Aquat Toxicol* 69:25-34.
- Landrigan PJ, Claudio L, Markowitz SB, Berkowitz GS, Bonner BL, Romero H, et al. 1999. Pesticides and inner-city children: exposures, risks, and prevention. *Environ Health Perspect* 107:431-437.
- Langheir BP, Dietrich K, Auinger P, Cox C. 2000. Cognitive deficits associated with blood lead concentrations < 10 microg/dL in US children and adolescents. *Public Health Rep* 115:521-529.
- Legreveland C, Guenther TM, Nelson DV. 1984. Importance of the route of administration for genetic differences in benzo[a]pyrene-induced rat aroclor toxicity and teratogenicity. *Teratology* 29:35-47.
- Liang KY, Zeger LL. 1986. Longitudinal data analysis using generalized linear models. *Biometrika* 73:13-22.
- Luster T, McAdoo R. 1996. Family and child influences on educational attainment: a secondary analysis of the High/Scope Perry preschool data. *Dev Psychol* 32:23-39.
- Manchester DK, Gordon SK, Golas CL, Roberts EA, Okey AB. 1987. Ah receptor in human placenta: stabilization by polychlorinated biphenyls and characterization of binding of 2,3,7,8-tetrachlorodibenzo-p-dioxin, 3-methylcholanthrene, and benzo[a]pyrene. *Cancer Res* 47:4861-4868.
- Marinova FD, Wright AL, Taussig LM. 1994. The effect of paternal smoking on the birthweight of newborns whose mothers did not smoke. *Am J Public Health* 84:1488-1491.
- Meyn MS. 1995. Archaic telomeres and cellular responses to DNA damage. *Cancer Res* 55:5991-6001.
- National Research Council. 1993. *Pesticides in the Diets of Infants and Children*. Washington, DC: National Academy Press.
- Neri M, Ugolini D, Bonassi S, Fucile A, Holland N, Knutsen LE,

- et al. 2006. Children's exposure to environmental pollutants and biomarkers of genetic damage. II. Results of a comprehensive literature search and meta-analysis. *Mutat Res* 612:14-39.
- New York City Department of Health. 1998-1999. *Vital Statistics*. New York: New York City Department of Health.
- Nicol CJ, Harrison ML, Laposa RR, Goughstein H, Wells PD. 1995. A tetraallelic suppressor allele for p53 in benzo[a]pyrene-treated transgenic p53-deficient mice. *Nat Genet* 10:181-187.
- Olden K, Peje J. 1995. Environmental justice and environmental health. *Bull Soc Occup Environ Health* 4:3-4.
- Perera FP, Birman SM, Kinney PL, Whyatt RM, Kelvin EA, Sheppard P, et al. 2002. The challenge of preventing environmentally related disease in young children: community-based research in New York City. *Environ Health Perspect* 110:197-204.
- Perera FP, Rauh V, Tsai WY, Kinney P, Camann O, Barr D, et al. 2003. Effects of transplacental exposure to environmental pollutants on birth outcomes in a multi-ethnic population. *Environ Health Perspect* 111:201-205.
- Perera FP, Rauh V, Whyatt RM, Tang D, Tsai WY, Bernert JT, et al. 2005a. A summary of recent findings on birth outcomes and developmental effects of prenatal ETS, PAH, and pesticide exposure. *Neurotoxicology* 26:573-587.
- Perera FP, Tang D, Whyatt R, Lederman S, Jedrychowski W. 2005b. DNA damage from polycyclic aromatic hydrocarbons (PAHs) measured by benzo[a]pyrene DNA-adducts in mothers and newborns from Northern Manhattan, the World Trade Center area, Poland, and China. *Cancer Epidemiol Biomarkers Prev* 14:709-714.
- Perera FP, Whyatt RM, Jedrychowski W, Rauh V, Manchester D, Santella RM, et al. 1996. Recent developments in molecular epidemiology: a study of the effects of environmental polycyclic aromatic hydrocarbons on birth outcomes in Poland. *Am J Epidemiol* 147:305-314.
- Rauh VA, Whyatt RM, Garfinkel R, Andrews H, Hoopner L, Reyes A, et al. 2004. Developmental effects of exposure to environmental tobacco smoke and maternal hardship among inner-city children. *J Neurotoxicol Teratol* 26:373-385.
- Schuster KJ, Ludwig H. 1994. Smoking and the risk of cancer. *Wien Med Wochenschr* 144:540-564.
- Schwartz J. 1994. Low-level lead exposure and children's IQ: a meta-analysis and search for a threshold. *Environ Res* 65:42-55.
- Sexton M, Fox NL, Hebel JR. 1990. Prenatal exposure to tobacco. II. Effects on cognitive functioning at age three. *Int J Epidemiol* 19:72-77.
- Šram RJ, Beneš I, Binkova B, Demek J, Horstman D, Kotesevác F, et al. 1996. Teplice Program—the impact of air pollution on human health. *Environ Health Perspect* 104:699-714.
- Sternberg RJ, Grigorenko EL, Dandy DA. 2001. The predictive value of IQ. *Monist/Palmer* 0:471-471.
- Tunna CC, Whyatt RM, Camann DE, Perera FP, Kinney PL. 2004. Predictors of personal polycyclic aromatic hydrocarbon exposures among pregnant minority women in New York City. *Environ Health Perspect* 112:754-759.
- Whyatt RM, Camann DE, Kinney PL, Reyes A, Bernert J, Dietrich J, et al. 2002. Residential pesticide use during pregnancy among a cohort of urban minority women. *Environ Health Perspect* 110:507-514.
- Whyatt RM, Perera FP. 1995. Application of biologic markers to studies of environmental risks in children and the developing fetus. *Environ Health Perspect* 103:105-112.
- Whyatt RW, Rauh V, Barr DB, Camann DE, Andrews HF, Garfinkel R, et al. 2004. Prenatal insecticide exposure and birth weight and length among an urban minority cohort. *Environ Health Perspect* 112:1125-1132.
- Winham GC, Eaton A, Hopkins B. 1999. Evidence for an association between environmental tobacco smoke exposure and birth weight: a meta-analysis and new data. *Paediatr Perinat Epidemiol* 13:35-57.
- Wong EY, Gohke J, Griffith WC, Farrow S, Fautzman EM. 2004. Assessing the health benefits of air pollution reduction for children. *Environ Health Perspect* 112:226-232.
- Wood KA, Youle RJ. 1995. The role of free radicals and p53 in neuron apoptosis *in vivo*. *J Neurosci* 15:5851-5857.
- World Health Organization. 1986. *Principles for Evaluating Health Risks from Chemicals during Infancy and Early Childhood. The Need for a Special Approach*. Environmental Health Criteria 58. Geneva: World Health Organization.
- Yulter K, Dietrich K, Aulinger P, Langheir BP, Horung R. 2005. Exposure to environmental tobacco smoke and cognitive abilities among U.S. children and adolescents. *Environ Health Perspect* 113:98-103.

Benefits of Reducing Prenatal Exposure to Coal-Burning Pollutants to Children's Neurodevelopment in China

Frederica Perera,^{1,2} Tin-yu Li,³ Zhi-jun Zhou,⁴ Tao Yuan,⁵ Yu-hui Chen,¹ Lirong Qu,^{1,2} Virginia A. Rauh,² Yiguan Zhang,³ and Deliang Tang^{1,2}

¹Department of Environmental Health Sciences, Columbia University, New York, New York, USA; ²Columbia Center for Children's Environmental Health, Columbia University, New York, New York, USA; ³Chongqing Children's Hospital, Chongqing University of Medical Sciences, Chongqing, China; ⁴School of Public Health, Fudan University, Shanghai, China; ⁵School of Environmental Science and Engineering, Shanghai Jiao Tong University, Shanghai, China

BACKGROUND: Coal burning provides 70% of the energy for China's industry and power, but releases large quantities of polycyclic aromatic hydrocarbons (PAHs) and other pollutants. PAHs are reproductive and developmental toxicants, mutagens, and carcinogens.

OBJECTIVE: We evaluated the benefit to neurobehavioral development from the closure of a coal-fired power plant that was the major local source of ambient PAHs.

METHODS: The research was conducted in Tongliang, Chongqing, China, where a coal-fired power plant operated seasonally before it was shut down in May 2004. Two identical prospective cohort studies enrolled nonsmoking women and their newborns in 2002 (before shutdown) and 2005 (after shutdown). Prenatal PAH exposure was measured by PAH-DNA adducts (benzo[*a*]pyrene-DNA) in umbilical cord blood. Child development was assessed by the Gesell Developmental Schedules at 2 years of age. Prenatal exposure to other neurotoxins and potential confounders (including lead, mercury, and environmental tobacco smoke) was measured. We compared the cohorts regarding the association between PAH-DNA adduct levels and neurodevelopmental outcomes.

RESULTS: Significant associations previously seen in 2002 between elevated adducts and decreased motor area developmental quotient (DQ) ($p = 0.043$) and average DQ ($p = 0.047$) were not observed in the 2005 cohort ($p = 0.546$ and $p = 0.146$). However, the direction of the relationship did not change.

CONCLUSION: The findings indicate that neurobehavioral development in Tongliang children benefited by elimination of PAH exposure from the coal-burning plant, consistent with the significant reduction in PAH-DNA adducts in cord blood of children in the 2005 cohort. The results have implications for children's environmental health in China and elsewhere.

KEY WORDS: China, coal burning, lead, neurobehavioral development, PAH-DNA adducts, prenatal. *Environ Health Perspect* 116:1396–1400 (2008). doi:10.1289/ehp.11480 available via <http://dx.doi.org/> [Online 14 July 2008]

China's vast industrial network and power plant system rely on coal for approximately 70–75% of their energy needs (Economy 2003; Zhang et al. 2002). Coal burning in China is the major source of ambient polycyclic aromatic hydrocarbons (PAHs). PAHs are also present in tobacco smoke and charred foods. Molecular and epidemiologic studies show that fetuses and infants are more susceptible than adults to environmental toxicants including PAHs (Perera et al. 2005), lead [Agency for Toxic Substances and Disease Registry (ATSDR) 2005], and mercury (ATSDR 1999). Experimentally, benzo[*a*]pyrene (BaP), a representative PAH, is a reproductive toxicant (Archibong et al. 2002), producing neurodevelopmental effects including decreased motor activity, neuromuscular, physiologic and autonomic abnormalities, and decreased responsiveness to sensory stimuli (Saunders et al. 2002, 2003; Wormley et al. 2004b). In studies in Europe, the United States, and China, prenatal exposure to PAHs has been associated with reduced fetal growth (Choi et al. 2006; Perera et al. 1998, 2005; Sram et al. 2005; Tang

et al. 2006) and developmental deficits (Perera et al. 2006). In addition, PAHs are mutagenic and carcinogenic, including via transplacental exposure (Bostrom et al. 2002; Bulay and Wattenberg 1971).

PAH-DNA adducts reflect individual variation in exposure, absorption, metabolic activation, and DNA repair; they therefore provide an informative biologic dosimeter that has been associated with risk of cancer and developmental impairment (Bartsch et al. 1983; Perera et al. 2007; Tang et al. 2001). Here we use adducts as a measure of exposure rather than as a mechanistic marker. PAH-DNA adduct concentrations in cord blood have been shown to increase across a gradient of ambient PAH exposure, albeit with substantial interindividual variation (Perera et al. 2005; Wyatt et al. 1998). Cord blood adducts in the 2002 Tongliang cohort (mean, 0.32 per 10⁶) were significantly higher than those in cohorts of newborns in the United States and Poland (Perera et al. 2005). As previously reported, in the 2002 Tongliang, Chongqing, China, cohort, PAH-DNA adducts in cord blood were associated with reduction of birth head

circumference (Tang et al. 2006) and reduced developmental quotients (DQs) at 2 years of age (Tang et al. 2008). As in the present sample, comparison of all cord bloods showed a significant decrease in adduct levels in 2005 (unpublished data).

Lead and mercury are also released by coal burning (Guo et al. 2002; Wang et al. 2006; Zhang et al. 2003) as well as other sources. Both metals are developmental neurotoxins even at low levels (ATSDR 1999, 2005; Canfield et al. 2003; Needleman et al. 1996) and are potential confounders of associations between PAH-DNA adducts and developmental outcomes.

We tested the hypothesis that comparison of the two cohorts of newborns in Tongliang both followed through 2 years of age would show that elimination of prenatal exposure to coal-burning emissions from the power plant resulted in improved developmental outcomes and in failure to observe the significant effects of PAH-DNA adducts on 2-year development seen in the first cohort, consistent with decreased levels of PAH-DNA adducts in cord blood of children in the second cohort.

Methods

Study design. Two identical prospective cohort studies were carried out (pre- and postplant shutdown, respectively). Nonsmoking mothers and their newborns were enrolled at delivery as described (Tang et al. 2008). The newborns were followed through their second birthdays,

Address correspondence to F. Perera, Mailman School of Public Health, Col P&S 19-407, New York, NY 10032 USA. Telephone: (212) 304-7280. Fax: (212) 544-1943. E-mail: fpp1@columbia.edu

We thank C. Lin and W. Tsai (Columbia Center for Children's Environmental Health, Columbia University), Y. Li (School of Public Health, Fudan University), and W. Wang (School of Environmental Science and Engineering, Shanghai Jiao Tong University).

This project has been supported by the V. Kann Rasmussen Foundation, The Energy Foundation, The Schmidt Family Foundation, The Rockefeller Brothers Fund, and The Porpoise Fund, and by general support from the National Institute of Environmental Health Sciences (5 P01 ES009600, 5 R01 ES008977).

The authors declare they have no competing financial interests.

Received 14 March 2008; accepted 10 July 2008.

at which time their intellectual and behavioral development was assessed using the Gesell Developmental Schedules (GDS). Levels of PAH-DNA adducts (specifically BaP-DNA adducts) were measured in umbilical cord blood. Exposure to known neurotoxicants [lead, mercury and environmental tobacco smoke (ETS)] and other potential confounders was assessed by biomarkers or questionnaire.

Setting. Tongliang, a county in Chongqing Municipality, has a population of around 810,000 and is situated in a basin approximately 3 km in diameter. Before 31 May 2004, a coal-fired power plant located just south of the town center operated every year during the dry season from 1 December to 31 May to compensate for insufficient hydroelectric power during that period (Chow et al. 2006; Tang et al. 2006). The plant was not equipped with modern pollution reduction technology and combusted about 25,000 tons of coal during each 6-month period of operation. In 2002, nearly all domestic heating and cooking units had been converted to natural gas, and motor vehicles were limited in number. Air monitoring analysis carried out as part of the study showed that PAHs of medium molecular weight (168–266) increased by up to 3.5 times during the operational period of the Tongliang power plant (Chow et al. 2006). After the government-mandated shutdown of the plant in May 2004, mean ambient levels of the same PAHs declined significantly (for BaP, $p = 0.01$), as did adducts in cord blood (unpublished data).

Participants. Subjects were children born to women who gave birth at any one of three major Tongliang County Hospitals located in the Town of Bachuan (informally known as Tongliang City) (representing about 95% of deliveries in Tongliang): the first cohort between 4 March 2002 and 19 June 2002 and the second between 2 March 2005 and 23 May 2005. The women were selected using a screening questionnaire when they checked in for delivery. All women who met the criteria for eligibility (nonsmoker, ≥ 20 years of age, and residence within 2 km of the site of the Tongliang power plant) were invited to participate (the population residing within this radius is about 86,325). Consenting subjects signed the consent form approved by the Columbia University Institutional Review Board and Chongqing University of Medical Sciences. They were administered a questionnaire and contributed a cord blood sample at the time of delivery. Follow-up was conducted by trained research workers who interviewed the mothers about the environmental and health history of their children at 18 and 24 months when the children were brought to the study clinic at 18 and 24 months of age for clinical assessments of health and neurodevelopmental status.

Because physicians first presented the study to the women, all eligible women agreed to participate in the 2002 cohort and only one declined in the 2005 study. The study population is therefore representative of nonsmoking women residing within a 2-km radius of the power plant and delivering in Tongliang. In the 2002 cohort, with a sample size of 150 we observed a 16-point deficit in motor DQ ($p = 0.043$) and a 15-point deficit in average DQ ($p = 0.047$) associated with a log-unit increase in PAH exposure. We therefore expected that a sample size of 150 would allow us to see a similar effect in the 2005 cohort if one existed.

Personal interviews. A 45-min questionnaire was administered by a trained interviewer after delivery, as described previously (Tang et al. 2006). The questionnaire included sociodemographic information, lifetime residential history, maternal history of active and passive smoking, and exposure during pregnancy to home and workplace chemicals, medications, alcohol, and dietary PAHs. The 6-month interview of the mothers elicited information on children's health and environment including ETS exposure.

Biologic sample collection and analysis. As described previously, at delivery umbilical cord blood was collected for PAH-DNA adducts in heparinized Vacutainer tubes and for mercury and lead measurements in EDTA Vacutainer tubes (Tang et al. 2008). Samples were transported to the field laboratory at the Tongliang County Hospital immediately after collection. The buffy coat, packed red blood cells, and plasma were separated and stored at -70°C . Samples were coded and assays were performed on all samples of adequate quantity and quality for analysis.

The laboratory methods have been described in detail (Tang et al. 2008). Briefly, as a validated proxy for PAH-DNA adducts, BaP-DNA adducts in extracted white-blood-cell DNA were analyzed using high-performance liquid chromatography/fluorescence method for BaP tetraols (Alexandrov et al. 1992; Rojas et al. 1994), modified as described (Perera et al. 2007). Samples of whole blood were analyzed for lead and mercury also as described (Tang et al. 2008).

Measures of child neurodevelopment and covariates. The GDS was selected for comparability to other studies in the Chinese population and because it has been adopted by the Chinese Pediatric Association and is widely used for assessing early child development in China and in other countries (Cui et al. 2001; Jin et al. 2007; Ke et al. 2009; World Health Organization 1999, 2004; Zhang and Li 1994; Zhu et al. 2005). Two-year-old children in the cohort were administered the version of the GDS for 0- to 3-year-old children adapted to the Chinese population (Beijing Mental

Development Cooperative Group 1985). Each child is assigned a DQ in each of the four areas: motor, adaptive, language, and social. The standardized mean (\pm SD) of the DQ is 100 ± 15 ; a score < 85 indicates developmental delay (Hudon et al. 1998). A study by Jin et al. (2007), which also used the GDS, showed means in the same range as those in our study. Testing was conducted by physicians in the same group who were certified in the GDS to maximize reliable assessment and valid interpretation. Therefore, both interexaminer and intraexaminer variability were minimal.

Research workers abstracted relevant information on covariates from maternal and infant medical records after delivery such as date of delivery, gestational age, and sex of newborn. Other covariates were derived from questionnaire data on socioeconomic status and environmental exposures.

Statistical analysis. The statistical methods have been previously described with respect to analysis of the 2002 cohort (Tang et al. 2008) and are briefly summarized here. Analysis of the 2005 cohort followed the same procedures. The main exposure of interest was PAH-DNA adducts in cord blood. As before (Tang et al. 2008), adducts were treated as a continuous variable, with nondetectable samples assigned a value of 0.125 per 10^8 (midway between 0 and the detection limit of 0.25). Lead and mercury values were dichotomized at the median to minimize the influence of outliers. In multiple regression analyses, age-adjusted DQs in the motor area, adaptive area, language area, social area, and the average of these four DQs served as the outcome variables. In logistic regression, the outcomes were developmental delays in the respective areas. As in our prior analyses, we included as covariates sex, gestational age, maternal education, ETS (hours of exposure/day), and lead. Mercury and exposure to chemicals during pregnancy were not included, because neither was a contributor to DQ at the level of $p \leq 0.1$ (Tang et al. 2008). We did not have direct measures of postnatal PAH-DNA adducts or lead but were able to adjust for postnatal ETS exposure.

We first compared the two cohorts with respect to developmental outcomes (mean DQ scores and frequency of developmental delay) by performing unadjusted analyses using *t*-test or Fisher's exact test as appropriate. Multiple linear regression and logistic regression were used to test whether the DQ means or odds ratios (ORs) for developmental delay differed significantly between the two cohorts after adjustment for relevant covariates (prenatal ETS, mother's education, gestational age, and sex) and further including cohort as a covariate. The associations between adducts and developmental outcomes were examined by multiple linear regression and logistic regression as

described. In additional exploratory analyses, we tested whether the relationships between cord adducts and DQ and between cord adducts and developmental delay were the same for the two cohorts by including an interaction term (cohort \times PAH-DNA) in models combining the two data sets.

Results

Table 1 provides details of the enrollment and retention of participants in both cohorts. The 2-year retention rate for the first cohort was 88.7% (150 mother-child pairs enrolled, 133 retained). The retention rate for the second cohort was 77.2% (158 pairs enrolled, 122 retained). All 2-year-olds who remained in the cohorts at that time point were administered the GDS. One hundred ten subjects in 2002 and 107 subjects in 2005 had complete data required for hypothesis testing. The sociodemographic, clinical, and environmental characteristics of the cohorts are provided and compared in Table 2. The subjects included in the analysis did not differ ($p < 0.05$) from those not included with respect to these characteristics except that in the 2005 cohort subjects included in the model had a higher mercury level. The two cohorts differed with respect to maternal age. As reported in the full cohorts (unpublished data), the mean PAH-DNA adduct level and percent of newborns with detectable adduct levels were significantly reduced in the 2005 cohort ($p < 0.001$). The 2005 mean for PAH-DNA adducts in the present sample was $0.20 \text{ per } 10^6$, and 51% of samples had detectable adducts. Mean lead and mercury concentrations did not differ between 2002 and 2005.

Table 3 compares the distribution of DQs for both cohorts. As in the 2002 cohort, in 2005 all DQ domains were significantly intercorrelated ($p < 0.01$), with r -values ranging from 0.40 to 0.83. Unadjusted comparisons of the mean scores showed that mean DQs, except for language area, were higher in 2005 but not significantly so. After adjustment for relevant covariates, the only significant difference in mean score was the social area DQ ($p = 0.033$) (Table 3). The frequencies of developmental delay in all DQ areas except for language were reduced in 2005

compared with 2002; before adjustment, the difference was significant for delay in the motor area ($p = 0.033$). After adjustment, a significant difference in the frequency of delay in the motor area ($p = 0.017$) remained.

The results of multiple regression analysis are shown in Table 4. In the 2002 cohort, cord adducts showed significant inverse associations with the DQ in the motor area before and after adjusting for cord lead level, ETS, sex, gestational age, and maternal education level [unadjusted $\beta = -13.78$; 95% confidence interval (CI), -29.18 to 1.63 ; $p = 0.082$; adjusted $\beta = -16.01$; 95% CI, -31.30 to -0.72 ; $p = 0.043$]. In 2002, cord adducts were also associated with the average DQ (adjusted $\beta = -14.58$; 95% CI, -28.77 to -0.37 ; $p = 0.047$). In contrast, in the 2005 cohort, cord adducts were not significantly associated with any of the DQs before or after adjusting for the same covariates (for motor area DQ, adjusted $\beta = -5.90$; 95% CI, -24.96 to 13.17 ; $p = 0.546$) and average DQ ($\beta = -12.38$; 95% CI, -28.95 to 4.21 ; $p = 0.146$). However, in 2005, associations for all DQs remained inverse, albeit not statistically significant. Whereas in the 2002 cohort, by logistic regression analysis, a 0.1-unit increase ($0.1 \text{ adduct}/10^6 \text{ nucleotides}$) in cord adducts was associated with increased odds of being developmentally delayed in the motor area (OR = 1.91; 95% CI, 1.22 to 2.97; $p = 0.004$), this association was not seen in 2005 (OR = 2.06; CI, 0.62 to 6.84; $p = 0.240$), nor were significant associations seen in 2005 between PAH-DNA adducts and developmental delay in the other DQ areas (Table 5). However, the interaction term (PAH \times cohort) was not significant in multiple or logistic regression models, which may be attributable to small sample size.

Further controlling for postnatal ETS, in multivariate regression the associations between adducts and DQ in the motor area and average DQ remained significant in the 2002 cohort: $\beta = -16.89$; 95% CI, -31.76 to -2.01 , $p = 0.026$ and $\beta = -16.56$; 95% CI, -31.21 to -1.92 , $p = 0.027$, respectively. Also by logistic regression, the OR for adducts and motor area delay remained significant: OR = 2.18; 95% CI, 1.31 to 3.61; $p = 0.003$.

Inclusion of postnatal ETS in the 2005 models did not affect the results.

Discussion

As hypothesized, comparison of the two cohorts of newborns in Tongliang, China, both followed through 2 years of age, has provided evidence that elimination of prenatal exposure to coal-burning emissions resulted in measurable benefits to children's development. In contrast to the 2002 cohort, in the 2005 cohort we did not observe a significant effect of PAH-DNA adducts on 2-year developmental scores. Consistent with prior analyses of adducts among all newborns (unpublished data), in the present subset the average adduct concentration and the frequency of detectable adducts in cord blood were reduced in the 2005 cohort by 38% and 36%, respectively. The mean cord adduct level in the 2002 cohort ($0.52 \text{ adducts}/10^6 \text{ nucleotides}$) was significantly higher than in New York City ($0.21 \text{ adducts}/10^6 \text{ nucleotides}$) or Krakow, Poland ($0.28 \text{ adducts}/10^6 \text{ nucleotides}$), consistent with the higher ambient PAH exposure in Tongliang (Perera et al. 2005). After the power plant shutdown, the adduct levels in Tongliang in 2005 ($0.20/10^6 \text{ nucleotides}$) were similar to those in New York City ($0.21/10^6$).

Whereas PAH-DNA adducts in cord blood were significantly associated with DQ decrements in the motor area and in the average DQ among children who were *in utero* during the power plant operation, these significant associations were not seen among children who were *in utero* after the power plant had been shut down. In the 2002 cohort, adducts were associated with an approximate 2-fold increased odds of developmental delay in the motor area; again, that effect was not seen in the 2005 cohort. However, the observation in the 2005 cohort of inverse, albeit non-statistically significant, associations between adducts and all DQs except for the average DQ suggests that even greater benefits will accrue in the future. PAHs are lipid-soluble compounds (Nickerson 2006), and it is reasonable to expect that the concentrations of PAHs stored in mothers' adipose tissue and transferrable to the fetus will be reduced over time. In 2007, we enrolled a third

Table 1. Enrollment and retention of the cohorts.

| | 2002 | 2005 |
|--|------|------|
| Examined for eligibility (screened) ^a | 202 | 173 |
| Confirmed eligible | 150 | 159 |
| Included in the study ^b | 150 | 158 |
| Completed follow-up ^c | 133 | 122 |

^aIn 2002, 52 women were either < 20 years of age, smoked during pregnancy, or resided > 2 km from the site of the power plant. The number of multiple women (same criteria) in 2005 was 13. ^bIn 2005, one woman declined to be interviewed. ^cLoss to follow-up before child's age 2 was attributed to work-related moves out of the county (17 women in 2002, 27 in 2005).

Table 2. Demographic and exposure characteristics of the cohorts.

| Characteristic | 2002 (n = 110) ^a | 2005 (n = 107) |
|-----------------------------------|--------------------------------|--------------------------------|
| | Mean \pm SD (range) or % | Mean \pm SD (range) or % |
| Maternal age (years) ^a | 25.18 \pm 3.15 (20.34–34.28) | 27.91 \pm 4.93 (20.45–37.85) |
| Maternal education (%) | | |
| < High school | 43.6 | 55.1 |
| > High school | 56.4 | 44.9 |
| Sex of newborn (% female) | 50.9 | 44.9 |
| Gestational age (days) | 277.35 \pm 11.27 (224–294) | 276.99 \pm 9.19 (250–300) |
| Cord lead (mg/dL) | 3.60 \pm 1.59 (0.92–12.93) | 3.74 \pm 1.50 (1.49–10.82) |
| Cord mercury (ppb) | 6.97 \pm 4.43 (2.28–39.72) | 6.61 \pm 2.77 (1.72–14.73) |
| Prenatal ETS exposure (hr/day) | 0.79 \pm 0.59 (0–5.00) | 0.30 \pm 0.54 (0–3.00) |

^aNumber of subjects with each type of data varies due to missing data. ^b $p < 0.05$; comparisons of continuous variables by Mann-Whitney test, and binary variables by chi-square test.

cohort of mothers and newborns, which we will follow to determine longer-term benefits of closing the power plant.

The finding of adverse developmental effects in the 2002 cohort is consistent with experimental findings that prenatal exposure to BaP during critical windows of brain development produces a variety of neurodevelopmental effects in the offspring (Wormley et al. 2004a) and with our prior finding in a New York City cohort that prenatal PAH exposure was associated with developmental impairment at age 3 years (Peters et al. 2006). The mechanisms by which PAHs adversely affect child development are not well understood.

Strengths of the study include the prospective cohort design, the use of a molecular marker of PAH exposure, and the ability to control for potential confounders. The results are internally consistent and generalizable to other nonsmoking Chinese women. A limitation of the study is that we did not have data on postnatal levels of PAH-DNA or metals to permit examination of the impact of postnatal exposure on 2-year cognitive development. Because the power plant was not shut down until May 2004, the subjects in the 2002 cohort continued to receive seasonal exposure to the plant emissions after birth. However, several lines of evidence indicate that fetal development is a period of heightened susceptibility to PAHs and lead (ATSDR 1999, 2005; Peters et al. 2005). We note that adjustment for postnatal ETS exposure did not alter the effect of PAH-DNA adducts. Another limitation of the present study is the small sample size in each cohort, which limited our ability to evaluate interactions between adducts and cohort on development or to assess interactions between pollutants.

Although results are interpretable only on the group level, the improvement in developmental outcomes and the lack of significant associations between PAH-DNA adducts and deficits in development in the 2005 cohort may be educationally meaningful, because compromised function at an early age may have a negative impact on subsequent school performance (Drillien et al. 1988). Within a Chinese population, there was a significant correlation between developmental assessment at 6–12 months on the Gesell and mental development at 6–7 years on the Chinese version of the Wechsler Scales for Children ($p < 0.01$) (Zhou et al. 2004). Continued follow-up of the present cohort will determine whether reduction of prenatal PAH exposure is associated with subsequent measures of cognitive development and school performance.

Conclusion

In conclusion, these results indicate that an intervention to eliminate emissions from a polluting coal-burning power plant was effective

in improving developmental outcomes among children living in Tongliang, Chongqing. Because coal-fired power plants currently produce 75% of China's electricity and most new plants in China are being built to burn coal,

albeit with modern pollution control, the results from the Tongliang study are relevant to the development of other children living in China and have implications for policies concerning energy and public health.

Table 3. Comparison of Gesell scores in the two prospective cohorts.^a

| IQ area | 2002 Cohort ^b n = 116 | 2005 Cohort n = 107 |
|---|-------------------------------------|-------------------------|
| Motor area | | |
| Mean ± SD (range) | 97.53 ± 11.47 (65–135) | 97.83 ± 7.82 (74–116) |
| Normal [n(%)] | 95 (86.4) | 102 (95.3) |
| Developmental delay [n(%)] ^c | 15 (13.6) | 5 (4.7) |
| Adaptive area | | |
| Mean ± SD (range) | 92.71 ± 14.90 (50–124) | 101.18 ± 10.96 (76–129) |
| Normal [n(%)] | 96 (87.3) | 96 (89.7) |
| Developmental delay [n(%)] | 14 (12.7) | 11 (10.3) |
| Language area | | |
| Mean ± SD (range) | 102.10 ± 12.83 (56–122) | 100.47 ± 9.78 (74–127) |
| Normal [n(%)] | 99 (89.0) | 96 (89.7) |
| Developmental delay [n(%)] | 11 (10.0) | 11 (10.3) |
| Social area | | |
| Mean ± SD (range) ^d | 99.40 ± 11.79 (57–121) | 101.83 ± 6.91 (75–117) |
| Normal [n(%)] | 100 (89.3) | 104 (97.2) |
| Developmental delay [n(%)] ^e | 10 (9.1) | 3 (2.8) |
| Average | | |
| Mean ± SD (range) | 99.42 ± 10.74 (57–120) | 100.30 ± 7.16 (76–117) |
| Normal [n(%)] | 103 (83.6) | 105 (98.1) |
| Developmental delay [n(%)] ^f | 7 (6.4) | 2 (1.9) |

^aUnadjusted comparisons of IQs between cohorts by t-test; perovni delay by Fisher's exact test; adjusted analyses by regression as described. ^bThis material appears as originally published in Tang et al. (2008). ^cUnadjusted, $p = 0.033$; adjusted, $p = 0.017$. ^dUnadjusted, $p = 0.064$; adjusted, $p = 0.033$. ^eUnadjusted NS (not significant); it is not appropriate to use logistic regression due to small cell count.

Table 4. Results of multiple regression analyses of Gesell scores at 2 years of age and PAH-DNA adducts.^a

| IQ area | 2002 Cohort β (95% CI), p-value | 2005 Cohort β (95% CI), p-value |
|----------------------|--|--|
| Motor area | -16.01 (-31.30 to -0.72) $p = 0.042$ | -5.90 (-24.96 to 13.17) $p = 0.546$ |
| Adaptive area | -15.51 (-25.63 to 4.61) $p = 0.134$ | -22.06 (-47.70 to 3.58) $p = 0.095$ |
| Language area | -16.64 (-33.73 to 0.46) $p = 0.059$ | -20.33 (-42.42 to 1.85) $p = 0.075$ |
| Social area | -9.29 (-25.25 to 6.70) $p = 0.258$ | -1.50 (-17.82 to 14.81) $p = 0.855$ |
| Average | -14.58 (-28.77 to -0.37) $p = 0.047$ | -12.38 (-25.95 to 1.20) $p = 0.146$ |

^aModel included cord lead level, sex, gestational age, maternal education, lead, and ETS as covariates.

Table 5. Results of logistic regression analyses of developmental delay at 2 years of age and PAH-DNA adducts.^a

| IQ area | 2002 Cohort OR (95% CI) ^b , p-value | 2005 Cohort OR (95% CI), p-value |
|----------------------|---|-------------------------------------|
| Motor area | 1.91 (1.22 to 2.97) $p = 0.004$ | 2.06 (0.62 to 6.94) $p = 0.240$ |
| Adaptive area | 1.18 (0.76 to 1.76) $p = 0.500$ | 1.78 (0.79 to 4.00) $p = 0.181$ |
| Language area | 1.31 (0.84 to 2.06) $p = 0.234$ | 2.34 (0.96 to 5.71) $p = 0.061$ |
| Social area | 1.52 (0.93 to 2.50) $p = 0.095$ | 3.38 (0.99 to 13.35) $p = 0.171$ |
| Average | 1.67 (0.93 to 3.00) $p = 0.083$ | NA ^c |

NA, not available.

^aModel included cord lead level, sex, gestational age, maternal education, and ETS as covariates. ^bThe ORs for cord adducts presented in this table represent the effect of a 1-unit (0.1 adduct/10⁸ nucleotides) increment in cord adducts. ^cSPSS statistical software (SPSS Inc., Chicago, IL, USA) failed to provide accurate estimates.

REFERENCES

- Alexandrov K, Rojas M, Goeste O, Castagnaro M, Camus AM, Pestuzelli S, et al. 1992. An improved fluorometric assay for desimetry of benzo[a]pyrene diol-epoxide-DNA adducts in smokers' lung: comparisons with total bulky adducts and aryl hydrocarbon hydroxylase activity. *Cancer Res* 52:6248-6253.
- Archibong AE, Iyanga E, Ramesh A, Greenwood M, Nayyar T, Koppombat P, et al. 2002. Alteration of pregnancy related hormones and fetal survival in F-344 rats exposed by inhalation to benzo[a]pyrene. *Reprod Toxicol* 16:801-808.
- ATSDR. 1995. *Toxicological Profile for Mercury*. Atlanta, GA: Agency for Toxic Substances and Disease Registry.
- ATSDR. 2005. *Toxicological Profile for Lead*. Atlanta, GA: Agency for Toxic Substances and Disease Registry.
- Bartsch H, Terracini B, Malaveille C. 1983. Quantitative comparisons of carcinogenicity, mutagenicity and electrophilicity of 10 DNA-acting alkylating agents and the initial 60-alkylguanine ratio in DNA with carcinogenic potency in rodents. *Mutat Res* 110:181-219.
- Beijing Mental Development Cooperative Group. 1985. *Gesell Developmental Diagnostic Scale*. Beijing, China: Beijing Mental Development Cooperative Group.
- Bostrom CE, Bunde P, Warberg A, Jernstrom B, Johansson C, Kykling T, et al. 2002. Cancer risk assessment, indicators, and guidelines for polycyclic aromatic hydrocarbons in the ambient air. *Environ Health Perspect* 110:451-480.
- Buluy DM, Wittenberg LW. 1971. Carcinogenic effects of polycyclic hydrocarbon carcinogens administered to near-dying pregnancy in the pronghorn. *J Natl Cancer Inst* 46:397-402.
- Cainfield RL, Henderson CR, Cory-Stecher DA, Cox C, Jusko TA, Lanphear SP. 2002. Intellectual impairment in children with blood lead concentrations below 10 µg per deciliter. *N Engl J Med* 346:1577-1579.
- Choi H, Jodrychowski W, Spongler J, Camano DE, Whyatt RM, Rauh V, et al. 2006. International studies of prenatal exposure to polycyclic aromatic hydrocarbons and fetal growth. *Environ Health Perspect* 114:1744-1750.
- Chow JC, Watson JB, Chen LW, Koracin D, Zelenka B, Tang D, et al. 2006. Exposure to PM_{2.5} and PAHs from the Tangjiazui, China, epidemiological study. *J Environ Sci Health A Tox Hazard Subst Environ Eng* 41:517-542.
- Cui H, Hsu J, Ma G. 2001. Influences of rearing style on the intellectual development of infants [in Chinese]. *Wei sheng yanjiu* 30:362-364.
- Dillon CM, Pickering CR, Drummond MB. 1986. Predictive value of screening for different areas of development. *Dev Med Child Neurol* 28:294-305.
- Economy EC. 2003. *China's Environmental Challenge: Political, Social, and Economic Implications*. New York: Council on Foreign Relations.
- Guo R, Yang J, Liu D, Liu Z. 2002. Transformation behavior of trace elements during coal pyrolysis. *Fuel Process Technol* 77:78:127-143.
- Hudon L, Meisen KJ Jr, Hegamer SE, Hill RM, Meise AA, Smith ED, et al. 1996. Long-term neurodevelopmental outcome after intrauterine transfusion for the treatment of fetal hemolytic disease. *Am J Obstet Gynecol* 179:858-863.
- Jin X, Sun Y, Jiang F, Ma J, Morgan C, Shen X. 2007. "Care for Development" intervention in rural China: a prospective follow-up study. *J Dev Behav Pediatr* 28:213-219.
- Ko DH, Su Q, Zhsang XY, Gao XX. 2004. Effect of active medical intervention on the physique and neuropsychological development of full-term infants: follow-up effect evaluation [in Chinese]. *Chinese J Clin Rehabil* 8:6796.
- Needleman HL, Ruzas JA, Tobin MJ, Gueszler SE, Greenhouse JR. 1996. Bone lead levels and delinquent behavior. *JAMA* 275:363-368.
- Nickerson K. 2006. Environmental contaminants in breast milk. *J Midwifery Womens Health* 51:26-34.
- Perera F, Tang G, Whyatt R, Lederman SA, Jedrychowski W. 2005. DNA damage from polycyclic aromatic hydrocarbons measured by benzo[a]pyrene-DNA adducts in mothers and newborns from Northern Manhattan, the World Trade Center Area, Poland, and China. *Cancer Epidemiol Biomarkers Prev* 14:769-774.
- Perera FP, Rauh V, Tsai WY, Kinney P, Camano D, Bari D, et al. 2003. Effects of transplacental exposure to environmental pollutants on birth outcomes in a multi-ethnic population. *Environ Health Perspect* 111:201-205.
- Perera FP, Rauh V, Whyatt RM, Tsai WY, Tang D, Diaz D, et al. 2006. Effect of prenatal exposure to airborne polycyclic aromatic hydrocarbons on neurodevelopment in the first 3 years of life among inner-city children. *Environ Health Perspect* 114:1287-1292.
- Perera FP, Tang D, Rauh V, Tu YH, Tsai WY, Becker M, et al. 2007. Relationship between polycyclic aromatic hydrocarbon-DNA adducts, environmental tobacco smoke, and child development in the World Trade Center cohort. *Environ Health Perspect* 115:1497-1502.
- Perera FP, Whyatt RM, Jedrychowski W, Rauh V, Manchester D, Santella RM, et al. 1998. Recent developments in molecular epidemiology: a study of the effects of environmental polycyclic aromatic hydrocarbons on birth outcomes in Poland. *Am J Epidemiol* 147:309-314.
- Rojas M, Alexandrov K, van Schooten FJ, Hillstrand M, Knek E, Bartsch H. 1994. Validation of a new fluorometric assay for benzo[a]pyrene diol-epoxide-DNA adducts in human white blood cells: comparisons with 32P-postlabelling and ELISA. *Carcinogenesis* 15:557-560.
- Saunders CR, Ramesh A, Shockley DC. 2002. Modulation of neurotoxic behavior in F-344 rats by temporal disposition of benzo[a]pyrene. *Toxicol Lett* 129:33-45.
- Saunders CR, Shockley DC, Knuckles ME. 2003. Fluoranthene-induced neurobehavioral toxicity in F-344 rats. *Int J Toxicol* 22:263-276.
- Štáň RJ, Birková B, Demek J, Bobák M. 2005. Ambient air pollution and pregnancy outcome: a review of the literature. *Environ Health Perspect* 113:375-382.
- Tang D, Li TY, Liu JJ, Chen YH, Gu L, Perera FP. 2006. PAH-DNA adducts in cord blood and fetal and child development in a Chinese cohort. *Environ Health Perspect* 114:1297-1300.
- Tang D, Li TY, Liu JJ, Zhou ZJ, Yuan T, Chen YH, et al. 2000. Effects of prenatal exposure to coal-burning pollutants on children's development in China. *Environ Health Perspect* 108:674-679.
- Tang D, Phillips DH, Stampfer M, Mooney LA, Hsu Y, Cho S, et al. 2001. Association between carcinogen-DNA adducts in white blood cells and lung cancer risk in the physicians health study. *Cancer Res* 61:6708-6712.
- Wang Q, He L, Wei S, Feng X. 2005. Estimation of mercury emission from different sources to atmosphere in Chongqing, China. *Sci Total Environ* 368:722-728.
- Whyatt RM, Santella RM, Jedrychowski W, Garts SJ, Bell DA, Bitman R, et al. 1996. Relationship between ambient air pollution and genotoxic DNA damage in Polish mothers and newborns. *Environ Health Perspect* 106:821-826.
- World Health Organization. 1999. *A Critical Link: Interventions for Physical Growth and Psychological Development*. Geneva: World Health Organization, Department of Child and Adolescent Health and Development.
- World Health Organization. 2004. *The Importance of Caregiver-Child Interactions for the Survival and Healthy Development of Young Children*. Geneva: World Health Organization, Department of Child and Adolescent Health and Development.
- Wormley OD, Chirwa S, Nayyar T, Wu J, Johnson S, Brown LA, et al. 2004a. Inhaled benzo[a]pyrene impairs long-term potentiation in the F1 generation rat dentate gyrus. *Cell Mol Biol (Noisy-le-grand)* 50:715-721.
- Wormley OD, Ramesh A, Head DB. 2004b. Environmental contaminant-mixture effects on CNS development, plasticity, and behavior. *Toxicol Appl Pharmacol* 197:49-65.
- Zhang J, Han G-L, Xu Y-Q. 2003. The release of the hazardous elements from coal in the initial stage of combustion process. *Fuel Process Technol* 84:121-133.
- Zhang MQ, Zhu YC, Deng RW. 2002. Evaluation of mercury emissions to the atmosphere from coal combustion, China. *Ambio* 11:482-484.
- Zhang X, Li J. 1994. The revise of Gesell Developmental Scale on 3-1/2-6 years of age in Beijing [in Chinese]. *CJCP* 2:140-150.
- Zhou X, Luo Y, Liang J, Chen T, Zhuang N, Zheng S, et al. 2004. Follow-up study of mental developments in high-risk children [in Chinese]. *Zhejiang Da Xue Xue Bao Yi Xue Ban* 33:449-451.
- Zhu H, Zhou ZY, Jiang YJ, Liang L, Wang JY, Mao HQ, et al. 2005. Multifactorial analysis of effects of mothers' autoimmune thyroid disease on their infants' intellectual development [in Chinese]. *Zhonghua Er Ke Za Zhi* 43:340-344.



Original Contribution

Association of Black Carbon with Cognition among Children in a Prospective Birth Cohort Study

S. Franco Suglia¹, A. Gryparis², R. O. Wright^{1,3}, J. Schwartz^{1,3}, and R. J. Wright^{3,4}

¹ Department of Environmental Health, Harvard School of Public Health, Boston, MA.

² Department of Applied Mathematics, University of Crete, Crete, Greece.

³ Channing Laboratory, Brigham and Women's Hospital and Harvard Medical School, Boston, MA.

⁴ Department of Society, Human Development and Health, Harvard School of Public Health, Boston, MA.

Received for publication June 20, 2007; accepted for publication September 21, 2007.

While studies show that ultrafine and fine particles can be translocated from the lungs to the central nervous system, the possible neurodegenerative effect of air pollution remains largely unexplored. The authors examined the relation between black carbon, a marker for traffic particles, and cognition among 202 Boston, Massachusetts, children (mean age = 9.7 years (standard deviation, 1.7)) in a prospective birth cohort study (1986–2001). Local black carbon levels were estimated using a validated spatiotemporal land-use regression model (mean predicted annual black carbon level, 0.56 $\mu\text{g}/\text{m}^3$ (standard deviation, 0.13)). The Wide Range Assessment of Memory and Learning and the Kaufman Brief Intelligence Test were administered for assessment of cognitive constructs. In analysis adjusting for sociodemographic factors, birth weight, blood lead level, and tobacco smoke exposure, black carbon (per interquartile-range increase) was associated with decreases in the vocabulary (–2.2, 95% confidence interval (CI): –5.5, 1.1), matrices (–4.0, 95% CI: –7.6, –0.5), and composite intelligence quotient (–3.4, 95% CI: –6.6, –0.3) scores of the Kaufman Brief Intelligence Test and with decreases on the visual subscale (–5.4, 95% CI: –8.9, –1.9) and general index (–3.9, 95% CI: –7.5, –0.3) of the Wide Range Assessment of Memory and Learning. Higher levels of black carbon predicted decreased cognitive function across assessments of verbal and nonverbal intelligence and memory constructs.

air pollution; child; cognition; intelligence; neurotoxicity syndromes; particulate matter; soot; vehicle emissions

Abbreviations: CI, confidence interval; IQ, intelligence quotient; K-BIT, Kaufman Brief Intelligence Test; SD, standard deviation; WRAML, Wide Range Assessment of Memory and Learning.

It is well documented that air pollution is associated with a number of adverse respiratory and cardiovascular health effects (1–3). Many of these effects seem to be more strongly associated with particles from traffic (1), which are rich in elemental carbon and are the principal source of ultrafine particle exposure. However, the possible neurodegenerative effect of air pollution remains largely unexplored. The potential effect of translocation of particles from the lung to other organs has been documented. Researchers have shown that ultrafine and fine particles can

be translocated from the lungs when they penetrate pulmonary tissue and enter the capillaries, reaching other organs (i.e., liver, spleen, kidneys, heart, brain) through circulation (4). In addition, fine and coarse particles can be phagocytized by macrophages and dendritic cells carrying the particles to the lymph nodes (5).

Animal studies have shown that inhaled particles can be translocated from the respiratory system directly to the central nervous system. In rats, Oberdorster et al. (6) found ultrafine carbon-13 particles in the olfactory bulb and the

Correspondence to Dr. Shakira Franco Suglia, Department of Environmental Health, Harvard School of Public Health, Landmark 415W, 401 Park Drive, Boston, MA 02215 (e-mail: sfranco@hsph.harvard.edu).

cerebrum and cerebellum after inhalation exposure of ultrafine elemental carbon-13 particles. More recently, Elder et al. (4) confirmed that ultrafine particles can reach the brain, either through circulation or directly translocated to the olfactory nerve from the nose to the brain. This raises the question of whether traffic particles can have neurotoxic effects.

The few studies that have focused on the potentially neurotoxic effects of particulate matter have focused on pathologic lesions that are generally present in neurodegenerative diseases (i.e., Parkinson's disease and Alzheimer's disease). Researchers have proposed that damage mediated by the particles is probably related to the oxidative stress pathway. Calderon-Garciduenas et al. (7) presented histologic evidence of chronic brain inflammation (i.e., nuclear factor- κ B activation and inducible nitric oxide synthase production) and an acceleration of Alzheimer-like pathology (i.e., apoptotic glial white matter cells, nonneuritic plaques, neurofibrillary tangles) among canines chronically exposed to high levels of air pollutants in Mexico City. Levels of proinflammatory cytokines, including interleukin-1 α and tumor necrosis factor- α , were higher in the brain tissues of mice exposed to particulate matter than in mice that were not exposed (8). In humans, exposure to severe air pollution has been associated with increased levels of cyclooxygenase-2, an inflammatory mediator, and accumulation of the 42-amino-acid form of β -amyloid, a cause of neuronal dysfunction (9). Changes in brain cytokine and chemokine expression in mice have been directly linked to intranasal exposure to ultrafine black carbon, suggesting a more general inflammatory response (10). Changes in cognitive function have been shown to be associated with relatively low doses of heavy metal exposure (11), which in high doses can produce some of the lesions cited above. Those low doses have also been associated with increased inflammation and oxidative stress.

Taken together, these results suggested that further examination of possible associations between markers of traffic particles and cognitive function would be worthwhile. Thus, we examined the relation between black carbon from traffic sources, a component of particulate matter, and cognition among children followed in a prospective birth cohort study. This provided us with the opportunity to adjust for markers of socioeconomic status and other environmental factors known to affect cognitive development.

MATERIALS AND METHODS

Study population

The sample for these analyses was drawn from participants in the Maternal-Infant Smoking Study of East Boston, a prospective cohort study designed to evaluate the effects of pre- and postnatal tobacco smoke exposure on childhood lung growth and development and respiratory health. The study has been described in detail previously (12). In brief, pregnant women receiving prenatal care (<20th week of gestation) at an urban community health center in Boston, Massachusetts, between March 1986 and October 1992 were eligible for enrollment. Women who did not speak either English or Spanish, who did not plan to have pediatric

follow-up at the clinic, and who were less than 18 years of age at the time were excluded. One thousand women were eligible and enrolled, of whom 848 continued participation and delivered a live infant. In November 1996, new study initiatives were implemented, including the assessment of social stressors and neurocognitive assessment, at which time 500 women and their children continued active follow-up. All active subjects were approached to participate in the cognitive battery, and 218 children completed the neurocognitive assessment. Notably, there were no significant differences between those who participated in the cognitive assessment and those who did not with regard to sociodemographic factors, birth weight, blood lead level, or tobacco smoke exposure. The study was approved by the human studies committees at the Harvard School of Public Health, Brigham and Women's Hospital, and the Beth Israel Deaconess Medical Center.

In the longitudinal study, detailed data on race/ethnicity and socioeconomic position (based on maternal educational level) had been ascertained through standardized questionnaires administered at baseline and clinic follow-up visits, as previously described (12).

Black carbon

Exposure to black carbon was estimated on the basis of the children's residence during study follow-up. In order to estimate residential black carbon level, we used a validated spatiotemporal land-use regression model to predict 24-hour measures of traffic exposure using data from more than 80 locations in the Greater Boston area. Three quarters of the monitoring sites were residential; the rest were commercial or government facilities. The data consisted of over 6,021 pollution measurements from 2,127 unique exposure days. A detailed description of all sources of exposure data is provided elsewhere (13). Predictors included in the regression analysis were the black carbon level at a central stationary monitor (to capture average concentrations in the area on that day), meteorologic conditions and other characteristics (e.g., weekday/weekend) of a particular day, and measures of the amount of traffic activity (e.g., geographic-information-system-based measures of cumulative traffic density within 100 m, population density, distance to the nearest major roadway, percentage of urbanization) at a given location. A cumulative traffic density measure was recorded once per location. We used spline regression methods to allow these factors to affect exposure levels in a potentially nonlinear way. Finally, we used thin-plate splines, a two-dimensional extension of regression splines, to model longitude and latitude and capture additional spatial variability that was unaccounted for after we included our deterministic spatial predictors in the model. This approach is a form of universal kriging (i.e., kriging extended to incorporate covariates) or a geoadditive model (14) for daily concentrations of particle levels. We had complete information on all of these factors for 2,114 of the 2,127 unique exposure days. Separate models were fitted for the warm (May–October) and cold (November–April) seasons. The R^2 value for the model (over both seasons) was 0.82, and the cross-validated R^2 between the daily measurements

taken outside the residential locations and corresponding predictions obtained from fitting the model to the data after excluding data from a particular residential location was 0.36. For the purposes of these analyses, we used the average of the two seasons as a measure of average lifetime black carbon exposure. If children moved during the study period ($n = 12$), an average black carbon measure for all addresses was calculated.

Cognitive measures

When the children were aged 8–11 years, a battery of cognitive tests was administered, including the Kaufman Brief Intelligence Test (K-BIT) and the Wide Range Assessment of Memory and Learning (WRAML). The K-BIT is an individually administered test of verbal and nonverbal intelligence (15). Two subscales, vocabulary and matrices, comprise the test, as well as a composite intelligence quotient (IQ) score. The K-BIT has acceptable correlation with the widely used Wechsler verbal performance and full-scale IQ scores (16); validation studies have been conducted for children less than 7 years of age with normative data available (17). The WRAML is a well-standardized psychometric instrument that allows evaluation of a child's ability to actively learn and memorize a variety of information (18, 19). The WRAML includes subscales on verbal memory, visual memory, and learning and an overall general index scale. It has been normed for children aged 5–17 years among racially diverse groups, including minorities. All measures are expressed as standardized scores, which represent the score of the individual taking the test relative to scores obtained by children of the same age and gender in the standardization sample. All scores have a mean of 100 and a standard deviation of 15.

Tobacco smoke exposure

At each clinic visit during pregnancy, mothers were asked about their smoking status and the smoking habits of members of their households. A urine specimen was obtained for determination of a creatinine-corrected cotinine level, as previously detailed (12). A mother was classified as never smoking during her pregnancy if she always reported that she had never smoked on the standardized questionnaire and each of her urinary cotinine levels was less than 200 ng/mg creatinine (12). At any visit, if the report of nonsmoking by the mother was contradicted by the urinary cotinine measure, the mother was classified as a current smoker for that interval. Maternally reported postnatal exposure of the child to secondhand smoke was assessed by questionnaire (monthly through age 26 months, every 6 months between ages 26 months and 4 years, and annually thereafter). Children were considered to have been exposed to secondhand smoke in a particular follow-up interval if the mother reported personal active smoking or active smoking by any other person living in the household. Postnatal secondhand smoke was categorized as early (occurring from birth through 25 months of age) or late (26 months of age or older). The late secondhand smoke exposure category in-

cluded children exposed both early and late (54 children) and late only (13 children), given that there were relatively few children in the latter category. Children's exposure to maternal smoking during pregnancy was highly correlated with postnatal secondhand smoke exposure. Forty-two children were exposed to prenatal tobacco smoke; among these children, only two were not exposed to secondhand smoke after birth.

Blood lead level

Children in Massachusetts are mandated by law to have blood lead testing annually, starting at 9 months of age, until age 4 years, unless they are considered to be at high risk (living in pre-1978 housing that is deteriorated or undergoing construction or having a sibling with lead poisoning), in which case they are tested annually until age 6 years. Results are incorporated into the medical records at the community health centers where the children obtain pediatric follow-up. Using a standardized instrument, blood lead levels were extracted from medical records at these health centers by a physician blinded to the study aims. Because the children had varying numbers of blood lead measurements which were dependent on their lead exposure (children with higher lead exposure had more follow-up tests than children with lower lead concentrations), we used the highest blood lead level recorded up to age 6 years for each child, referred to hereafter as the "peak blood lead level."

Statistical analyses

A total of 218 children completed the cognitive assessment, of whom 214 were successfully geocoded and assigned a black carbon measure. Eleven children were removed from the data set before analysis because they had black carbon values considered to be outliers according to the extreme studentized deviation model (20); in addition, one child was missing information on socioeconomic status. This left 202 children for our analyses. Multiple imputation was used to impute missing data on birth weight (seven children) and blood lead level (12 children). Since black carbon was being used as a surrogate for traffic particle exposure, which includes more than just carbon particles, it did not make sense for us to report results on a unit mass basis. Instead, we report estimated effects of predicted black carbon level per interquartile-range increase. We conducted bivariate analyses to determine the association between cognitive outcomes and demographic and environmental measures of interest. We also tested for associations between black carbon and environmental and sociodemographic markers. The effect of predicted black carbon on cognition was estimated by linear regression while adjusting for child's age at cognitive assessment, gender, race/ethnicity, and maternal education (as a marker of socioeconomic status) (model 1). To assess the potential for confounding, we examined the sensitivity of those results to further adjustment for in-utero and postnatal secondhand tobacco smoke exposure (model 2), birth weight (model 3), and blood lead level (model 4). All analyses were conducted in SAS, version 9.0 (SAS Institute, Inc., Cary, North Carolina).

RESULTS

Among the 202 children in this study, 52 percent were female and 57 percent spoke Spanish as their primary language. Maternal educational level was less than high school graduation for 42 percent of the mothers (table 1). The mean age was 9.7 years (standard deviation (SD), 1.7), and the mean peak blood lead level was 8.5 $\mu\text{g}/\text{dl}$ (SD, 6.1). Mean scores on the K-BIT subscales were as follows: composite, 94.9 (SD, 13.9); vocabulary, 89.5 (SD, 16.3); and matrices, 101.4 (SD, 14.0). WRAML mean subscale scores were: verbal memory index, 84.7 (SD, 15.1); visual memory index, 93.3 (SD, 13.8); learning index, 101.1 (SD, 15.0); and general index, 91.1 (SD, 14.5). The mean annual predicted black carbon level was 0.56 $\mu\text{g}/\text{m}^3$ (SD, 0.13).

In bivariate analyses (data not shown) of black carbon and cognitive measures, black carbon was associated with the vocabulary, matrices, and composite subscales of the K-BIT and the visual and verbal subscales and the general index of the WRAML. Primary language spoken at home and maternal education were associated with the cognitive measures and black carbon. Children who primarily spoke Spanish at home and children whose parents had a high school education or less scored lower on the composite, vocabulary, verbal, and general memory subscales of the WRAML and K-BIT. In addition, they had higher predicted black carbon levels than children who primarily spoke English at home and whose parents had more than a high school education. Marital status was not associated with any of the cognitive measures or with black carbon. Thus, in multivariate analyses, we adjusted for both parental education and primary language spoken at home, as well as birth weight, blood lead level, and in-utero and postnatal secondhand tobacco smoke exposure.

In multiple linear regression analyses (tables 2 and 3), an interquartile-range increase in log black carbon predicted a 2-point decrease (95 percent confidence interval (CI): -5.3, 1.3) on the vocabulary scale, a 4.2-point decrease (95 percent CI: -7.7, -0.7) on the matrices scale, and a 3.4-point decrease (95 percent CI: -6.6, -0.3) on the composite subscale of the K-BIT. Black carbon level also predicted a 1.1-point decrease (95 percent CI: -4.6, 2.3) on the verbal learning scale, a 5.2-point decrease (95 percent CI: -8.6, 1.7) on the visual learning scale, a 2.7-point decrease (95 percent CI: -6.5, 1.1) on the learning scale, and a 3.7-point decrease (95 percent CI: -7.2, -0.2) on the general index scale of the WRAML. Further adjustment for tobacco smoke exposure, birth weight, and blood lead level did not attenuate these effect estimates.

DISCUSSION

In this prospective urban birth cohort study, long-term concentration of black carbon particles from mobile sources was associated with decreases in cognitive test scores, even after adjustment for socioeconomic status, birth weight, tobacco smoke exposure, and blood lead level. Although our linear regression-based analyses do not establish causation, only associations, a number of features strengthen our findings. Decreases in cognitive functioning were seen in verbal

TABLE 1. Demographic characteristics, environmental exposures, and scores on cognitive subscale measures ($n = 202$) in the Maternal-Infant Smoking Study of East Boston, 1986-2001

| | No. | % | Mean (SD)* |
|--|-----|------|--------------|
| Demographic characteristics | | | |
| Child's age (years) | | | 9.7 (1.7) |
| Child's gender | | | |
| Male | 97 | 48.0 | |
| Female | 105 | 52.0 | |
| Primary language spoken at home | | | |
| English | 87 | 43.1 | |
| Spanish | 115 | 56.9 | |
| Mother's educational level | | | |
| Some college | 37 | 18.3 | |
| High school graduation/technical school | 81 | 40.1 | |
| Less than high school/no graduation | 84 | 41.6 | |
| Marital status | | | |
| Married/living with someone | 155 | 76.7 | |
| Separated/divorced/single | 47 | 23.3 | |
| Medical history and environmental exposures | | | |
| Tobacco exposure | | | |
| Nonsmoker | 70 | 34.7 | |
| In-utero and SHS* exposure | 42 | 20.8 | |
| Early SHS exposure† | 23 | 11.4 | |
| Late SHS exposure‡ | 67 | 33.2 | |
| Birth weight (kg) | | | 3.35 (0.5) |
| Peak blood lead level ($\mu\text{g}/\text{dl}$) | | | 8.5 (6.1) |
| Black carbon ($\mu\text{g}/\text{m}^3$) | | | 0.56 (0.13) |
| Cognitive subscales | | | |
| Kaufman Brief Intelligence Test | | | |
| Composite | | | 94.9 (13.9) |
| Matrices | | | 101.4 (14.0) |
| Vocabulary | | | 89.5 (16.3) |
| Wide Range Assessment of Memory and Learning | | | |
| Verbal | | | 84.7 (15.1) |
| Learning | | | 101.1 (15.0) |
| Visual | | | 93.3 (13.8) |
| General index | | | 91.1 (14.5) |

* SD, standard deviation; SHS, secondhand smoke.

† SHS exposure before 26 months of age.

‡ SHS exposure at 26 months of age or older.

and nonverbal intelligence constructs as well as memory constructs. Moreover, our results are consistent in that we noted decreases across all subscales, though not all associations between black carbon and cognitive subscales were statistically significant.

TABLE 2. Relation of predicted black carbon levels (average of summer and winter) at children's residences to scores on subscales of the Kaufman Brief Intelligence Test in linear regression models ($n = 202$), Maternal Infant Smoking Study of East Boston, 1986–2001†

| Black carbon model | Vocabulary | | Matrices | | Composite | |
|--|------------|-----------|----------|-------------|-----------|-------------|
| | Estimate | 95% CI‡ | Estimate | 95% CI | Estimate | 95% CI |
| Adjusted for demographic factors§ | -2.0 | -5.3, 1.3 | -4.2 | -7.7, -0.7* | -3.4 | -6.6, -0.3* |
| Adjusted for above factors + in-utero tobacco smoke + secondhand smoke | -2.0 | -5.3, 1.4 | -4.0 | -7.5, -0.4* | -3.3 | -6.4, -0.1* |
| Adjusted for above factors + birth weight | -2.0 | -5.4, 1.3 | -4.0 | -7.6, -0.5* | -3.3 | -6.5, -0.2* |
| Adjusted for above factors + blood lead level | -2.2 | -5.5, 1.1 | -4.0 | -7.6, -0.5* | -3.4 | -6.6, -0.3* |

* $p < 0.05$.

† Change in subscale score per interquartile-range ($0.4\text{-}\mu\text{g}/\text{m}^3$) increase in log black carbon level.

‡ CI, confidence interval.

§ Adjusted for age, gender, primary language spoken at home, and mother's education.

These results are of comparable magnitude to results found for other environmental neurotoxicants. For example, among children, a $10\text{-}\mu\text{g}/\text{dl}$ increase in blood lead level has been associated with a loss of 1–5 IQ points (21). Children born to mothers who smoke 10 or more cigarettes per day during pregnancy have an average decrease of 4 IQ points (22). In our cohort, an interquartile-range ($0.4\text{-}\mu\text{g}/\text{m}^3$) increase in log black carbon predicted a 3-point decrease in IQ (K-BIT composite subscale).

There are several potential mechanisms that could be contributing to the associations found in this study. First, since black carbon comes almost entirely from traffic, these particles are surrogates for all traffic particles, and other components of traffic particles may play a role. For example, there is evidence that ultrafine particles are translocated up the olfactory nerve to the brain without entering the lung (6). Ultrafine particles in the brain are probably associated with increased oxidative stress, since that has been seen in other tissues (23). The carbon particles themselves are rarely pure carbon; they generally have transition metals adsorbed on the surface. These metals have been shown to induce oxidative stress in the lung (24–28). Other studies have also implicated traffic exposure in oxidative stress (29–31). There is evidence that the oxidative stress and inflammation induced by particles translates systemically (30). For example,

exposure of rodents to concentrated air particles collected from a busily trafficked roadway resulted in increased oxidative stress in the heart as well as the lung (31). Other studies comparing animal brains in areas of Mexico City that are heavily influenced by traffic have reported histologic evidence of chronic brain inflammation and an acceleration of Alzheimer-like pathology (7). Taken together, the current body of knowledge suggests that inflammatory processes and increased oxidative stress (7) may play a role in the mechanism by which particles can have an impact on the nervous system; however, additional work in this area of research remains to be done.

While, to our knowledge, no other studies have examined an association between air pollution and cognition, a few have examined the role of traffic noise in cognition among children (32, 33). In the RANCH project, a cross-sectional study of 2,000 children from three European cities (Madrid, London, and Amsterdam), aircraft noise at home and at school was associated with impaired reading comprehension (32). Road traffic noise, however, was not associated with reading comprehension. It is possible that the associations found in our study could be attributable to traffic and/or aircraft noise and not to black carbon; conversely, it is also possible that the associations previously found between road and aircraft noise and cognition are actually due to air

TABLE 3. Relation of predicted black carbon levels (average of summer and winter) at children's residences to scores on subscales of the Wide Range Assessment of Memory and Learning in linear regression models ($n = 202$), Maternal Infant Smoking Study of East Boston, 1986–2001†

| Black carbon model | Verbal | | Visual | | Learning | | General | |
|--|----------|-----------|----------|-------------|----------|-----------|----------|-------------|
| | Estimate | 95% CI‡ | Estimate | 95% CI | Estimate | 95% CI | Estimate | 95% CI |
| Adjusted for demographic factors§ | -1.1 | -4.6, 2.3 | -5.2 | -8.6, -1.7* | -2.7 | -6.5, 1.1 | -3.7 | -7.2, -0.2* |
| Adjusted for above factors + in-utero tobacco smoke + secondhand smoke | -1.2 | -4.7, 2.3 | -5.3 | -8.8, -1.8* | -2.6 | -6.5, 1.2 | -3.7 | -7.3, -0.1* |
| Adjusted for above factors + birth weight | -1.3 | -4.7, 2.2 | -5.3 | -8.8, -1.8* | -2.6 | -6.5, 1.3 | -3.8 | -7.4, -0.2* |
| Adjusted for above factors + blood lead level | -1.3 | -4.8, 2.2 | -5.4 | -8.9, -1.9* | -2.8 | -6.6, 1.1 | -3.9 | -7.5, -0.3* |

* $p < 0.05$.

† Change in subscale score per interquartile-range ($0.4\text{-}\mu\text{g}/\text{m}^3$) increase in log black carbon level.

‡ CI, confidence interval.

§ Adjusted for age, gender, primary language spoken at home, and mother's education.

pollutants, such as black carbon. Future studies may be designed to distinguish traffic effects due to noise from those due to pollution.

The current study had a number of limitations. As is typical with longitudinal studies, there was a significant reduction in the sample available from the original cohort over time. The nonparticipation of some subjects from the longitudinal study may be seen as a limitation, although there were no differences based on race/ethnicity, maternal education, smoking status, birth weight, or blood lead level when we compared children who had cognition assessed with those who did not among the participants who remained in follow-up. Thus, this is unlikely to have influenced our findings. While we were able to adjust for a number of factors associated with cognition and air pollution, it is still possible that the associations found in this study could be attributable to unmeasured or residual confounding, perhaps most notably from socioeconomic status. Socioeconomic status has been shown to be a determinant of cognitive ability and achievement from early childhood through young adulthood (34, 35). Furthermore, socioeconomic status can determine whether a family lives in close proximity to roadways (36). In addition to adjusting for mother's educational level, the present study was somewhat restricted regarding socioeconomic status, given that all families were recruited from one neighborhood health center in Boston. This restricted the variability of income in this population, thereby reducing the potential for confounding.

Our measure of exposure was also subject to limitations. While we attempted to capture black carbon exposure from all residential addresses, it is possible that we potentially missed exposures incurred at school and/or other locations where children spend portions of their time. However, this potential misclassification of exposure was nondifferential with respect to the outcome, and thus it is unlikely to account for the associations found. Furthermore, compared with adults who work, children spend considerably longer periods of time at home or in the vicinity of their home. Furthermore, exposure studies using personal monitors indicate that home exposures are the most important in predicting personal exposure (37). While demonstrated in adults, time activity studies indicate that children spend more time at home and near home, making the finding relevant (38). Other studies (39) have shown that residential indoor concentrations of particulate matter of outdoor origin are highly correlated with outdoor concentrations. In another study (40), the personal exposures of the working spouses of persons with chronic illnesses have been shown to be highly correlated with their spouses' personal exposures. Taken together, we believe these studies indicate that personal exposures to ambient particles are driven primarily by exposures incurred at home. Moreover, we attempted to capture black carbon exposure from all residential addresses when children moved.

Another limitation of this study is the use of predicted exposure, rather than observed measurements taken outside the residences of the study participants. Since the latter approach is not practical in a large community-based study, we decided to use all available exposure data and advanced modeling approaches to predict the missing exposure at the

residences of the participants. This is an approach that has become very popular in recent years. A potential statistical issue that arises when using spatial-temporal predictions of exposure rather than measured quantities is that predicted quantities are uncertain, and this could bias the resulting health effect estimates. In a previous study, Gryparis et al. (41) found that the use of predictions from spatial exposure models induces a Berkson-type measurement error. This results in unbiased parameter estimates for the association between the predicted exposure and the observed health outcome. However, the standard errors for the parameter of interest might be incorrect. In such a case, we would expect larger standard errors for the parameter of interest.

In summary, this is the first study to have found a consistent relation between exposure to black carbon and reduced neurocognitive functioning across a number of domains in urban, community-dwelling school-aged children. More studies are needed to explore the potentially neurotoxic effects of particulate matter, both to determine the possible impact on cognitive development among children and cognitive decline across the life cycle and to determine the potential contribution of air pollutants to the development and exacerbation of neurodegenerative diseases (i.e., Parkinson's disease, Alzheimer's disease).

ACKNOWLEDGMENTS

This study was supported by Environmental Protection Agency grants R827353 and R832416 and National Institutes of Health grants ES015172-01, ES-00002, T32 ES007142, and K08 HL 04187.

Conflict of interest: none declared.

REFERENCES

- Schwartz J, Litonjua A, Suh H, et al. Traffic related pollution and heart rate variability in a panel of elderly subjects. *Thorax* 2005;60:455-61.
- Schwartz J. Air pollution and hospital admissions for respiratory disease. *Epidemiology* 1996;7:20-8.
- Katsouyanni K, Touloumi G, Spix C, et al. Short-term effects of ambient sulphur dioxide and particulate matter on mortality in 12 European cities: results from time series data from the APHEA project. *Air Pollution and Health: a European Approach*. *BMJ* 1997;314:1658-63.
- Elder A, Gelein R, Silva V, et al. Translocation of inhaled ultrafine manganese oxide particles to the central nervous system. *Environ Health Perspect* 2006;114:1172-8.
- Peters A, Veronesi B, Calderon-Garciduenas L, et al. Translocation and potential neurological effects of fine and ultrafine particles: a critical update. Part I: *Fibre Toxicol* 2006;3:13.
- Oberdorster G, Sharp Z, Atudorci V, et al. Translocation of inhaled ultrafine particles to the brain. *Inhal Toxicol* 2004;16:437-45.
- Calderon-Garciduenas L, Azzarelli B, Acuna H, et al. Air pollution and brain damage. *Toxicol Pathol* 2002;30:373-89.
- Campbell A, Oldham M, Becaria A, et al. Particulate matter in polluted air may increase biomarkers of inflammation in mouse brain. *Neurotoxicology* 2005;26:133-40.

9. Calderon-Garciduenas L, Reed W, Maronpot RR, et al. Brain inflammation and Alzheimer's-like pathology in individuals exposed to severe air pollution. *Toxicol Pathol* 2004;32:650-8.
10. Tin Tin Win S, Yamamoto S, Ahmed S, et al. Brain cytokine and chemokine mRNA expression in mice induced by intranasal instillation with ultrafine carbon black. *Toxicol Lett* 2006;163:153-60.
11. Lanphear BP, Hornung R, Khoury J, et al. Low-level environmental lead exposure and children's intellectual function: an international pooled analysis. *Environ Health Perspect* 2005;113:894-9.
12. Hanrahan JP, Tager IB, Segal MR, et al. The effect of maternal smoking during pregnancy on early infant lung function. *Am Rev Respir Dis* 1992;145:1129-35.
13. Gryparis A, Coull BA, Schwartz J, et al. Semiparametric latent variable regression models for spatio-temporal modeling of mobile source particles in the greater Boston area. *J R Stat Soc Ser C* 2007;56:183-209.
14. Kammann E, Wand M. Geoaddditive models. *Appl Stat* 2003; 52:1-18.
15. Kaufman AS, Kaufman NL. Kaufman Brief Intelligence Test manual. Circle Pines, MN: American Guidance Service, 1990.
16. Wechsler D. Wechsler Intelligence Scale for Children—Third Edition (WISC-III) manual. San Antonio, TX: Psychological Corporation, 1991.
17. Childres J, Durhan T, Wilson S. Relation of performance on the Kaufman Brief Intelligence Test with the Peabody Picture Vocabulary Test-Revised among preschool children. *Percept Mot Skills* 1994;79:1195-9.
18. Sheslow D, Adams W. Wide Range Assessment of Memory and Learning. Wilmington, DE: Jastak Associates, Inc, 1990.
19. Putzke JD, Williams MA, Glutting JJ, et al. Developmental memory performance: inter-task consistency and base-rate variability on the WRAML. *J Clin Exp Neuropsychol* 2001; 23:253-64.
20. Rosner B. Percentage points for a generalized ESD many-outlier procedure. *Technometrics* 1983;25:165-72.
21. Bellinger DC. Lead. *Pediatrics* 2004;113:1016-22.
22. Olds DL, Henderson CR Jr, Tatelbaum R. Intellectual impairment in children of women who smoke cigarettes during pregnancy. *Pediatrics* 1994;93:221-7.
23. Beck-Speier I, Dayal N, Karg E, et al. Oxidative stress and lipid mediators induced in alveolar macrophages by ultrafine particles. *Free Radic Biol Med* 2005;38:1080-92.
24. Ghio AJ. Biological effects of Utah Valley ambient air particles in humans: a review. *J Aerosol Med* 2004;17:157-64.
25. Kim JY, Mukherjee S, Ngo LC, et al. Urinary 8-hydroxy-2'-deoxyguanosine as a biomarker of oxidative DNA damage in workers exposed to fine particulates. *Environ Health Perspect* 2004;112:666-71.
26. Knaapen AM, Shi T, Borm PJ, et al. Soluble metals as well as the insoluble particle fraction are involved in cellular DNA damage induced by particulate matter. *Mol Cell Biochem* 2002;234:317-26.
27. Ghio AJ, Richards JH, Carter JD, et al. Accumulation of iron in the rat lung after tracheal instillation of diesel particles. *Toxicol Pathol* 2000;28:619-27.
28. Gardner SY, Lehmann JR, Costal DL. Oil fly ash-induced elevation of plasma fibrinogen levels in rats. *Toxicol Sci* 2000;56:175-80.
29. Lai CH, Liou SH, Lin HC, et al. Exposure to traffic exhausts and oxidative DNA damage. *Occup Environ Med* 2005;62: 216-22.
30. Hirano S, Furuyama A, Koike E, et al. Oxidative-stress potency of organic extracts of diesel exhaust and urban fine particles in rat heart microvessel endothelial cells. *Toxicology* 2003;187:161-70.
31. Gurgueira S, Lawrence J, Coull B, et al. Rapid increases in the steady-state concentration of reactive oxygen species in the lungs and heart after particulate air pollution inhalation. *Environ Health Perspect* 2002;110:749-55.
32. Clark C, Martin R, van Kempen E, et al. Exposure-effect relations between aircraft and road traffic noise exposure at school and reading comprehension: the RANCH project. *Am J Epidemiol* 2006;163:27-37.
33. Stansfeld SA, Berglund B, Clark C, et al. Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet* 2005;365:1942-9.
34. Noble KG, McCandless BD, Farah MJ. Socioeconomic gradients predict individual differences in neurocognitive abilities. *Dev Sci* 2007;10:464-80.
35. Baydar N, Brooks-Gunn J, Furstenberg FF. Early warning signs of functional illiteracy: predictors in childhood and adolescence. *Child Dev* 1993;64:815-29.
36. O'Neill MS, Jerrett M, Kawachi I, et al. Health, wealth, and air pollution: advancing theory and methods. *Environ Health Perspect* 2003;111:1861-70.
37. Rohas-Bracho L, Suh H, Koutrakis P. Relationship among personal, indoor, and outdoor fine and coarse particle concentrations for individuals with COPD. *J Expo Anal Environ Epidemiol* 2000;10:294-306.
38. Liu L-J, Box M, Kalman D, et al. Exposure assessment of particulate matter for susceptible populations in Seattle. *Environ Health Perspect* 2003;111:909-18.
39. Samat J, Long C, Koutrakis P, et al. Using sulfur as a tracer of outdoor fine particulate matter. *Environ Sci Technol* 2002;36: 5305-14.
40. Brown K. Characterization of particulate and gaseous exposure of sensitive populations living in Baltimore and Boston. (Doctoral dissertation). Boston, MA: Harvard University, 2006.
41. Gryparis A, Paciorek CJ, Coull BA. Measurement error caused by spatial misalignment in environmental epidemiology. Boston, MA: Harvard University, 2006. (<http://www.bepress.com/harvardbiostat/paper59>).

Senator BOXER. Governor Gregoire, I have a question for you. The Western Governors' Association passed a resolution that said "Appropriate actions are needed to reduce greenhouse gas emissions. Many of these actions could create significant economic benefit for the West as the United States moves toward new energy sources." They urge the Federal Government to act decisively to create a national policy to reduce greenhouse gas emissions and to recognize and encourage State action in any national market-based emission reduction policy.

How important are these Federal policies for promoting job growth?

Ms. GREGOIRE. Madam Chair, the Western Governors' Association was united this summer in the policy that you just described, and we are very diverse section of the country. We are agriculture, we are aerospace, we are your State, and very clearly one of the main impetuses behind it was the fact that, if we can have a national standard, national policy on energy, we know that we can get the capital investment.

My State stands as an example. With a minor tax incentive, we are now the fifth largest producer of wind power in the country. But they will not continue to invest unless and until they see the Congress setting a standard for America that allows them to have predictability and sustainability for them to invest their capital and invest in these new companies and new technologies that will create green collar jobs.

It is that, in part, which led all of us to say we need that policy. But it is also the impact that we have had from forest fires and droughts and floods in the Western part of the country that has led us to say that policy ought to be the policy of the United States.

Thank you, Madam Chair.

Senator BOXER. Thank you.

Governor Hoeven, are you seeing private sector interest in using North Dakota's significant wind resources as an engine to create renewable energy?

Mr. HOEVEN. Madam Chairman, no question about it. In North Dakota, our approach is developing all of our energy resources, both traditional and renewable. I would say right now we have in some stage of development close to 5,000 megawatts of wind energy, which is huge, and a huge investment. So, that is tremendously positive, as is the case with biofuels, both biodiesel and ethanol, solar, geothermal, biomass, all of those things, and we are promoting them very vigorously.

But the other point that I want to make is that we are promoting them in partnership with the traditional sources like oil and gas, like the coal and new clean coal technologies, and finding ways not only to create more energy that is cost-competitive, but do it with better environmental stewardship.

So, understand that each and every source of energy has some drawbacks, traditional and renewable. They all have their drawbacks. But we have got to be careful in energy policy about picking winners and losers, and instead incentivize the States, this country, to develop all of our energy resources and do so in environmentally sound ways.

Senator SANDERS. Thank you very much, Governor.

Senator Barrasso.

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

Senator INHOFE. I apologize, Mr. Chairman, I thought I would not be able to be here, and we have to trade. Thank you for your understanding, Senator Barrasso.

Senator BARRASSO. You are welcome, Senator Inhofe.

Senator SANDERS. Senator Inhofe.

Senator INHOFE. Let me start off with Governor Hoveen. I understand that your State is No. 5 now, fifth in the Nation's oil production. Now, we will probably take that position back over with the recent developments in the Balkan trade. I am afraid you will get that back anyway.

So, your State has the potential to contribute a lot more in energy security with oil and shale production. I do not know what kind of policies you think that we ought to adopt here. I know it is not this bill. Anything that you would like to suggest that we could do that would help you in your future productions?

Mr. HOEVEN. One of the keys is creating certainty. If you want businesses, both the utility industry as well as the venture capitalists and others, to make these investments in the new technologies that will create more energy, which is vitally important from a security standpoint, is vitally important from the standpoint of our economy, but to do it so that we have continued better environmental stewardship, which I understand we all share that concern. You have got to create certainty so that you can get that investment into these new technologies and get them deployed.

It is one thing to talk about them over at the Department of Energy or in the research lab at the university. It is another to get these companies to invest billions, billions that it takes to do these things, whether it is carbon capture and sequestration or any of the renewable energy deployment, oil drilling, you name it. To make those investments, you have got to create a legal and regulatory framework at the Federal level like we have worked to do at the State level to encourage that investment to move this Nation forward.

Senator INHOFE. And it is the predictability. In a minute, I am going to ask you about your offset statement. But I wanted to first of all talk to Governor Ritter for just a moment here.

You know, you talk about expanding the use of natural gas into transportation. I agree with that. In fact, I have the legislation that would overcome some of the barriers that are out there right now. So, I agree with you on that.

However, I am just really kind of wondering why you are here. According to the EIA, the Energy Information Agency, Colorado's oil shale deposits hold an estimated 1 trillion barrels of oil, nearly as much oil as the entire world's proven reserves, and over the long term that could equate to hundreds of billions in economic benefit to Colorado.

Few would disagree that the passage of Waxman-Markey would effectively kill any future oil shale production in Colorado. That is a huge thing for the State of Colorado. I mean, that is the biggest single economic blow that you could have, in my opinion.

Then you have the second one, this came out from the Food and Agricultural Policy Research Institute, and now we are talking

mostly about Eastern Colorado. It released a study stating that a typical 1,900-acre feed grain farm would face \$11,649 in higher energy costs by 2020, and \$30,000 by 2050. Now, if you look at Colorado, you have average sized farms, about 858 acres. If you do your math, that means that the passage of this bill would cost your farmers somewhere about \$5,000 a year by 2020, \$14,000 a year by 2050.

I guess I would have to ask you, with those two major economic factors in Colorado, do you support, are you here supporting Waxman-Markey today?

Mr. RITTER. I am here by invitation, so that is—

Senator INHOFE. Wait a minute. That might clear it up then. So you do not necessarily support it?

Mr. RITTER. Here is what I support. I support a national energy policy that is married to a national climate policy, which gets at these goals that we have for greenhouse gas reductions. I believe that if you do that, there will be some vehicle that may not look exactly like Waxman-Markey, particularly after the Senate finishes its work, but I very much support climate legislation that is joined with a national energy policy to get us to the greenhouse gas emission reduction goals that are set for 2050.

Senator INHOFE. So you support the goals. All right. That is fine.

Governor Hoeven, the thing I was going to bring up is, there is a lot of discussion when you talk about your offset capability there and what you are doing, that is great. We are doing somewhat the same thing, although most of ours is marginal production. But I would suggest to you that the use of hydraulic fracturing is necessary in your State to be able to explore, to retrieve, all of these oil capabilities.

Mr. HOEVEN. It is absolutely vital. You know, you mention some of these new formations. The oil is not connected. You have to go underground, and you are talking 2 miles underground and make a fracture in order to get the oil to flow. That is vitally important—

Senator INHOFE. OK, I wanted to get that into the record because there is some effort to do away from hydraulic fracturing, and it would be devastating.

Thank you very much, Mr. Chairman.

Senator SANDERS. Thank you, Senator.

Let me start off with, well, I have brief questions for all of the Governors.

Governor Corzine, I think many of our colleagues here would be surprised to now that New Jersey is one of the leaders in the country in terms of producing solar energy.

Mr. CORZINE. [Microphone off.] No. 2.

Senator SANDERS. No. 2. How does it happen that your State, which is not in the solar belt, is not part of the Saudi Arabia of solar, how are you doing that?

Mr. CORZINE. [Microphone off.] Well, we have created markets—

Senator SANDERS. Microphone, please.

Mr. CORZINE. We have created stability in our regulatory environment, which Governor Hoeven talked about. We have created market allotment factors that allow for support of solar implemen-

tation by our utility companies. We have created programs that work in the public sector, power purchase agreement that allows private companies to put up the capital to install the equipment that then gets paid with savings over a period of time. We are implementing those similar kinds of programs in residential and business communities, and it has had a very powerful capacity to move in solar. We are implementing the same programs with offshore wind. We have major programs in place there.

Senator SANDERS. Thank you, and congratulations.

Governor Gregoire, in your testimony you mentioned that your State set a goal in 2007 for 25,000 green jobs by 2020, only to discover this year that your State now has 47,000 green jobs. What is your vision for creating the next 100,000 green jobs in the State of Washington?

Ms. GREGOIRE. Well, Senator, it is very clear to us that the incentives that we put in place for alternative energy sources are just beginning. As I mentioned to you, now the fifth largest producer of wind when we were not producing any in 2001. The largest silicon solar manufacturing plant in the United States located is in Washington State, and we are not known for our sunshine. And we have one of the largest generating plants now going in for solar in our State.

That is just the beginning. We are now looking at biomass, we are looking at algae, and we are looking at all of the new technologies. And our community and 4-year universities are involved in the research and development to make that happen. So, we are very pleased at what we have done thus far. We think it is just the beginning, sir.

Senator SANDERS. Thank you.

Governor Hoeven, let me ask you a very simple question. The reason we are here today is not only talking about the creation of jobs, but also dealing with the crisis in global warming. We have had some of the leading scientists in the world sitting, actually, exactly where you are sitting. What they have told us is that if this planet and the countries of the world do not get their act together, the future for our kids, our grandchildren, our great-grandchildren, is going to be very, very dire as the planet warms up.

Do you believe that assessment?

Mr. HOEVEN. Well, the science shows that there is warming. There different opinions to what exactly is the cause of it. But the point I am making is, if you want to get the technology out there to capture and store CO₂, to reduce CO₂ emissions, you need the right kind of Federal policy to do it. Waxman-Markey is not the—

Senator SANDERS. That was not my question. My question was a pretty simple one. Some of the leading scientists in the world tell us that global warming is a huge crisis for this world now and that it will only get worse. Do you agree with that assessment?

Mr. HOEVEN. I agree we need to address it. I think there are different opinions as to the direct cause—

Senator SANDERS. Well, they are all different opinions—

Mr. HOEVEN. But I do believe that we need to address it, and we are doing that, and I described how in my testimony.

Senator SANDERS. Thank you.

Governor Ritter, you mentioned in your testimony that your State was the first to have a voter-approved renewable energy standard, and that was in 2004. More recently, and interestingly, you doubled that standard to 20 percent by 2020. How has this policy effected Colorado's energy future, and do you believe it will produce positive results for Colorado's electric customers?

Mr. RITTER. I think in part the doubling of that helped us lure fairly significant companies to the State. Vestas has been talked about. I take some issue with former [unintelligible] about Vestas, but Vestas, I believe, made their decision ultimately to locate in Colorado 2,500 new jobs over \$700 million in investment because we had doubled our renewable energy standard.

What I should point out is that Xcel Energy, which Senator Klobuchar referred to, they initially had opposed a renewable energy standard when it was on the ballot. When we went to double it for investor-owned utilities to 20 percent by 2020, they supported it because they found out how easy it was to get to the 10 percent goal that was initially set by the voters.

Senator SANDERS. Thank you very much.

Senator BARRASSO.

Senator BARRASSO. Thank you very much, Mr. Chairman. I appreciate this opportunity. Thank you all for being here and testifying.

I wanted to start by just responding a little bit about what Senator Boxer had said at the beginning of this because I had talked about the stimulus package. She said I had labeled it a failure and quoted a Washington Post article, editorial, that said it was squandered.

I think, Senator Boxer, you made my point. You said that less than 10 percent of the money has been given out, which is my criticism of it. This is a failure. This was supposed to be timely, and temporary and targeted. And it has not done those things at all.

I also heard you say, Madam Chairman, that the Democrats wanted to move ahead with climate change legislation and the Republicans just spoke gloom and doom. Yet, I have an editorial that I would like to introduce into the record by Senator Byron Dorgan, Reduce CO₂ Yes, Cap-and-Trade No. He said, I do not support the cap-and-trade plan now being debated in Congress. I think it is the wrong solution. I do not support it.

Then, last Friday, on a television show, we had Governor Schweitzer of Montana. He was asked about cap-and-trade, and the Governor of Montana said cap-and-trade was the wrong approach. Schweitzer heads the Democratic Governors Association. Bill Maher asked him. He said, Governor, but isn't that the Democratic approach? He said, well, it might be some of the Democrats' approach.

Governor Freudenthal from Wyoming has taken the same position. He has sided with me and my colleague, Mike Enzi, to say he does not support what is going on.

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

Senator BARRASSO. So, Governor Hoeven, if we could visit with you. This is what your Senator has said. Can you talk a little bit about that and that there is bi-partisan opposition to the things that are going on here, especially in the Rocky Mountain West?

Mr. HOEVEN. Well, I think there is a real desire to move forward to produce more energy domestically, to deploy the technology that will help us do it in environmentally sound ways. The key is the right kind of Federal policy to do that.

Again, I go back to the need to create certainty so that businesses can invest the billions of dollars it takes to do it. You need to create benchmarks that are reasonable and attainable. Then you need to create the incentives to get there. And you need to be careful not to pick winners and losers, but to develop all of our sources of energy.

Senator BARRASSO. There is something call the Western Climate Initiative. Is your State a member of that group?

Mr. HOEVEN. We are a member of the Western Governors. We are not a member of the Western Climate Initiative, as is the case for about half of the States that are members of the Western Governors' Association. A number of them are observers, a number of them just are not participating. Only about 7 out of 14 or so, I would say roughly half, are actually participants in WCI.

Senator BARRASSO. They are predicting economic stimulus from green investment and green collar jobs. Do you have some observations or comments about their positions and why—

Mr. HOEVEN. If you look at the statistics for the creation of green jobs, North Dakota is doing very well. I think we are growing at a rate of 9 percent or more in green jobs. The point is that we are also growing in traditional energy jobs, and we need them both, and we need them working together. And we need the technology to develop all of them with the environmental stewardship we seek. We should not be penalizing companies that are trying to do that very thing.

Senator BARRASSO. Governor Corzine, if I could. I am also on the Energy Committee, and you spent time on this side. They have approved legislation that expands first eminent domain authority in terms of overriding State objections on proposed transmission lines, which is what, in Wyoming, we need transmission lines to move the wind power to market.

What are your thoughts on States giving this authority to the— of taking this authority from the States?

Mr. CORZINE. I think most States want to have a partnership in that effort, and I do not think the overriding of the ability to look at the local implications of this actually should be overridden. That does not mean that we do not have to work proactively to improve our grid, which is a tremendous problem.

One of the reasons we are so supportive of offshore wind is that we have fewer of those problems, particularly in the highly, densely populated areas that are near our coastline. But it is not something that I think many local governments or State governments want to give up control of.

Senator BARRASSO. When I look at wind, Secretary Salazar recently testified to the Energy Committee that you need about 138,000 acres of land to build a wind farm to replace one coal-fired power plant. That equates to 215 square miles. And if you look at the Jersey coastline on-shore, you have what, 127 miles up and down, you would need to have the entire coast of New Jersey from

the coastline in for over 1.33 miles of wind turbines just to be able to get the energy of one coal-fired power plant.

Mr. CORZINE. To be honest——

Senator BARRASSO. So the math kind of does not work sometimes.

Mr. CORZINE. Senator, the fact is that there is tremendous capacity on offshore wind, and it does not have to be scattered in the way that you are talking about. We have on the blueprints 3,000 megawatts in the next 5 years. That is almost four nuclear power plants. And it is only on four different wind farms.

Senator BARRASSO. Thank you, Governor. Thank you, Mr. Chairman.

Senator SANDERS. Senator Boxer, your name was taken in vain by Senator Barrasso. Would you want to respond?

Senator BARRASSO. With great respect. She is good friend.

Senator BOXER. With great friendship. It was.

Senator SANDERS. And you will respond in friendship, I am sure. [Laughter.]

Senator BOXER. My friend misquoted me. I said on this committee, the Democrats, week after week, are saying let us step up the plate and pass legislation, and the Republicans on this committee are in opposition. And you said that Senator Dorgan does not support cap-and-trade. I can tell you that several Senators on your side do and my Governor is a Republican.

I just wanted to make sure that people understood it, so I will reiterate it. Week after week we hear the same thing in this committee. Democrats on this committee pushing forward with, what I hope is going to some excellent legislation, addressing the issue, which will level the playing field for everybody and be great for the creation of jobs and help our kids avoid pollution. And I thank you for the opportunity to respond to my good friend.

Senator SANDERS. Senator Carper, you did not make an opening statement. Why do you not ask the next question?

Senator CARPER. Thanks so much.

I just want to say to our Governors, as a recovering Governor, welcome. It is great to see each of you. Thank you for joining us here on the anniversary of the birth of Senator Barrasso. It is his birthday today.

The last time I did that, the room erupted into song for George Voinovich. I think we will try to restrain ourselves here today because we only have 5 minutes.

I had the pleasure of talking with Governor Corzine early this year about the potential for maybe New Jersey, Delaware and Maryland working together on a windmill venture. We are planning to deploy, in 2 or 3 years, a windmill farm about 12 miles off the coast of Rehoboth Beach, and New Jersey has far more ambitious goals. But I think we are the first windmill project to actually have a buyer. One of the utilities has already purchased the electricity that will be created.

My hope is that we can find, maybe as you go forward with your other projects, we can find some synergies and economies of scale by doing a venture which would, I think, be almost as close to Cape May as it would be to Delaware.

I understand that with our new Governor, Jack Markell, there have been some discussions with New Jersey and with Maryland, and I would just ask if you could give us any update on where we might be headed in that regard.

Mr. CORZINE. Thank you, Senator, and it is good to see you.

We are very much working in partnership on the arrangement that you are talking about off of the Delaware coast. It is one of the four authorized, permitted projects to move forward, and it includes New Jersey companies as a part of the consortium that is building it, and we intend to compete for actually purchasing some of that power.

I think this is something that we should be utilizing in all of the developments of offshore wind. It is quite a directive, and we have those discussions ongoing with the new administration.

Senator CARPER. Well, that is great. I am glad to hear that.

I think it was Governor Gregoire, but maybe a couple of you used the term smart grid. Would you just talk with us about—I think in some places around the country, I think California among them, the utilities have figured out, working with the public service commissions, the Governors, the legislators, they have figured out how the utilities can make money not by selling more gas and electricity, but actually by selling less and trying to help their customers conserve and consume less.

Could either of you, I will start with you, Governor Gregoire, but could you speak to us a little bit about what you might be doing in your State in that vein, and any lessons maybe for us and the rest of the country? And anything that you are doing with smart grid, that would be appreciated as well.

Ms. GREGOIRE. Well, thank you, Senator. Let me speak to that. The Pacific National Laboratory in Washington State has been a leader in this. We put in place, along the peninsula of Washington State, the consumer ability to decide when and how much they will use by way of electricity.

They can make their decision on their computer, whether they are in Europe or at home, whatever they want to do. They have reduced their own costs as consumers. They have saved money. In their report back to us, they like being in control and using energy when they want to use it at a rate that they want to use it.

So, it has been very successful in Washington State. We are now looking to expand it across the State.

Senator CARPER. All right. Good. Governor Ritter.

Mr. RITTER. We have two parts to this. One is in Boulder, Colorado. Xcel, our major utility, investor-owned utility, is building the first fully integrated smart grid in the world in Boulder and chose that as sort of its pilot place. But it is going to be, over time, 100,000 people who will be subject to their smart grid approach and again, deciding to let consumers decide how to use energy.

As importantly, we just had a company that opened up, and over \$30 million from a venture capital company, and they are building the hardware and the software for smart grid that allows you to be connected into your meter in a wireless fashion. So, we are creating jobs utilizing sort of smart grid technology as a manufacturing opportunity for us in Colorado.

Senator CARPER. Good. I want to ask one more quick question, if I could.

In 1975, we passed the first CAFE legislation. We raised from 15 to 25 miles per gallon the fuel efficiency requirements for cars, trucks and vans. Instead of using less gasoline, we used about 150 percent more in the years to come.

We raised CAFE standards in 2007. The President raised them again this year. If we are not careful, we may end up using more oil and more gas, not less, because we end up driving more cars, driving more miles.

Have you all thought about this? And how what, if anything, we might want to do with respect to reining that in?

Ms. GREGOIRE. Well, one of the things that we passed this past legislative session is incentives for electric cars. I have joined with my colleagues in Oregon and California with the concept that we ought to have an electric highway that goes from the Canadian border all the way to the southern border of California. We are trying to look not just at hybrids, but that potentially is a transitional opportunity for us to go to electric cars, and the consuming public has been very positive toward it.

Senator CARPER. All right.

Mr. RITTER. We have a company actually manufacturing electric trucks in Colorado. So that is a part of it as well. It does not have to be confined just to automobiles alone. The other part of that is we are looking at how we, as a State, can be a leader in compressed natural gas for our own fleet and how we can convert parts of our fleet to compressed natural gas, and likewise, how we can build out an infrastructure that provides compressed natural gas so that heavy vehicles can utilize those as well.

Senator CARPER. Thank you very much. Again, thanks so much for being here and for your leadership.

Senator SANDERS. Senator Udall.

Senator UDALL. Thank you. Governor Gregoire, in your testimony, you cited the bi-partisan coalition of 31 Governors, including Governor Bill Richardson of New Mexico, which calls on Congress to pass comprehensive energy and climate change policy.

In that statement, I think all of you said, "We support legislation that invests in using energy more efficiently and producing more clean energy at home and sets a cap on greenhouse gases to reduce emissions level guided by science to avoid dangerous global warming."

I will note that Governor Schweitzer, I think, also signed that bi-partisan statement because that should be part of the record from what was said earlier.

This statement was also signed by six Republican Governors, Governor Charlie Crist of Florida, Arnold Schwarzenegger of California, Jodi Rell of Connecticut, John Hunstman of Utah, Jim Douglas of Vermont and Donald Carcieri of Rhode Island, and also the Republican Governor of Puerto Rico, Luis Fortuno. Another one of the signers, Governor Mark Parkinson of Kansas, was the head of the Kansas Republican Party as recently as 2006.

So, you have really worked to build this bi-partisan coalition in Governors. My question to you is, one, congratulating and applaud-

ing you, but what advice would you give us to develop bi-partisanship here in the Senate on this very important issue?

[Laughter.]

Ms. GREGOIRE. Well, Senator Udall, I am very proud of the Governors across the country. Not only do we have bi-partisan support on the policy that you just articulated, but the Western Governors' Association, much like the National Association of Western Attorneys General, have also issued a policy just this last month at their gathering in which they said, we urge Congress and the President to act decisively to create a national policy to reduce greenhouse gas emissions.

The third thing, the Western Common Initiative, is signed on by Senator Schweitzer. It is 72 percent of the economy of Canada and about 20 percent of the economy of the United States.

This is not a partisan issue for Governors. This is a bi-partisan issue. This is about a 21st century economy.

Senator UDALL. Thank you, and I think you set a very good example for us.

Governor Ritter, New Mexico and Colorado both have very diverse energy resources. We produce oil, natural gas, coal, uranium, and we also are blessed with renewable resources like solar and wind.

Now, your State is also a large producer of coal. Yet Colorado is taking action to reduce greenhouse emissions by 20 percent by 2020 and achieve a 20 percent renewable electricity standard by the same time.

Could you describe how Western States can achieve job creation and economic development by reducing greenhouse gas emissions, including the role of natural gas, which I think you mentioned in your testimony? You saw a role for natural gas, and I could not agree with you more. I am wondering what your ideas are there.

Mr. RITTER. Well, thank you, Senator. And again, I think Governor Hoeven and I are not very far apart in thinking about how everything has to be involved in a national energy policy that you should not necessarily pick winners and losers.

There are a lot of incentives that are already in play for traditional extractive industries, but also for the renewable industries. The way we have done job creation around this is by creating an ecosystem that starts with the research and development corridor in Colorado. The National Renewable Energy Laboratory is the backbone of that.

But we have had a lot of other private research come in. We have formed a collaboration with our research institutes, and then out of there, out of those research institutions, are coming ideas that actually, if they get a bit of cap x, if they are capitalized, they are doing job creation.

This abounds in solar. That idea was hatched in the CSU laboratory; about \$15 million of Department of Energy money went to approve the concept, and now \$150 million in venture capital money, and it is now 200 jobs in a downturn. And that is just one example. But it is because this ecosystem starts with research and development, a commitment to innovation, and then grows into venture capital money following it because they know they can produce solar more cheaply.

Senator UDALL. Thank you. Thank you very much. There was a chart that was put up about Colorado and your jobs. I would just ask that the Chairman, if you want to submit anything in addition to whatever you submitted today in light of that chart, I would ask that the Chairman allow you to do so.

Senator SANDERS. Without objection.

Senator UDALL. Thank you, Senator.

Governor Hoeven, to ask you one quick question here. You stated that the House bill hits carbon sequestration at coal plants twice; they must buy allowance and pay for sequestration technology. My understanding of the House bill, and tell me what the difference is here, cap-and-trade is an incentive for doing sequestration. So, if you do it you do not need an allowance because the carbon is not emitted. You are taking care of it.

The second part of the House bill devotes \$60 billion, this is the largest amount aside from what is dedicated to consumers, for coal capture and sequestration. Those allowances are given to utilities, and also into research.

So, I do not see how you make this argument that they are hit twice. In fact, there are significant provisions in there to encourage the industry to move to CCS.

Mr. HOEVEN. First, the funding that is in the bill for carbon capture and sequestration is a good thing. There are also some provisions in there that would help in terms of developing transmission. That is a good thing as well.

But overall your problem is that you set these allowances at a level where you are going to force the costs of energy from carbon emitting sources higher, and consumers are going to have to pay that. CBO scored it at \$175 a family. The Heritage Foundation scored it at about \$3,000 per family.

So, in essence, you are going to have that cost to consumers that these companies are going to pay in cap-and-trade, and they are still going to have to invest the billions in order to put in the technology to actually capture and store the CO₂.

Senator UDALL. Well, the bill also has a major amount of the allowances going back to consumers. I think we are doing everything we can to protect them, starting with the lowest income consumers, and then working up. That is a significant, significant part of the bill that I think has not been mentioned.

Mr. Chairman.

Senator SANDERS. Thank you very much.

Senator Merkley.

Senator MERKLEY. Thank you very much, Mr. Chair.

A couple of you mentioned electric cars. My colleagues across the aisle have been talking about the electrification of passenger transportation. It has been estimated that if we have regenerative braking and cars can go the first 30 miles, if you will, on electricity, that we would reduce 80 percent of our carbon dioxide production from passenger transportation.

What are other aspects that you are considering in the States to promote the transformation to an electric passenger car world? And what other ideas should we be considering here in our Nation's capital?

Mr. RITTER. Sir, one of the things about electric cars is their tie into a smart grid. Actually, an electric car that is fully charged can load back onto the grid and get compensated for that, and pull off at an off-peak time and wind up being a net savings. So, this idea to have a smart grid and electric cars at the same time has really interwoven in a way that makes economic sense to the family.

Ms. GREGOIRE. The one that I would suggest, Senator, and the thing that we are grappling with with the electricity highway, north to south between our three States, is how does the consumer to travel a long distance without regeneration? So, we are looking at using our public facilities where they can either stay and regenerate, or they can transfer their battery and get a new battery in and move along so that it is very convenient for the consumer.

We really need help and incentives in research and technology on how to make this happen efficiently and effectively. We would ask for your help in that regard.

Senator MERKLEY. Thank you. Governor, you wanted to jump in as well.

Mr. HOEVEN. In North Dakota, we have a company called Global Electric Motors owned by Chrysler. They make electric vehicles for Chrysler. We also are doing development work in terms of hydrogen and hydrogen-powered vehicles. In both cases, I go back to both creating a certainty and then also the right kind of incentives.

For example, something as simple as making sure those vehicles are street legal. In some places, you cannot drive them. So, certainty so that consumers can buy these vehicles and know that they are going to be able to use them, combined with incentives, both for research and development, but then also for consumers that buy the vehicles in the new technology.

Senator MERKLEY. Thank you. Those are all great points, and I appreciate the work the States are doing.

Governor Ritter, you noted that you support major climate legislation but not necessarily in the exact format from Waxman-Markey. Are there specific suggestions that you would have for how we might improve upon Waxman-Markey?

Mr. RITTER. Well, again, as a State with natural gas, I think natural gas and a different focus on that than was in the Waxman-Markey bill, is important to consider. It is a much cleaner burning hydrocarbon, whether you talk about it in terms of turbines used to generate electricity or compressed natural gas used to motorize vehicles. So, that is certainly one thing. I will admit a self-interest as the Governor of a State with abundant natural gas and such a volatile market presently.

Other than that, I think that the most important thing is that it be driven around climate goals and that the good work of the Senate be focused on that, and listen to the people who are the critics of Waxman-Markey and ask the question, what is the way to improve upon it, so that there are not such significant winners and losers, perhaps, except around climate reduction.

Senator MERKLEY. Thank you. And our other Governors, Governor Gregoire and Governor Hoeven, is there anything you would like to add on that score?

Ms. GREGOIRE. I would only ask that you consider whether the ability for efficiency in the standards is beyond what it should be,

and we should solidly have a national set of standards for renewables and stick to it. I agree with the predictability and sustainability concept. But if we say efficiency can eat into that dramatically, I do not need that we are going to incent the kind of capital investment that we need in renewable energy.

Senator MERKLEY. So, perhaps separating the two standards rather than having them exchange for each other. OK.

Governor Ritter, in your written testimony, I am not sure if you mentioned this is your oral testimony, but Boulder County has a program of low interest loans to help people pay for energy investments, energy improvements to their homes up front, then pay those loans off on their property tax bill. We just passed a similar bill in Oregon. Do you want to comment on how that is working and the theory behind it?

Mr. RITTER. It was passed by the voters, and again, I think, Senator, in all fairness I think it is just too early to say how it is working because it has just been passed. It is modeled after something that a local community in California had done as well. We are considering it, whether that is something to do at the State level. But I cannot really say much about it because our tax assessments are done every other year, so we just have to wait to see how many people wind up participating in it.

Senator MERKLEY. Great. Well, we will look forward to those results, and hopefully we will have the Oregon program up and running as an example as well.

I think my time has actually expired. Thank you all very much. It is tremendous to see what you are doing at the State level.

Senator SANDERS. Senator Klobuchar.

Senator KLOBUCHAR. Thank you very much.

Governor Ritter, you were talking about your renewable portfolio standard. I think it is interesting because, as you said, you are a State that has oil, natural gas, but you had some popular bi-partisan support for putting a renewable electricity standard in place. Why do you think that is as we look at how we can gain bi-partisan support for an energy policy?

Mr. RITTER. Thanks, Senator. I really do think it is because the voters led the way initially. There was no leadership in our State that really, I think, supported a renewable energy standard, and we put it on the ballot and the people in the State, I think people in the West have a real interesting, I think, tie to the land, and I believe view our time here really as stewards.

I am not trying to be glib about that. I really believe we have this relationship to the land that may be different than other places. And it is why you have seen the Western Climate Initiative and the Western Governors be able to get together on this.

We have some evidence of things that we believe are a product of global warming. The pine beetle kill in Colorado is very significant. I think that helps people think about climate and the need to address it. The renewable energy standard was just one way of doing that in 2004.

Once the utility, the investor-owned utility, saw that they could make it, and make it far ahead of the goal, then they were on board for us to double the renewable energy standard. That has been our secret, seeing that there are these benefits that are about

the economy, about energy policy and the environment, and they are all intermeshed.

Senator KLOBUCHAR. I also think, it seems, our State has a similar story. People saw that they could have some skin in the game, that they could make some money off this, that they could get some jobs off this. And I think part of why there is more support in our State was the biofuels.

And while that may not be related to the electricity standard, they could just see that part of this home grown energy, this new energy economy, that they could be a piece of this, that unlike the information technology revolution, which gave the Silicon Valley a bunch of jobs, there actually could be jobs, Governor Hoeven, in the Red River Valley.

So, I guess that is my next question. One of the things we are going to be looking at is biofuels. I think we will make a transition to cellulosic. I do not think we should be pulling the rug out from under our biofuels, but one of the things that we have been looking at is increasing the blend standard for biofuels.

Governor Hoeven, as a State that has both biofuels and oil, do you want to talk about what you think of that idea?

Mr. HOEVEN. You should do it.

Senator KLOBUCHAR. Thank you, with that North Dakota directness. Governor Ritter, any comment on that? I know Senator Salazar was working on that before he left, and your two Senators have been working on that.

Mr. RITTER. I, likewise, would support that. We also have a plant that is just opening up on the Southern Ute Reservation that turns algae to biofuel. We have a variety of different corn ethanol plants in the State. There is great research happening about how to transition to different kinds of things that are not food supply based, like corn.

But I think the most recent thing happening, and the biggest thing that may be happening in Colorado, is, in fact, that algae research from Colorado State University is being transferred to commercial technology.

Senator KLOBUCHAR. Governor Gregoire, along these lines of getting people behind a new energy policy and feeling that they can be a piece of this, too, would be forestry and biomass from logging. I know, like Minnesota, you have a major forestry industry in Washington State.

Do you want to talk about the role that the forestry industry can have in this?

Ms. GREGOIRE. Well, they are at the table. They are supportive of the initiatives of that we have put in place for cap-and-trade because they know they are part of the solution. Agriculture is also at the table. They see themselves as part of the solution with new kinds of biofuels. Boeing has had its first international flight testing biofuels. It can transform the entire aerospace industry.

So, our public is very supportive, and now our business community has stepped up to the challenge of the public. And it has been welcome, and it is a job creator for us.

Senator KLOBUCHAR. Very good. And then last, I talked in my opening statement about China. I recently visited there with Senator McCain and Senator Graham and the work that is going there

and some of these other countries. In Vietnam, the No. 1 issue the Prime Minister there raised was their concerns on climate change and the effect on the world.

Do you want to talk, being in Washington State and having many trade deals with Asia and things like that, your concerns about, I raise this issue, that we should be selling to them instead of them selling to us, on the technology issue?

Ms. GREGOIRE. My best is the story in which President Hu Jianto and the Vice President of China came to visit Washington State in 2007. In a conversation that I had with them, I asked the question what is the greatest challenge to China? The answer back was energy and the environment.

And the next conversation was about global climate change and how we could work together, and that we had new initiatives in biofuels, and they indicated to me that whatever we could produce, they would import it all.

Therein lies what I began to understand is a future 21st century economy where we can be exporting technology, exporting biofuels. It is a new economy for Washington State. That is what is driving us as one of the most trade-dependent States in the country.

Senator KLOBUCHAR. Thank you very much.

Senator SANDERS. Let me conclude the Governors' section of the hearing by thanking Governor Ritter, Governor Gregoire, Governor Hoeven and Governor Corzine, not only for what you are doing back home, but for being here today.

You may or may not know that this hearing was attended by almost every Senator, which is a bit unusual for hearings, and it indicates, I think to all of us, the important work that you are doing, what we can learn from you, and how we have got to go forward together on this important issue.

So, I thank you very much. Now, it is time for the Mayors.

OK. We are delighted to have four wonderful Mayors with us. As a former Mayor, I very much appreciate the hard work that you do and how you have to deal with day-to-day problems. I think the last 8 or so years we have seen great innovation coming from city halls all over this country.

I will say to the Mayors is that we think there may be a vote in 5 or 10 minutes. Senator Merkley and I will rotate the gavel, and I will be back as soon as I can.

But why do we not begin with Mayor Bob Kiss of Burlington, Vermont, which is the city of which I live and in which I had the honor of being Mayor some years ago.

Mayor Kiss.

**STATEMENT OF HON. ROBERT KISS, MAYOR,
BURLINGTON, VERMONT**

Mr. KISS. Thank you, Senators, Chair of the subcommittee and other members of the committee, for having us here today. I have some written testimony that already has been submitted, and I will refer to it in a minute.

One thing that I wanted to comment on is that in Vermont right now, Bill McKibben is in residence at Middlebury College. He is an environmental activist very concerned about climate change and greenhouse gases. I think the message he has been giving to the

people of Vermont really says that if we do not do something in the next 8 years, there is going to be irrevocable changes in our climate 30 years out that will be unacceptable.

I think some of the people who left here, who were escorted out earlier, younger people, really are taking that to heart. They see it not only affecting their own future seriously, but their children's futures. They are not convinced, I do not think, that we will have the ability or the determination to challenge the issue that confronts us today. And I think that really is the backdrop to our discussion.

In Burlington, what I assumed, when I became Mayor, I think, was a commitment to build a sustainable city, and sustainability has not been a lot of the conversation that has been here today, either. What we have to do here is something that lets us live into the future successfully. I think we have to have courage in order to be able to do that.

Clearly, greenhouse gas emissions and climate changes, in my mind, are real, not a figment of someone's imagination, and we need to address it.

From Burlington's perspective, I think we have been successful in a lot of ways because we had begun to attack this issue, really, about 30 years ago. I am going to just read two paragraphs from my information that was submitted earlier to talk about what we have done over the past 30 years.

In 1990, Burlington voters approved an \$11 million bond to fund energy efficiency programs for 2002. Since 2003, Burlington Electric Department customers pay a small monthly charge that supports energy efficiency programs. The result of this investment is compelling.

Annual electricity consumption in 2008 was about 1 percent greater than in 1989. Even with substantial local economic growth over the last 19 years, Burlington has met demand with about the same amount of electricity used in 1989.

And energy efficiency investments save Burlington consumers over \$8.9 million in retail electric costs annually, savings that go back into the local economy. Every year, these savings also include preventing the release of carbon dioxide measured at 64,700 tons in 2008.

These energy efficiency efforts go hand-in-hand with a commitment to renewable electricity generation. Currently, 67 percent of Burlington's electricity is generated through renewable energy sources. A substantial portion of Burlington's renewable energy is supplied by the McNeil Generating Station, a wood burning plant that began operation in 1984.

At full load, McNeil can generate 50 megawatts of electricity. Much of the wood that fires McNeil comes from Vermont and regional sources, keeping the economic activity created by wood demand local.

Last year, BED installed a nitrous oxide reduction unit at McNeil which allows it to sell renewable energy credits. The sale of these credits is expected to pay the costs of installation of the nitrous oxide reduction unit within about 3 years.

Building a green economy is an integral part of Burlington's development plan. That is what we are about. But I think the goal

here is to build a public infrastructure that is green, so that all jobs become greener. At the same time, jobs in the new economy are green collar jobs that are responding to our capacity to create a public infrastructure that is green.

I think that has got to be our goal. Ultimately, it cannot be just about developing green jobs. It has got to be about creating a green infrastructure in society that does this routinely and is an answer to the question of what our lives will look like in 30 years.

So, Senator Sanders, there are two other elements that come from this, and maybe I will talk about them later. But, we want to create, and we have authorizing legislation in Vermont now, clean energy assessment districts. This is the same idea that was talked about in terms of Boulder. Burlington is looking at that process now, and as I said, we have State legislation that would allow us to do it.

Second, we have heat that is wasted at McNeil that we know can be used to support district energy, in other words, using that waste heat to heat as many as 8,000 homes in the city of Burlington. That is the second project we are looking at.

Thank you.

[The prepared statement of Mr. Kiss follows:]

Office of
the Mayor
Burlington,
Vermont



Bob Kiss
Mayor
Room 34, City Hall
Burlington, VT 05401
Tel: (802) 865-7272
Fax: (802) 865-7270
TDD: (802) 865-7142

Clean Energy Jobs, Climate-related Policies and Economic Growth

Written Testimony of
The Honorable Robert Kiss
Mayor of Burlington, VT

Before the
Committee on Environment and Public Works and
Subcommittee on Green Jobs and the New Economy
United States Senate

July 21, 2009

Chairwoman Boxer, Ranking Committee Member Inhofe, Subcommittee Chairman Sanders, Ranking Subcommittee Member Bond, and Members of the Committee –

Thank you for the opportunity to testify on the issue of clean energy jobs, climate-related policies and economic growth. This issue is critical to our economic future as we wrestle with the twin challenges of recession and the effects of climate change. Before I go further, I would like to acknowledge the work and leadership of Vermont's Congressional delegation – Senator Leahy, Senator Sanders, and Congressman Welch – on economic development and environmental issues. I appreciate that Senator Sanders was one of the lead sponsors of the Energy Efficiency and Conservation Block Grant program – which is a significant step forward on protecting the environment and reducing greenhouse gas emissions. It is clear that the federal government must be a partner with states and cities in any effort to deal with these problems – and in that respect I hope the EECBG program will be funded in the future as a new and essential resource.

1. Burlington, Vermont's experience with the green economy.

As the Mayor of Burlington, Vermont, and a Burlington resident for more than 35 years, I see a strong and successful connection between climate-related policies, economic growth, and job creation. Burlington is ahead of the curve in building a public infrastructure that encourages the creation, retention and growth of green collar jobs and supports business growth, in general, within a green framework.

According to the City's latest economic report, *Jobs & People IV, 2009*, from 1990 - 2006, the Professional, Scientific, and Technical Services sectors, those with the most green jobs, showed a 55% positive growth trend in the Burlington area. This sector represents 11% of the total private sector earnings in Chittenden County. In 2004 indicators from the Environmental Consulting Services sector showed that it is poised for exporting these services outside of the Burlington area, bringing needed new dollars into the local economy.

Specific Examples of Green Businesses

I would like to highlight some of the green businesses that have started and grown in Burlington, both large and small:

- The Vermont Energy Investment Corporation was co-founded in 1986 with a mission to reduce the costs, both monetary and environmental, of energy use. VEIC works nationally and internationally with utilities, regulatory agencies, and energy advocacy groups to design programs that reduce energy use through energy efficiency and renewable energy. VEIC is identified as the state energy efficiency utility. It has approximately 170 employees, with 30 positions added since January 1, 2009. By the end of the year, it is anticipated that a total of 35 positions will be filled for 2009. Additional staff are proposed for 2010.
- For 20 years Seventh Generation in Burlington has sold and promoted environmentally-responsible home products for cleaning and other uses. Seventh Generation has been the leading company nationally for “green cleaning” products. The company has grown from a staff of 65 at the beginning of 2008 to a current level of 113 employees.
- Draker Laboratories provides high performance hardware monitoring and software-as-a-service data management systems for commercial-scale renewable energy systems including: solar photovoltaics (PV), wind, solar thermal and hybrid systems. Draker currently employs 8 people full time, has 2 part time interns and one part time contractor. In the next year Draker anticipates hiring 2-5 new people, and as many as 10 depending on the economy and credit market.
- ReCycle North is a non-profit organization located in Burlington with a 3-part mission to promote reuse, offer job-skills training, and provide anti-poverty assistance. Reclaiming materials that would otherwise end up in a landfill allows ReCycle North to teach job skills to disadvantaged individuals, create jobs, and promote economic development. Recycle North currently has 37 full-time positions and 3 part-time positions, and statewide employs 47 people.
- Spring Hill Solutions is a comprehensive carbon management, clean energy and business sustainability consulting firm located in Burlington. Currently, the staff consists of 2 full time and 3 part time employees. This company sees great potential for growth which could double or triple its staffing in the next two years.

The reasons that businesses locate and grow in certain communities are complex. Personal geographic and lifestyle preferences, strong public school and higher education

systems, access to quality healthcare, good public infrastructure, among other factors, are all in the mix. Burlington has many of these attributes – comprehensive hospital care, public transportation, a state-of-the-art municipal broadband internet, phone, and cable service, four area colleges and a public university offering a broad continuum of educational opportunities, a good public school system (including a magnet elementary school focused on sustainability), and a municipal commitment to basic public infrastructure. Even as the largest city in Vermont, Burlington is small by national standards with a population of about 39,000. We do not benefit from the economies of scale that larger cities do and we face many of the same challenges.

As of 2006 there are approximately 32,500 jobs in the City with about 85 percent of residents working in Chittenden County, and just under 40 percent working in Burlington. We are not by any means a wealthy community – with a median income of \$33,070 and poverty rate of 20 percent according to the last U.S. Census figures. Like many cities we face an aging water, wastewater, and street infrastructure, with a dependence on the property tax system or rate increases to fund improvements.

Energy Efficiency Programs and Renewable Power Generation

Burlington's early adoption of an energy efficiency program has yielded substantial benefits to the community in terms of reduced energy use and cost, economic development and job creation, and greenhouse gas reduction. In 1990 Burlington voters approved an \$11 million bond to fund energy efficiency programs through 2002 by its municipal electric department, Burlington Electric Department (BED). Since 2003, BED customers (like all other Vermont electric customers) pay a small monthly charge that supports efficiency programs. When these funding sources are included with direct investment from customers, about \$30 million has been invested in energy efficiency efforts sponsored by BED over the last 19 years.

The overall results are compelling. Annual electricity consumption in 2008 was about 1% greater than in 1989. Even with substantial local economic growth over the last 19 years, Burlington has met demand with about the same amount of electricity used in 1989. Energy efficiency investments save Burlington consumers over \$8.9 million of retail electric costs annually – savings that go back into the local economy. Energy efficiency expenditures are made almost entirely locally, usually in the form of professional services, skilled trade employment, and equipment purchases.

During 2008, total BED program spending was \$1,499,592 and participating customers spent an additional \$1,127,075 to fund energy efficiency investments in their facilities. Due to energy savings generated by energy efficiency programs in 2008, the release of about 64,700 tons of carbon dioxide was prevented.

These energy efficiency efforts have been matched by a commitment to renewable electricity generation. Currently 67% of Burlington's electricity is generated through renewable energy sources. A substantial portion of Burlington's renewable energy is supplied by the McNeil Generating Station, a wood-burning plant that began operating in 1981. Construction of the McNeil plant was financed through a bond passed by Burlington voters in 1978. Seventy percent of the wood burned by McNeil comes from low quality wood and harvest residue. The remainder of McNeil's wood requirements are met through residues such as sawdust, chips and bark from local sawmills and by using processed urban wood waste. At full load, McNeil can generate 50 megawatts of electricity.

Much of the wood comes from Vermont and regional sources – keeping the economic activity created by wood demand local. Last year, with approval of Burlington voters, BED installed a nitrous oxide reduction unit at McNeil which has allowed it to sell renewable energy credits. The sale of these credits is expected to exceed the costs of installation of the nitrous oxide reduction unit within about 3 years.

Urban Agriculture

Burlington has also been the site of a successful urban agriculture effort which has spurred job creation, preserved open space, and greatly improved access to local, healthy produce. The "Intervale" is a large swath of wetland and farmland in the middle of Burlington, 350 acres of which have been managed for the last 20 years by a local non-profit, the Intervale Center. The Intervale supports 12 small farms on site, employing 56 total workers and producing more than one million pounds of organic produce per year to the local market. The Intervale Center has an "incubator farm" program which supports agricultural development and works with farms across the state.

City and regional planning in the 1950s and 60s identified the Intervale as a site for limited access highways; in subsequent years the area became a dumping ground for old

cars. With the commitment of several partners it has been transformed into a green economic engine and source of local food and recreation. The City helped solidify the Intervale Center's ability to expand by selling it 179 acres of land in the Intervale which it had previously leased.

2. Green Economic Development and Climate Policy.

The existence of an expanding green economy in Burlington is no accident. The investments made by the City and Burlington voters during the 1980s and 90s in the McNeil plant and a vigorous energy efficiency program formed vital infrastructure support for clean energy efforts.

Green Policy Development

Sustainable energy policy has been an integral part of Burlington's planning over the last 10 years. In 2000 Burlington was one of the first communities in the country to develop and approve a comprehensive Climate Action Plan. The City is currently completing a process of rewriting the Plan, involving residents and other stakeholders, and setting GHG reduction goals of 20 percent by 2020 and 80 percent by 2050.

In 1999, Burlington began to develop a unified community vision based around "the four E's of sustainability": environment, education, social equity and economics. The resulting Legacy Action Plan was passed unanimously by the City Council in 2000 and since then has been used as a template and guide for much of the City's progress.

In the late 1970s and the early 1980s – when Senator Sanders was Mayor – Burlington intensified a focus on developing its downtown business district and waterfront – creating an urban core where people can live, work, and play. This effort has continued to progress through subsequent years and City administrations. Currently Burlington has a downtown business district which is a significant source of economic activity for the City and region. A very successful outdoor pedestrian mall draws tourists as well as residents into the downtown.

Sustainable energy policy is a key element of the Burlington's 2006 Municipal Development Plan. The Plan recognizes the importance of:

“...public education in resource conservation, publicly-owned alternatively-fueled electric generation, biomass-fueled district energy technologies, energy-efficient green building technologies, and climate-friendly transportation solutions, which includes support for alternative fueled vehicles.”

The municipal development plan also establishes policies for the development of mixed-used neighborhoods, with the goal of achieving a thriving live/work environment. At the same time these policies allow a reduction in the need for unnecessary vehicle trips and parking spaces.

Zoning Ordinances

Burlington’s zoning ordinance includes height bonuses for the construction or rehabilitation of green buildings that achieve a minimum Silver certification under the US Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) rating system.

The ordinance also allows the City to grant waivers from the parking requirements if the applicant can demonstrate that the proposed development can be adequately served by a more efficient approach to reducing dependence on the single-occupancy vehicle (SOV). Exemptions are also given for carpool, vanpool, car-share and alternative fuel vehicle parking, again encouraging a reduction of SOVs.

Site plan and architectural design standards in the ordinance also promote and enable green job creation by supporting the use of renewable energy resources, encouraging the reduction of energy utilization, and increasing the use of durable and environmentally friendly building materials.

Business Assistance Program

Through its BE3 Project, the City’s Community and Economic Development Office (CEDO) offers over 125 restaurants and convenience stores a variety of free audits and services with project partner organizations that can help these business owners save money in an environmentally sustainable way. By helping this business sector save money through reductions in energy and water use, diverting organic waste from landfills

to compost projects, waste fry oil to biodiesel production, and switching to more environmentally benign consumables, including ‘greener’ paper products and cleaners, this program makes businesses more efficient while supporting job creation in the green economy.

3. Future Policies and Projects.

I want to highlight two pending projects which will allow Burlington to move forward in its sustainable energy policy and I believe are valuable at the federal, state, and local level.

Clean Energy Assessment District

Burlington is actively working towards establishing a Clean Energy Assessment District which will allow homeowners to fund energy efficiency and renewable energy projects with 15 or 20 year loans, where re-payment is connected to the property, not the owner. This will significantly strengthen the incentive for homeowners to make energy improvements, which give a return on investment over a longer period of time than the typical 5 or 7-year home improvement loan. And, if the home is sold, both the benefit and the obligation to repay go with the property. This is modeled after a similar program initiated in Berkeley, California, focused on solar projects. Recent Vermont legislation allows any town or city in Vermont to establish these assessment districts.

This effort has great potential to grow jobs in both the renewable energy and energy efficiency industries.

District Energy

The Burlington District Energy Service (BURDES) is a proposal to capture waste thermal energy from the McNeil wood-fired plant to provide heating, hot water, and potentially cooling to residences, institutions and businesses. When fully-built, BURDES will make Burlington more energy self-sufficient – mitigating the impact of escalating fuel costs, increasing the efficiency of McNeil, and reducing the City’s carbon footprint. Burlington is in the process of developing an implementation plan for this project.

Federal Policy and Funding

Cities face serious and extensive challenges. They must have the support of both the federal and state government, or we may all fail together to meet these challenges. As noted earlier, the EECBG program is a very important step toward giving local government the resources to adequately address climate change. The Climate Change bill passed by the House last month is also a significant step towards transitioning to a clean energy economy, including promotion of green jobs. The House version does not provide for direct funding for local governments. As a Mayor, I know that cities are well-positioned to distribute funds quickly and efficiently, focusing on local needs and priorities. The Senate version of the bill should provide for direct funding of municipalities, including full funding of the EECBG program, to ensure continued and sustained funding for local energy efficiency and conservation efforts. And, I hope the Senate provides EECBG funding for small cities in a fair and equitable manner.

Federal initiatives such as EECBG or the Climate Change bill now under consideration in the Senate directly address climate change and the green economy. Federal policy can also have an indirect yet significant impact on green job development. Burlington is fortunate to have been designated one of forty Renewal Communities nationwide, and one of 12 rural Renewal Communities. This HUD-designation comes with a number of important Federal tax incentives for businesses and commercial property owners located within the designated area.

RC designation has been integral to growing our green economy. Through one of the RC tax incentives, the commercial revitalization deduction, a local developer was able to construct an 118,000 square foot, LEED certified building that created hundreds of construction jobs and now houses one of the largest green businesses in the city, Seventh Generation. That tax incentive allowed the developer to build a desirable space that attracted and retained a green business providing livable wage jobs to Burlington area residents. Another tax incentive, the wage credit, is used by many businesses to help retain employees, to reinvest savings in their businesses, and often to undertake energy efficiency improvements. The Renewal Community program is slated to sunset at the end of 2009. This successful program should be extended to 2020 as an important tool in growing a green economy.

4. Conclusion.

For Burlington, sustainability means that we will take steps to remain healthy over the long term, develop a strong sense of place and a shared vision for our future, build on our assets, value healthy ecosystems and use resources efficiently, seek to retain and enhance locally based economies, develop productive partnerships between community stakeholders, and thrive on engaging, inclusive, and constructive public debate.

Burlington has made a commitment to sustainable economic development with tangible results to show for it. Affordable housing, livable wages, a vibrant downtown, an accessible waterfront, energy conservation and renewable resources, small business development, public telecommunications, arts and culture, food security, civic engagement and long-term planning are elements in a list to measure success for Burlington as a sustainable community.

Thank you again for the opportunity to address these issues and share some of the successes and challenges from Burlington's experience with green economic development. I reiterate that cities will continue to need the federal government as a strong partner if our efforts to address climate change and the economy are to succeed. I look forward to any questions Committee members may have.

Office of
the Mayor
Burlington,
Vermont



Bob Kiss
Mayor
Room 34, City Hall
Burlington, VT 05401
Tel: (802) 865-7272
Fax: (802) 865-7270
TDD: (802) 865-7142

August 26, 2009

Senator Barbara Boxer, Chair
Senator James Inhofe, Ranking Committee Member
Senate Committee on Environment and Public Works Committee
Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Boxer and Senator Inhofe,

Thank you for the opportunity to provide testimony to the Environment and Public Works Committee, and Subcommittee on Green Jobs and the New Economy, on July 21. This letter is in response to a subsequent question from Senator Inhofe:

1. In 2007, over 80% of Vermont's electricity generation was provided by the Vermont Yankee nuclear power plant without emitting air pollutants or carbon dioxide. However, its operating license will expire in 2012. Do you support extending Vermont Yankee's license for 20 years? If not, how do you propose replacing 80% of Vermont's electricity needs by 2012 and the 650 green jobs and 100 million per year in economic benefit created at Vermont Yankee?

I do not support extending Vermont Yankee's license. Vermont consumes power from several sources – according to Vermont Yankee's website, about 53 percent of Vermont's electric supply is from out-of-state sources and about 47 percent from in-state sources, with Vermont Yankee providing about 34 percent of power consumed in Vermont (see www.safeandcleanreliable.com/pdf/Vermont_Elec_Supply.pdf). Other sources include hydro-electric (about 39 percent), gas, oil and coal (about 16 percent), wood, wind and farm methane (about 4.5 percent), and demand-side management (about 6.5 percent).

In Burlington and Vermont, sustainable energy policy has been driven in the first instance by support for energy efficiency improvements. As outlined in my written testimony submitted to the Committee, annual electricity consumption in Burlington in 2008 was about 1 percent greater than in 1989, even while there was substantial residential and commercial development in the city during this time period – accomplished through a strong energy efficiency program coordinated through the Burlington Electric Department. It seems clear that energy efficiency improvements and demand-side management should be the foundation of a "green" energy policy.

Vermont Yankee does not produce environmentally-friendly power nor is it a sustainable basis of jobs and economic benefit. Constructing, running, and potentially dismantling a nuclear power plant – which because of inherent safety risks cannot be redeveloped – requires a significant level of energy consumption which translates into greenhouse gas emissions. In addition, Vermont Yankee has produced an estimated 100 million pounds of nuclear waste since it opened, with all of this waste stored on site near the Connecticut River. We all know there is no safe solution for the storage of the leftover by-products of nuclear power. According to the Vermont Public Interest Research Group (VPIRG), there have been several incidents reflecting compromised safety at the plant – such as lost radioactive fuel rods, a transformer fire that shut the plant down, cracks in a steam dryer, collapsed cooling towers, and the discovery of radiation levels above the legal limit at the fence line. A serious accident at Vermont Yankee would be devastating to Vermont's environment and its economy.

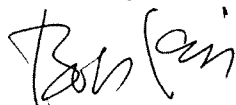
Nuclear power does not come without a substantial cost to the American taxpayer, with billions of dollars in subsidies over the years from the U.S. Government to make nuclear power plants economically feasible.

In its 2006 report titled *A Decade of Change* (www.vpirg.org/documents/decadeofchange.pdf), VPIRG suggests several viable ways for Vermont to meet its power needs without Vermont Yankee and primarily through renewable energy sources. This plan starts with substantial investment in energy efficiency measures. A report prepared for the Vermont Department of Public Service determined that Vermont could meet 19 percent of its 2016 electricity demand through cost-effective energy efficiency measures. The VPIRG report outlines an energy portfolio for Vermont that by 2015 relies on several renewable sources – biomass (primarily wood), Vermont-based and regional hydro-electric, wind, farm-based methane, and small customer-sited renewable energy generation (such as wind, solar, and combined heat projects) – and estimates that Vermont would require purchasing about 20 percent of its energy from the New England energy market.

The support and development of these energy sources in Vermont will reduce greenhouse gas emissions, be safer, and create good jobs in diverse areas across the state. I believe that we can end our reliance on energy from Vermont Yankee and we will be better for it. We need to pursue the goals of energy sustainability and a reduction of greenhouse gas emissions with new urgency. We need to make a difference now.

Thank you for the opportunity to address this issue.

With best regards,



Bob Kiss, Mayor

Senator SANDERS. I am going to introduce Mayor Bill Euille of Alexandria, Virginia. We thank you very much for being here.

I am going to run down and vote. Senator Merkley will take the gavel and then I will be up in a few minutes.

Mayor Euille.

**STATEMENT OF HON. WILLIAM D. EUILLE, MAYOR,
ALEXANDRIA, VIRGINIA**

Mr. EUILLE. Thank you, sir.

Good afternoon, Mr. Chairman and members of the committee. My name is William Euille, and I am the Mayor of the city of Alexandria, Virginia. Thank you for the opportunity to testify about three critical environmental challenges, climate change, clean energy and the new green economy which, indeed, requires a joint collaborative partnership between cities, States and the Federal Government.

As Mayor and lifelong resident of Alexandria, I am concerned about the potential impacts climate change may have on a coastal city like Alexandria, our 141,000-plus residents and the surrounding region.

In February 2005, I, as a Mayor, endorsed and signed the 2005 YES Conference of Mayors Climate Protection Agreement along with 278 other Mayors from 43 States, representing a total population of over 48 million. The sole purpose there was for the conference to meet or exceed the Kyoto Protocol greenhouse gas reduction targets through the use of local land use planning, urban forest restoration, public outreach campaigns and other greenhouse gas reduction strategies.

In 2007, Alexandria began a strategic planning process known as the Eco-City Alexandria initiative, to guide the city over the next 30 years toward becoming a true eco-city, in other words, sustainability, a place where people can live healthier and economically productive lives while reducing their environmental impact. City officials, city residents and staff spent countless hours exploring best practices from communities across the country to develop an environmental plan for the city.

In 2008, the City Council adopted the Eco-City Charter, which outlines the vision and guiding principles for Alexandria to become an eco-city. One year later, Council adopted Environmental Action Plan 2030 as a road map for city leaders, staff and residents to implement the sustainability, visions and principles set forth in the Eco-City Charter. Only a handful of communities have developed such a comprehensive action plan that includes climate change protection as a critical component.

I would like to tell you about some of the things that we are doing to become an eco-city. In Alexandria, we recognize how the quantity and sources of energy used by local government, businesses and residents affect our environment and quality of life. And we have committed to managing our energy supply and usage in a sustainability manner.

A prime example of this commitment is the city's partnership with an energy-from-waste facility for more than 25 years. This facility generates enough clean, renewable energy to supply power to approximately 20,000 homes via the combustion of municipal solid

waste. Diversion of our municipal solid waste from a landfill to the energy waste facility reduces the city's carbon emissions by approximately 160,000 metric tons annually.

The city also supports energy efficiency and conservation technologies and is working to create a green jobs training program to train residents to perform energy audits, weatherize houses and other buildings, install solar, wind, geothermal devices and other clean and renewable energy technology.

To support the implementation of the Eco-City Environmental Action Plan, Alexandria plans to use some of its energy efficiency in Conservation Block Grant Funding for conversion of the city's street lights and traffic signals to energy efficient LED lamps, expansion of the city's green fleet program, support of green jobs training for weatherization technicians and energy auditors, and establishment of a green revolving loan program for property owners.

Implementation of these programs and related projects will result in the creation of approximately 15,000 jobs and reduce carbon emissions by an estimated 19,000 metric tons.

Among Alexandria's other green projects and achievements are the new T.C. Williams High School building, which received the LEED Gold Certification, the award winning design of a green building in a former brown field that will house a fire station, retail and 64 units of public housing, adoption of a new city policy that will seek to have all new buildings achieve LEED Silver Certification or better, completion of the city's greenhouse gas emissions inventory, and installation of solar panels to provide lighting in bus shelters and vegetative filter boxes on neighborhood streets to treat and clean roadway runoff.

I have spoken to you today about some of the steps Alexandria has taken to become an eco-city, and about some green amenities that make Alexandria a great place to live. However, to fully implement the Eco-City Alexandria initiative goals, we need your support.

America's cities and towns need your support. Such support should include the annual funding of the Energy Efficiency Block Grant Program, increased funding for transit, pedestrian and bicycle projects, and revisions to Federal programs to ensure that they will support a green economy.

Local governments play a critical role in improving energy efficiency, shifting the country to cleaner sources of energy, and reducing greenhouse gas emissions. While partnerships with States and the private sector are essential to successful local actions, the development of effective climate change and clean energy strategies will certainly fall short without direct appropriation of funding to local governments to supplement local funds that we will spend.

Local governments should have the flexibility to spend direct funds in areas such as capacity building, development of green initiatives, outreach education, and planning efforts like the Eco-City Alexandria initiative. Federal support for these and similar program would enable communities across the country to build their own eco-cities.

America's cities have always been the economic engine for growth and prosperity, and continued Federal support will go a

long way in ensuring their continued success in energy efficiency,
job growth expansion and eco-stability.

Thank you.

[The prepared statement of Mr. Euille follows:]

**TESTIMONY OF WILLIAM D. EUILLE
MAYOR, CITY OF ALEXANDRIA, VIRGINIA**

**HEARING ON CLEAN ENERGY JOBS, CLIMATE-RELATED POLICES AND
ECONOMIC GROWTH – STATE AND LOCAL VIEWS**

Good morning Madame Chair, and members of the committee: my name is William Euille and I am Mayor of the City of Alexandria, Virginia. Thank you for the opportunity to testify about three critical environmental challenges: climate change, clean energy, and the new green economy.

As Mayor and a lifelong resident of Alexandria, I am concerned about the potential impacts climate change may have on a coastal city like Alexandria and our 141,000 residents.

In 2007, Alexandria began a strategic planning process, the *Eco-City Alexandria* initiative, to guide the city over the next 30 years toward becoming a true Eco-City: a place where people can live healthier and economically productive lives, while reducing their environmental impact. City officials, City residents, and staff spent countless hours exploring best practices from communities across the country to develop an environmental plan for the City.

In 2008, City Council adopted the Eco-City Charter, which outlines the vision and guiding principles for Alexandria to become an Eco-City. One year later, Council adopted Environmental Action Plan 2030 as a “road map” for City leaders, staff, and residents to implement the sustainability, visions, and principles set forth in the Eco-City Charter. Only a handful of communities have developed such a comprehensive action plan that includes climate change protection as a critical component. I’d like to tell you about some of the things we are doing to become an Eco-City.

In Alexandria, we recognize the quantity and sources of energy used by local government, businesses and residents affect our environment and quality of life, and we have committed to managing our energy supply and usage in a sustainable manner. A prime example of this commitment is the City’s partnership in an energy-from-waste facility for more than 25 years. This facility generates enough clean, renewable energy to supply power to approximately 20,000 homes via the combustion of municipal solid waste. Diversion of our municipal solid waste from a landfill to the energy-from-waste facility reduces the City’s carbon emissions by approximately 160,000 metric tons annually.

The City also supports energy efficiency and conservation technologies and is working to create a green jobs training program to train residents to perform energy audits; weatherize houses and other buildings; and install solar, wind, geothermal devices, and other clean, renewable energy technologies.

To support the implementation of the Eco-City Environmental Action Plan, Alexandria plans to use some of its Energy Efficiency and Conservation Block Grant funding for

- conversion of the City’s street lights and traffic signals to energy efficient LED lamps,
- expansion of the City’s “Green Fleet” program,

- support of green jobs training for weatherization technicians and energy auditors, and
- establishment of a green revolving loan program.

Implementation of these programs and related projects will result in the creation of approximately 15 jobs and reduce carbon emissions by an estimated 19,000 metric tons.

Among Alexandria's other green projects and achievements are

- the new T.C. Williams High School building, which received LEED Gold Certification, and the award-winning design of a green building in a former brownfield that will house a City fire station, retail, and affordable housing;
- adoption of a new City policy that will seek to have all new buildings achieve LEED Silver certification or better;
- completion of the City's greenhouse gas emissions inventory;
- installation of solar panels to provide lighting in bus shelters and of vegetative filter boxes on neighborhood streets to treat and clean roadway runoff.

I've spoken to you today about some of the steps Alexandria has taken to become an Eco-City, and about some of green amenities that make Alexandria a great place to live. However, to fully implement the Eco-City Alexandria initiative goals, we need your support. Such support should include the annual funding of the Energy Efficiency Block Grant Program, increased funding for transit, pedestrian and bicycle projects, and revisions to Federal programs to ensure that they will support a green economy.

Local governments play a critical role in improving energy efficiency, shifting the country to cleaner sources of energy, and reducing greenhouse gas emissions. While partnerships with states and the private sector are essential to successful local actions, the development of effective climate change and clean energy strategies will certainly fall short, without direct appropriation of funding to local governments to supplement the local funds that we will spend. Local governments should have the flexibility to spend direct funds in areas such as capacity building, development of green incentives, outreach and education, and planning efforts like the Eco-City Alexandria initiative. Federal support for these and similar programs would enable communities across the country to build their own Eco-Cities.

Thank you!



Mayor William D. Euille

Mayor William D. Euille is the Founder/President and Chief Executive Officer of Wm. D. Euille & Associates, Inc., formed on April 9, 1987. He is also Chairman of the Board of Directors of the firm, chartered in Washington, DC with offices in Alexandria, Virginia.

Mayor Euille began his business career as an accountant with an Alexandria construction company in 1972, and within eight years, he advanced to Vice President/Controller, ultimately having responsibility for all contracting, financial and administrative functions.

A native of Alexandria, Virginia, Mayor Euille graduated from T.C. Williams High School and earned a bachelor's degree in accounting from Quinnipiac College in Hamden, Connecticut in 1972.

The Mayor is active in community affairs in Alexandria and Washington, DC. His dedicated involvement includes the William D. Euille Foundation, which he founded in 1994; the Alexandria Boys and Girls Club; the American Heart Association; 1998-2000 Chairman of the Alexandria United Way Campaign; INOVA Hospital Health System Board; Hopkins House Association; 2001 Chairman of the NOVA Urban League Board of Directors; and the Scholarship Fund of Alexandria. He is a member of Ebenezer Baptist Church in Alexandria.

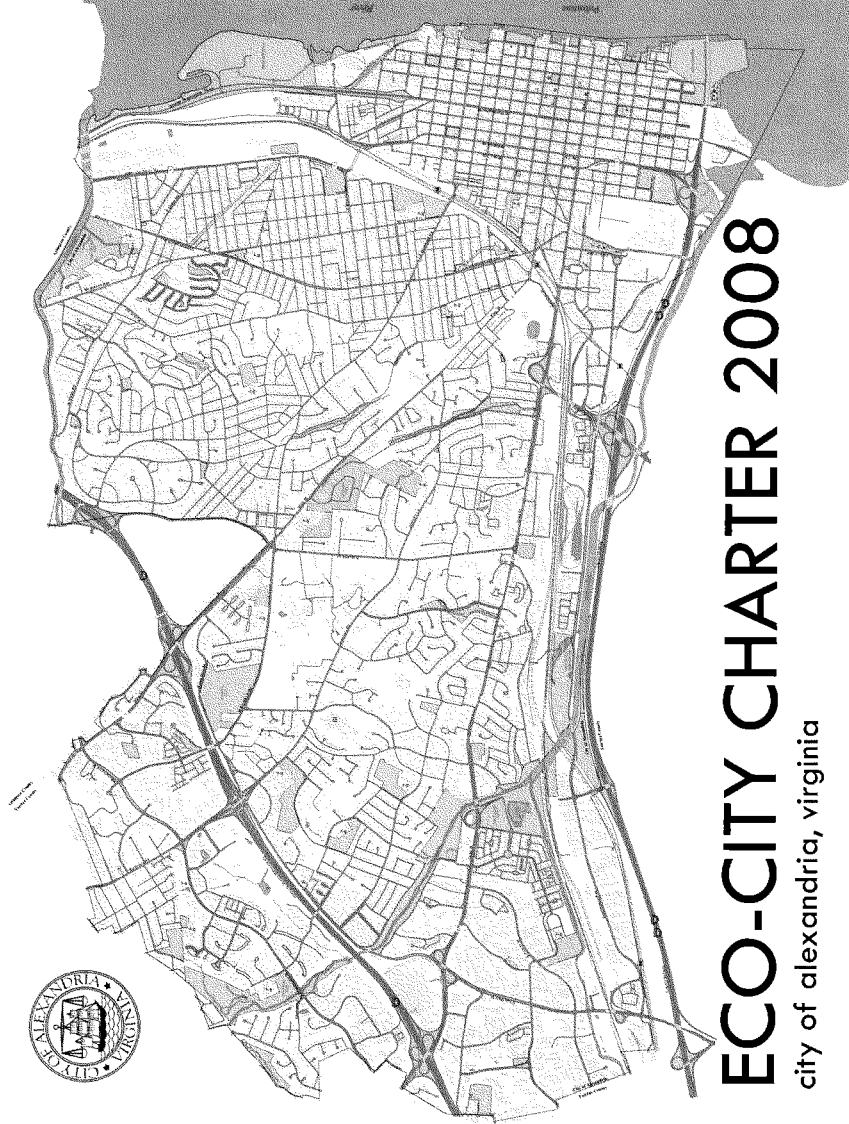
He is also active in business and construction industry organizations such as the Alexandria Chamber of Commerce; the US Chamber of Commerce; National Association of Minority Contractors; Associated Builders and Contractors, Inc; and the NOVA Building Industry Association.

Mayor Euille has received many major awards and honors, such as the 1994 Entrepreneur of the Year from the Virginia NAACP (The Mayor was the inaugural winner of this award); *Who's Who in the East*; *Who's Who in America*; 1995 Community Service Award from the Hopkins House Association; Outstanding Young Men of America Award; 1996 Blue Chip Award from the US Chamber of Commerce; the 1996 Entrepreneur of the Year from the *Washington Post* and Ernst & Young, LLP; the 1996 Small Business Person of the Year from the US Small Business Administration; and community service awards from the Alexandria NAACP (1996), Northern Virginia Urban League, Inc. (1997), Alexandria Chamber of Commerce (1997), and the Alexandria Sportsman Club (1998); Philanthropist of the Year 2000 from the Alexandria Chamber of Commerce; SBA's Graduate of the Year Award in 2000; Education Association of Alexandria's "Whole Village Award" (2001); and the Alexandria Chamber of Commerce Business Leader of the Year (2001).

Additionally, Mayor Euille is a major donor to many service and non-profit organizations which serve youth; provide funding for educational and recreational initiatives; and which help promote self-sufficiency for those less fortunate. Through the William D. Euille Foundation, he contributes more than \$50,000 for various causes; additionally, the firm Wm. D. Euille & Associates contributes more than \$20,000 to the community.

Mayor Euille was elected to a three-year term on the Alexandria City Council in May, 1994. He was re-elected in May, 1997 (Vice Mayor) and in May, 2000. He was elected the City's first African-American Mayor in May, 2003 and was re-elected Mayor in May, 2006 and May, 2009. He serves on the Board of Directors for the Washington Metropolitan Area Transportation Authority; the Northern Virginia Transportation Authority (NVTA); the Alexandria Pension Study Committee; and the Local Emergency Planning Commission. He is Secretary/Treasurer of the Northern Virginia Transportation Commission and Vice-President of the Virginia Transit Authority. He serves on the Board of Trustees of the Eisenhower Partnership; the Alexandria Economic Development Partnership; and the Chesapeake Crescent.

Additionally, he serves as the Co-Chair of City Council Task Forces on Affordable Housing and the Woodrow Wilson Bridge Project. He is Chairman of the Alexandria Youth Policy Commission and serves on the Governor's Council on Virginia's Future.



ECO-CITY CHARTER 2008

city of alexandria, virginia

COMPILED BY:

Environmental Policy Commission
City of Alexandria

The Urban Affairs and Planning Program
Virginia Polytechnic & State University
Alexandria Center

SUBMITTED TO:

Alexandria City Council
Mayor, William D. Euille
Vice Mayor, Redella S. "Del" Pepper
Councilman Ludwig P. Gaines
Councilman Rob Krupicka
Councilmember Timothy B. Lovain
Councilman Paul C. Smedberg
Councilman Justin M. Wilson

ADOPTED:

June 14, 2008



Eco-City Charter
City of Alexandria, Virginia

Vision
Definition of Sustainability
Guiding Principles
Roles & Responsibilities
Pledge & Commitment

JUNE 14, 2008



vision

On September 14, 2004, the City Council of Alexandria, Virginia adopted the 2004-2015 Strategic Plan* that sets forth the following vision:

Alexandria is a Vibrant, Diverse, Historic, and Beautiful City with Unique Neighborhoods and Multiple Urban Villages where we take Pride in Our Great Community.

Using the 2015 Strategic Plan as our guide, we offer the following Eco-City Vision in which Alexandria's citizens, businesses, and City government participate in a vibrant community that is always mindful of the needs and lifestyles of the generations to come.

We see Alexandria as a city where social well-being is supported by a strong economy and sustained by a healthy environment. Specifically, we envision Alexandria as a city that:

Builds Wisely

Where our built environment preserves and maximizes open spaces, natural landscapes, historic resources, and recreational opportunities, while protecting and improving our natural environment and public health.

Embraces Natural Beauty

Where we create beautiful parks, gardens, streetscapes, trails, and open spaces that embrace Alexandria's natural beauty, preserve our biodiversity, increase our tree canopy and streamside vegetation, and encourage a healthy, active lifestyle for all of our residents.

Improves Water Quality

Where we celebrate our heritage as a great port city by improving the Potomac River waterfront, eliminating combined sewer overflows, reducing storm water runoff, and improving the quality of our streams so that they are once again fishable and swimmable.

Clears the Air

Where we reduce significantly air pollution from all sources including vehicles, industrial sources, and power plants.

* See <https://www.alexandriava.gov/uploads/Files/council/14/15/strategicplan.pdf>

Moves Smartly

Where we travel less and less by car and increasingly by mass transit, walking, and bicycling.

Conserves Energy and Resources

Where we reduce our energy and water use and minimize our environmental footprint.

Minimizes Waste

Where we reuse and recycle materials and significantly reduce our volume of solid waste and toxic chemical releases.

Supports Healthy Living

Where we create environmental policy and programs not only for a healthier planet but also for a healthier and safer citizenry.

Readies for Change

Where we foresee and mitigate the impacts of environmental threats such as climate change.

Leads. Intelligently & Holistically

Where we implement change harmoniously and synergistically across interdependent areas.

Shares Responsibility

Where individuals take responsibility, decision-making is shared, and the community works together to achieve common goals that reflect the interests of a growing, diverse, and well-informed population.



definition of sustainability

Sustainability means meeting our community's present needs while preserving our historic character and ensuring the ability of future generations to meet their own needs. It involves balancing and integrating environmental, economic, health and social issues so as to maximize the quality of life for all of Alexandria's residents. Sustainability also requires us to consider the impacts of our decisions and actions beyond the City of Alexandria and seek the continuous evolution of policies and programs.

ADOPTED JUNE 14, 2008

guiding principles

The following guiding principles are rooted in the definition of sustainability and reflect the goals established in Alexandria's 2015 Strategic Plan. This interdependent network of guiding principles and policies is consistent with a systematic and integrated approach to sustainability.

LAND USE & OPEN SPACE

The City's land use and open space policies must harmonize its built and natural environments to ensure that growth does not jeopardize environmental sustainability and preserves Alexandria's character. The City's land use policies will accommodate increases in people and jobs through green development that:

- Ensures that land use is designed to encourage walking, biking, and public transportation through mixed-use zoning, interconnected pathways, and targeted density increases around public transportation hubs.
- Creates greater opportunities for sustainable compact development and redevelopment that requires the use of green building practices and prioritizes provision of usable open space and recreational areas.
- Ensures that City building codes, zoning ordinances, and other land use regulations reflect the goals of this Charter, so that sustainability requirements are consistently applied to all preservation, redevelopment, and development across Alexandria in ways appropriate to the character of the particular neighborhood.
- Ensures that development protects and enhances natural resource capacity.
- Protects, enhances, and increases Alexandria's open space and green infrastructure including wildlife habitat, parks, trails, tree canopy, and watersheds.
- Ensures that land use decisions do not foster or perpetuate social injustice.

WATER RESOURCES

Alexandria's past, present, and future are indelibly linked to the Potomac River and the quality of life the river sustains. Water quality in Alexandria will be managed in a sustainable manner consistent with good stewardship of the local streams, the Potomac River, and the Chesapeake Bay for the public health, ecological and recreational benefits of current and future generations. The City will:

- Promote public health by continuing to ensure safe and reliable drinking water.
- Use environmentally responsible flood management, stormwater control, and wastewater treatment to protect the public's health and property.
- Promote – through sustainable practices – safe, swimmable, and fishable waterways for its citizens and visitors, and enhance the ecological integrity of its downstream waters, by minimizing stormwater runoff and pollutants draining to the Potomac River and Chesapeake Bay.

- Advocate water conservation and reuse in order to preserve the quantity, not just the quality, of our water resources.

AIR QUALITY

Alexandria faces significant challenges in improving air quality including those presented by emissions from vehicles, older industrial facilities, and the regional transport of air pollution. Given that one in eight residents have respiratory illnesses, the City should influence and control emissions sources in a manner that reflects the choices and wishes of the community. The City and its citizens will:

- Enhance their ability to manage outdoor air quality from damaging pollutants in its jurisdiction and will consider emerging threats when establishing outdoor air quality goals and regulatory approaches.
- Be proactive in protecting public health and ecological quality by lowering the amount and number of sources of air, light, and noise pollution.
- Educate those who manage commercial and public buildings on methods for improving indoor air quality and educate citizens on the harms associated with poor indoor air quality.

TRANSPORTATION

The City of Alexandria will encourage modes of transportation that reduce dependence upon the private automobile by promoting mass transit and pedestrian- and bike-friendly transportation networks. The City will integrate transportation options with land use decisions in order to ensure a healthy environment while continuing economic growth. The City will:

- Provide all its citizens - regardless of age, income, race or ability - with safe, accessible, efficient, and affordable transportation options.
- Prioritize walking, biking, and public transit in order to discourage single-occupancy vehicles.
- Reduce the environmental footprint of travel by introducing, designing and encouraging sustainable methods of transport and infrastructure.

ENERGY

The quantity and sources of energy used by Alexandria's government, businesses and residents impact our environment and quality of life—whether it be through pollutants added to the air, negative effects on water quality or local contributions to climate change. Recognizing this, Alexandria commits to managing its energy—both the electricity that powers our buildings and homes and the fuel that powers our vehicles and other equipment—based upon the following principles:

- Reduce energy consumption through conservation.
- Produce energy locally and sustainably, through installation and promotion of the use of renewable and efficient energy technologies.
- Convert existing uses of fossil-fuel energy to renewable energy.

We envision and work toward a day when Alexandria relies solely on renewable energy sources.

ADOPTED JUNE 14, 2008

BUILDING GREEN

Alexandria's government, businesses, and citizens impact our environment through the choices they make when renovating existing structures and constructing new ones. These choices manifest themselves in the quantity and types of energy we use, the impact we have on our water quality, the amount of waste we create, the amount and quality of green space available to us, and our public health. Therefore, the City's building practices will:

- Adapt and maintain initiatives that require best in practice measures to reduce overall environmental impact of renovation, redevelopment, and new development.
- Integrate green building and sustainability standards into all private and public development, including historic preservation, renovation, and new construction.
- Encourage the preservation and adaptive reuse of existing buildings, and promote the reuse and recycling of building materials in all development.

SOLID WASTE

Recognizing that managing waste is a public health issue as well as a quality of life issue, Alexandria will maintain its well-preserved public image by managing, handling, and disposing of solid waste in an environmentally sustainable manner. Alexandria will manage waste as a hierarchy of uses with the following priorities:

- Priority One: Reduce
- Priority Two: Reuse
- Priority Three: Recycle
- Priority Four: Resource recovery (e.g., convert to energy, composting, etc.)
- Priority Five: Proper disposal

ENVIRONMENT & HEALTH

Sustainability is not just about the health of the earth; it is also about human health. Indoor and outdoor air quality, water quality, land use planning, toxic chemical exposure, noise and light pollution, and the safety and habitability of buildings directly impact human health and the natural environment. Alexandria will:

- Promote and support policies and individual decisions that reduce exposure to toxins and pollutants, minimize environmental impact, and encourage a healthy lifestyle.
- Increase equitable access to safe, healthy, and organic food, in particular for children and adolescents, and encourage local and regional food production.

EMERGING THREATS

Alexandria must be adaptive and responsive to emerging and unforeseen environmental threats – such as climate change – that could strain infrastructure, deplete natural resources, disrupt the economy, and threaten public health. Failure to respond quickly and appropriately to such threats will likely have severe consequences for the health and economy of Alexandria and its citizens. To better prepare for and avert environmental crises, Alexandria will:

- Make policy, infrastructure, and land use decisions that prepare for flooding, drought, disease, and other impacts to humans and wildlife from environmental threats such as climate change.
- Conserve energy and achieve carbon-neutrality.

- Identify ways to reduce/eliminate nutrient loading to waterways.
- Conduct accurate and continual assessments of resource and infrastructure capacity when planning to ensure growth and development does not exceed capacity.
- Ensure that Alexandria understands these threats, its role in the problem, and its part in the solution.

IMPLEMENTATION

Improving environmental quality, conservation and the public welfare requires a harmonized approach to implementation, as well as collaboration both within and around Alexandria. The primary responsibility of environmental stewardship shall be equally shared by all Alexandrians. In order to achieve the Eco-City Vision and the Guiding Principles set forth in this Charter, the City will:

- Educate and engage its citizens, visitors, local businesses, schools, and civic organizations on the City's concept of sustainability, the importance of identifying goals for environmental quality, and the vision and principles of this Charter.
- Develop and encourage more public-private-civic partnerships within Alexandria and beyond, and work with federal, state, and neighboring governments to implement these principles and achieve sustainability.
- Conserve resources, make sustainable purchasing choices, and make the long- and short-term investments necessary to achieve the principles of this Charter.
- Ensure city policies give incentives for achieving the vision and principles of this Charter and disincentives for behaviors that impede sustainability.
- Become a leader, educator, advocate, facilitator, integrator, and innovator in sustainability.

roles & responsibilities

The Eco-City Charter serves as a guide for moving the city towards a sustainable future. Fulfilling this Charter requires coordinated participation and commitment by the EPC, City government, and the community. The Charter's success depends on each of these parties taking an active and innovative role as stewards and guardians of this Charter's principles and vision.

ENVIRONMENTAL POLICY COMMISSION

- Develop an Environmental Action Plan that adheres to the principles outlined in this Charter and advances the City towards the vision of a sustainable city; review and revise the Action Plan as needed, but no less than once every five years.

ADOPTED JUNE 14, 2008



- Inform and educate the community on the vision, principles, and policies outlined in the Charter and the Environmental Action Plan.
- Identify specific steps that citizens and businesses can take to help Alexandria achieve the principles and vision set forth in this Charter.
- Work with and support City Departments, Boards, and Commissions to promote and ensure that the principles within the Charter are considered in key decisions and infused in City programs and policies.
- Produce an annual report card that evaluates the progress of the City toward meeting the sustainable vision set forth in the Charter and Environmental Action Plan.
- Review the Charter no less than every ten years and amend as necessary to ensure that it continues to meet emerging sustainability issues and the needs of the City and its residents.

CITY COUNCIL, CITY MANAGER, CITY DEPARTMENTS, BOARDS & COMMISSIONS

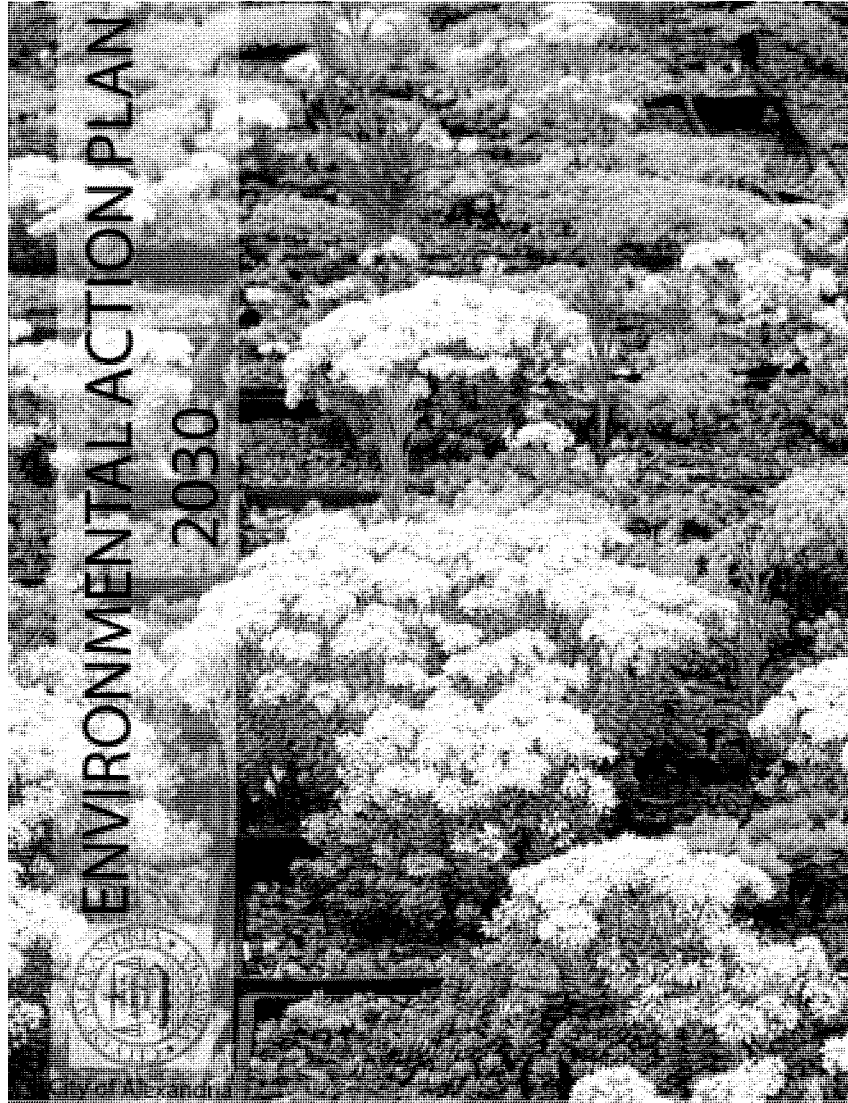
- Lead by example: identify and implement specific projects for the City government to become more sustainable and create incentives for Alexandria citizens to do the same.
- Maintain our best environmental practices while investing in new ideas to achieve the vision and principles of this Charter.
- Incorporate sustainability practices, and encourage interdepartmental coordination to ensure all City decisions are compatible with the principles of the Charter.
- Work with the Environmental Policy Commission to advance the principles in the Charter and the steps set forth in the Environmental Action Plan.
- Work to make sustainability the natural, easy, and preferred choice for decisions by the City as well as its citizens and businesses.
- Develop and implement an outreach program to educate the community on the vision and principles in the Charter, with particular attention on ensuring that the City's youth are given a foundation of knowledge in the principles of environmental stewardship.
- Identify and develop key regional partnerships to address the sustainability challenges of the region.

CITIZENS & COMMUNITY

- Take responsibility for the social, environmental, economic, and health impacts of our decisions and be accountable for our actions.
- Encourage children, businesses, neighbors and community organizations to practice and demand sustainability.
- Engage in and contribute to the City's sustainability planning processes and bring forth ideas to ensure the Charter and the Environmental Action Plan are current and meet the needs of the community.
- Hold local, regional, state, and national leaders accountable for achieving sustainability.

This charter is the result of a collaborative effort between the City of Alexandria, its Environmental Policy Commission, and Virginia Tech's Urban Affairs & Planning Program in Alexandria.





ECO-CITY  ALEXANDRIA

Environmental Action Plan

FY 2009-2030

City of Alexandria, Virginia

COMPILED BY:

Environmental Policy Commission
City of Alexandria

The Urban Affairs and Planning Program
Virginia Polytechnic & State University
Alexandria Center

SUBMITTED TO:

Alexandria City Council
Mayor, William D. Euille
Vice Mayor, Redella S. "Del" Pepper
Councilman Ludwig P. Gaines
Councilman Rob Krupicka
Councilmember Timothy B. Lovain
Councilman Paul C. Smedberg
Councilman Justin M. Wilson

ADOPTED:



table of contents

Environmental Action Plan 2030
Overview 5
Cross Cutting Strategies 8
Chapter 1: Transportation 16
Chapter 2: Green Building 20
Chapter 3: Air Quality 24
Chapter 4: Water Resources 27
Chapter 5: Environment and Health 31
Chapter 6: Energy 36
Chapter 7: Land Use and Open Space 41
Chapter 8: Solid Waste 47
Chapter 9: Global Climate Change and Other Emerging Threats 51
Chapter 10: EAP Implementation and Sustainability Sectors 55
Appendices
Appendix 1: List of Targets 62
Appendix 2: Civic Engagement Timeline 65
Appendix 3: Matrix of Existing and Adopted City Plans 67
Appendix 4: Glossary of Terms 75

overview

The Environmental Action Plan 2030 (EAP) will serve as the road map for city leaders, staff, and citizens to implement the sustainability visions and principles set forth in Alexandria's Eco-City Charter (adopted by City Council on June 14, 2008). It explains how Alexandria can lead the new green economy, address the challenges of climate change, and continue its high quality of life while decreasing the city's carbon and ecological footprints.

The Environmental Action Plan merges the short term goals and action steps (FY-2009-2011) approved by the City Council in January 2009 with new mid and long range goals and actions (2012-2030). As a policy plan the EAP does not commit or appropriate funds, but provides strategic guidance for the City Council and City Manager as they move through their regular fiscal planning and annual budget processes.

The Overview section outlines the EAP framework and nine cross cutting strategies followed by the EAP's policy goals and action steps organized in ten chapters according to the Eco City Charter's ten principles. The EAP also includes an appendix that consists of the following items: 1) A consolidated list of targets; 2) A glossary of sustainability terms; 3) A community engagement timeline; and 4) A matrix of existing city plans. Footnotes and references are found throughout the EAP that partially explain the rationale, cross references and discussions behind certain provisions.

The Overview section explains in more detail: 1) the action planning process and community involvement process; 2) the elements of the EAP; 3) the assumptions underlying the policy goals and action steps; and 4) the general roles and responsibilities involved in the implementation and monitoring of EAP progress. Virginia Tech Urban Affairs and Planning Program (UAP) has also provided a separate report with its analysis of the EAP and the overall Eco-City Project (The Eco City GreenPrint).

I. The Action Plan Process and Community Outreach

Throughout this strategic planning process, the Alexandria Environmental Policy Commission (EPC), a commission of volunteers appointed by the Mayor and City Council, has led the effort to develop an Eco-City Charter and companion Environmental Action Plan. The EPC held numerous public work sessions, community open houses, drafting retreats and meetings with the city's Environmental Coordinating Group (ECG).¹ Thanks to the hard work and dedication of EPC, Virginia Tech's UAP faculty and students, and the City's departments, particularly Transportation & Environmental Services, Planning and Zoning, Recreation, Parks and Cultural Activities, General Services, Health, and Code Administration, the EAP reflects a high degree of community consensus.

A. Phase One Environmental Action Plan (Short Term)

During the fall of 2008 the EPC, working closely with city staff and Virginia Tech's Eco-City Studio, developed a Phase One Action Plan that involved 38 goals and 123 action steps to guide sustainability efforts through fiscal year 2011 (June 30, 2011). Given current budget and revenue limitations, existing resources and staff are already moving forward on approximately 59 of these programs and policies. These actions are highlighted with an asterisk in the goals and action plan section of this document. The City Council unanimously approved the Phase One Action Plan in January 2009.

¹ More than 200 local residents participated at different EAP events (November 2008-May 2009) sharing their ideas and insights and offering feedback on the draft EAP. Appendix 2 includes a timeline of public outreach events and matrix of public comments for the entire Eco City project.

The EPC applied the following criteria in setting the EAP's goals and action steps:

- Ensure EAP consistency/compatibility with:
 - o the vision and principles of the Eco-City Charter; and
 - o the goals and objectives across existing city plans.
- Build on current legal and policy authority in the short term and advocate for greater local authority as necessary to advance mid-to-long term actions.
- Maximize/leverage existing programs, resources, and staff and seek new resources for mid-to-long term actions.
- Promote some level of cost savings and reasonable return on overall sustainability investments.
- Deliver sustainability benefits (environmental, economic, and social) across multiple Charter principles.
- Minimize the unintended impacts or indirect consequences across Charter principles.

B. Phase Two Environmental Action Plan (Mid-Long Range)

For Phase Two the action planning process shifted its focus to the trends and challenges that Alexandria will confront from today through the year 2030. By many accounts climate change and peak oil will drive the need to build more sustainably, provide alternative transportation choices, and design renewable energy sources to meet the demands of residents and businesses alike. At the same time, the EPC and city staff recognizes the importance of retaining the historic charm and compact character of the city.

Given this 20+ year horizon, EPC's spring 2009 work sessions and meetings were devoted to special cross cutting themes, such as climate change, land use/open space, environmental health, business and civic sustainability. Virginia Tech faculty and students prepared special background reports on each topic and compiled the meeting notes on these special cross cutting topics.² These intense discussions set the framework for the EAP's cross cutting strategies and general performance targets. The EPC also held a two-day retreat at Virginia Tech to refine these ideas and merge the short, mid-and-long-range actions into a comprehensive draft that was released to the public at the Earth Day Celebration on April 25, 2009.

Finally, on May 11th the Environmental Policy Commission convened its second open house at the new Charles Houston Recreation Center. Unlike other events, this open house served as a "call to action" as more than 50 participants offered suggestions on how they as individuals and as businesses could advance the EAP and the Eco-City agenda. They also brainstormed about potential projects beyond the annual Earth Day celebration to demonstrate their commitment to sustainability. Many submitted pledge cards to volunteer their time as part of an emerging Eco-City Action Corps. Virginia Tech compiled all public input for final consideration by the EPC at their May 18th public meeting.³ EPC voted unanimously with one abstention to accept the current draft and transmit it to the Mayor and City Council for its consideration.

II. The Environmental Action Plan 2030

As submitted to the mayor and city council, the draft EAP contains 48 goals, 50 preliminary targets, and 353 actions that would span the course of 21 years. Each of the 10 Charter Principles remained relatively constant with between 4-6 goals each. Nearly 42% of all actions are short term (they are already underway or will be completed by 2011) and by coincidence 42% of the actions are also mid-term (designed to be launched and ideally completed between 2012 and 2020). The remaining 16% are a combination of mid-to-long range or long range goals that would be commenced sometime before 2030. Implementation contained the most total actions steps (57) followed closely by land use and open space (56).

² Reports and agendas on climate change, environmental health, land use/open space, business suitability, and civic sustainability can be found on the Virginia Tech Eco City Web site (<http://ecocity.ncr.vt.edu>)

³ Members of the public also provided feedback on the draft action plan by sending e-mails to ecocity@alexandriava.gov and posting comments on the new Eco City Alexandria blog at <http://ecocityalexandria.wordpress.com>.

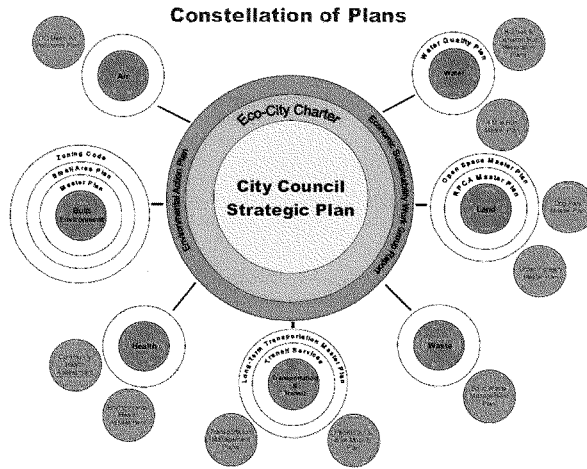
A. Relationship with Existing Plans and Initiatives

Alexandria has numerous plans that range from the City's overall Master Plan (e.g., its comprehensive land use plan) to special program master plans (e.g., Open Space, Parks and Recreation, Urban Forestry, Transportation, Water Quality, and Solid Waste). It also has several policy and development plans that focus on particular projects or areas along roughly 20 Small Area Plans administered by Planning and Zoning.

Nearly all City departments have one or more master or policy plans that guide a critical part of their respective missions. Many of these City master plans are driven by individual citizen commissions managed by that particular department.⁴ Within the two year span of the Eco-City project, the City has completed and continues to work on several new plans, such as the Transportation Master Plan, the Urban Forestry Plan, and the Climate Change Action Plan and Emissions Inventory.

As the diagram below illustrates each of these plans tend to function independently of each other within their own policy and programmatic orbits. The City Council's 2015 Strategic Plan, however, seems to set the general policy direction across these individual master plans which explains why this plan is the center of the planning constellation below. The 2015 plan also includes several goals that directly relate to the environment and sustainability.

Given its broad sustainability vision and ten core principles, the Eco-City Charter together with the EAP complements the City Council's Strategic Plan as it infuses the 2015 vision with sustainability's premise of interdependence. The Charter and EAP can also create the most direct connection across all of Alexandria's plans; thus the Charter and EAP are positioned directly adjacent to the City Council's 2015 Strategic Plan.



ENVIRONMENTAL ACTION PLAN

⁴See Appendix No. 2, a Matrix of City plans and City and regional boards/commissions.

B. Cross Cutting Strategies

Throughout 2009 the EPC and City staff examined the cross cutting connections among several of the Charter's principles and sustainability concepts, such as land use, transportation, open space, energy and environmental health. Based on these conversations, the EPC devised nine broad strategies as a way to link the EAP's goals and actions across multiple principles and maximize the delivery of economic, health, and environmental benefits, such as reduction of carbon emissions and other environmental contaminants; promotion of energy conservation; generation of clean, renewable energy; promotion of healthy lifestyles and active living environments; mitigation of stormwater runoff, flooding, disease, and urban heat island impacts; assurance of good indoor air quality; and the reduction of the city's resource footprint. These strategies also offer a unique policy and programmatic lens for implementation of the entire EAP as City officials can use these cross cutting strategies to coordinate activities across City departments and infuse the city's culture with sustainability.

1. Establish a city-wide network of high quality, affordable, and accessible eco-sustainable⁵ neighborhoods and villages with optimal densities to balance land use and transportation policies with open space, green infrastructure, and energy efficient building policies.
2. Develop a holistic city transportation system that puts the health, mobility, and accessibility of "people first" by implementing development and transportation programs and projects consistent with the following level of precedence: pedestrians, bicyclists, public transportation, shared motor vehicles and private motor vehicles.
3. Integrate energy-efficient green construction with sustainable building techniques, materials, and site design and the latest technology in new development and in the rehabilitation and retrofitting of existing places.
4. Build a seamless and holistic network of green infrastructure⁶ that maintains and enhances existing assets, creates new amenities, improves connectivity and access among public and private green spaces, and creates a diverse local ecology by harmonizing the built and natural environments.
5. Put public and private systems in place that measure, monitor, and track the ecological efficiency⁷ of buildings, transportation, infrastructure, and operations throughout the entire city.
6. Develop an economic strategy for Alexandria that promotes the integration of sustainability practices within the existing business facilities and operations and also attracts new green businesses that provide a wide range of green jobs.
7. Create a city-wide civic sustainability information and education strategy that engages schools, nonprofit, and community-based organizations in Eco-City initiatives and sustainability practices through a variety of communication and outreach activities (e.g., Eco-City cafes, summits, open houses, blogs websites, etc.).



⁵ Eco-sustainable neighborhoods and villages would exhibit these essential characteristics: mixed use, walkable, bikeable, transit convenient, low impact development, green infrastructure, and energy efficiency.

⁶ Green infrastructure includes all types of open space, parks, tree canopy, green roofs and walls, urban gardens, living streets, etc., on public and private property.

⁷ Eco-efficiency offers a more integrated notion of how cities process resources similar to any complex metabolic system with flows and cycles and where ideally negative outputs (such as wastes) are re-envisioned as productive inputs to satisfy other urban needs, including energy. See Peter Newman, *The Resilient City*.

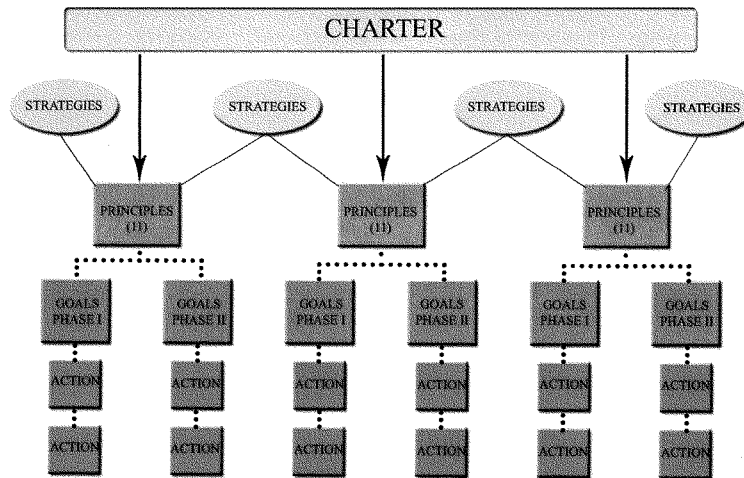
8. Establish a green fiscal policy that identifies cost savings, provides incentives, seeks new revenue sources as necessary, and creates a funding strategy that ensures the city's future operating and capital expenditures (e.g., programs, plans, CIP budgets, and projects) are consistent with the principles, goals, and actions set forth in the Eco-City Charter and Environmental Action Plan.

9. Establish a holistic decision-making process for all City actions that considers both environmental and human health issues, especially in the areas of water and air quality, toxic exposures, vector control, and the built environment.

Climate change is a primary focal point of several cross cutting strategies. They collectively present a cohesive policy agenda to help the city and the region mitigate climate change impacts through reductions of greenhouse gas emissions and adapt to anticipated climate change effects. Such effects include increases in flooding due to rising water levels, increased storm intensity, and likely adverse health and ecological effects such as outbreaks of environmentally-linked disease and changes in natural habitat. These strategies will have significant social, economic, and environmental benefits beyond climate change considerations.

Implementation, education, and outreach are vitally important to the success of the EAP. Cross cutting strategies five through nine focus on these areas and provide the City staff with critical tools, such as tracking performance, financing and funding proposed EAP action steps, and making decisions consistent with the vision of the Eco City Charter and the EAP's goals. Strategies six and seven target two critical sectors in the city's ability to address climate change and become an Eco-City – citizens and businesses.

The diagram below further illustrates the relationship of the EAP's cross cutting strategies, policy goals, specific action steps, and tentative timelines. Commission members believe these strategies will build a bridge between the Charter's sustainability vision and the general policy and programmatic goals that may be undertaken under each Charter principle.



C. Policy Goals, Targets, and Specific Action Steps

For each Charter principle the EAP sets a series of policy goals to guide implementation by the city, the business community and citizens. The action steps include the particular means (ordinances, policies, and programs, projects) to implement and achieve the EAP's goals. Based on the review of existing City plans and the plans from other cities, the EPC used the following time horizons for the EAP:

- Short Term Action Steps: FY 2009 to FY 2011
- Mid Term Action Steps: FY 2012 to FY 2020
- Long Range Action Steps: FY 2021 to 2030+

A common theme for each EAP chapter is to build on existing City master plans; for example, goals under Transportation, Water, and Green Buildings all call for following the elements of existing plans and policies.⁸ Another theme is education and outreach as many of the EAP Chapters set goals and actions that will require fundamental changes in how people and businesses conduct their day-to-day activities.⁹ Shifting to a carbon neutral economy and addressing the challenges of climate change will require a major shift in how people and businesses conduct their day-to-day activities. Education and outreach are imperative to help make these transitions and transformations as efficient and effective as possible. The EAP also includes a number of far reaching goals and action steps that will be critical to Alexandria's Eco-City journey, such as:

- Institutionalizing the responses and educating the public about the possible changes from climate change,
- Eliminating the harmful impacts of combined sewer overflows,
- Giving precedence to walking, biking, and transit projects over the automobile,
- Expanding an integrated rapid transportation system that includes rail, trolley, street car, and bus,
- Retrofitting existing structures to make them more energy and water efficient and with the lowest ecological impact,
- Purchasing and generating more renewable energy within Alexandria,
- Approving more compact, walkable and bikeable land use patterns and development projects,
- Improving respiratory health by mitigating the impacts of harmful air pollutants (outdoors and indoors), and
- Increasing equitable accesses to safe, healthy and organic foods.

To help make these goals more concrete and increase the chances of success, each EAP chapter includes a number of preliminary targets. Some of these targets are consistent with existing City master plans while a few go beyond. Setting ambitious targets can accelerate the commitment and level of activity necessary to meet critical challenges such as carbon emissions reductions. These preliminary targets also lay the groundwork for the EPC and the City's Office of Environmental Quality (OEQ) to establish performance measures and eventually create an EAP Score Card.

⁸ For example, see Transportation Goal No. 1, Green Building Goal No. 1, Air Goal No. 1, Water Goals No. 1 and No. 2, Land Use Goal No. 1.

⁹ For example, see Transportation Goal No. 2, Green Buildings Goal No. 2, Air Quality Goals No. 2 and 3, Water Goal No. 3, Environmental Health Goals No. 1-5, Energy Goal No. 2, Solid Waste Goal No. 4, and Climate Change Goal No. 3.

iii. Assumptions Underlying the Environmental Action Plan

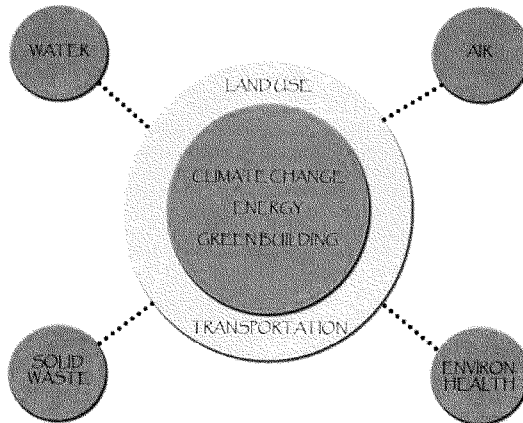
A. What are Eco-Cities?—Cities as Ecosystems

The three core tenants of sustainability—harmonizing environmental, economic, and community/social goals—set the foundation for the entire Eco-City Alexandria project. As illustrated by the Eco-City logo and letterhead, the City's Eco-City Charter and its 10 principles rest firmly on this foundation of sustainability. The concept of an Eco-City refines these notions of sustainability by viewing cities as complex ecosystems with inputs and outputs and like any other natural ecosystem.¹⁰ Such a system's approach highlights the unsustainability of existing practices and provides a framework for action and ecological restoration. It also recognizes that cities, such as Alexandria, exist within bioregions that require it to establish partnerships and programs across political boundaries and sectors.

B. Alexandria in 2030

In developing the EAP, one of the initial decisions was the time horizon for the plan. Should it be 10, 20 or 30 years? The EPC felt 30 years was too long a period of time that might perpetuate incremental changes, so it adopted the 2030 time horizon.

In the setting of mid-to-long term action steps it was difficult for many EPC members, residents, and City staff to grasp how different Alexandria might be by 2030. Based on research from other eco-cities and its analysis of proposed sustainability policies, Virginia Tech identified the challenges of climate change and energy/peak oil as the primary policy and political drivers over the next twenty years. As the diagram below illustrates, these primary issues will also greatly influence the need to address related issues, such as water and air quality, land use planning, and transportation.



¹⁰ Refer to Professor Peter Newman, *Cities as Sustainable Ecosystems—Principles and Practices*, (Island Press 2006), “[T]he best innovations in human history have arisen by learning and modeling natural systems. Cities need to develop this perspective.”

Another related assumption is Alexandria will continue to grow in population and jobs given the positive growth predicated for the entire Washington, DC metropolitan region.¹¹ In the short-to-mid term several of the EAP action steps would require the city to seek expressed legal authority from the state legislature. For example, changes to state building codes to make them greener. As the pressure mounts for cost-efficient government actions, it is likely that Dillon's Rule will incrementally erode so that local governments can respond more quickly. In some areas, such as air, water, solid waste, and energy, the state could opt for more regional authorities or facilitate inter-local agreements among local jurisdictions.

C. Financing the EAP

The EAP provides a comprehensive menu of policy and programmatic actions for the Mayor, City Council and City Manager to evaluate as part of the City's annual budgetary process. The fiscal implications of a 20+ year action plan are difficult to quantify. Not all EAP actions will require additional funding. Some proposed actions may have initial costs, but overtime these programs will produce significant returns on investment while generating multiple social, economic and environmental benefits. Cost savings from energy and other resource conservation measures alone could generate funds to support Eco-City outreach and education activities. Certainly in the short term, the City and the EPC must prioritize the activities it can accomplish given the City's current budget limitations (see EPC cover letter to the EAP).

Cross cutting strategy eight calls for the city to "establish a green fiscal policy that identifies cost savings, provides incentives, seeks new revenue sources as necessary, and creates funding streams that insure the city's future operating and capital expenditures... are consistent with the principles, goals, and actions set forth in the Eco-City Charter and Environmental Action Plan." On the more immediate horizon, under the Implementation chapter, the short term actions under Goal No. 1 suggest the City convene a special task force to examine a wide range of economic measures, such as incentives and disincentives; the City should also explore the creation of a special Eco-City fund.

More and more communities have found creative ways to support their sustainability programs with cost savings and cost recovery through program fees and green permits while generating capital through sustainability bonds.¹² Moreover, new federal and state resources are now available for facilitating energy conservation and carbon emissions reductions. Proposed federal and state legislation will likely create a new carbon economy that could support a myriad of proposed EAP actions

Many of the ideas set forth in the EAP are not only good for the environment, but offer Alexandria the opportunity to grow green businesses and jobs. Cross cutting strategy six requires the City and its economic development partners to develop a green business/economic strategy for existing business facilities and operations and that also attracts new green businesses and green jobs. Goal No. 4 under the Implementation chapter recognizes that education, outreach, and training to local businesses and related organizations will be critical to the EAP's business sustainability activities. The short term actions suggest creating business leadership groups and eco-city awards programs; providing web/internet based educational resources; and identifying certain business sectors (e.g., tourism, rental property, and restaurants) ready for a possible green business certification program.

¹¹ See the analysis from the Greater Washington 2050 Initiative; the Metropolitan Washington Council of Governments (COG) leads this initiative along with a coalition of public, business, civic and environmental stakeholders. Greater Washington 2050 will build on what many people now believe is an opportunity for convergence of agreement on big issues of growth, transportation and the environment. See www.greaterwashington2050.org

¹² See Virginia Tech's Funding Sustainability Report, Eco-City Studio, Fall 2008. See <http://ecocity.ncrvt.edu>

IV. Implementation and Next Steps

Successful implementation of the EAP will require changes in how Alexandria currently does things—changes in city operations and its organizational culture, changes in business and commerce, changes in how everyone get around, and changes at home. Everyone has a role to play. Climate change, peak oil and the new energy economy are too complex for anyone to tackle on its own. These challenges also offer a vast array of potential partnerships that can foster new opportunities, such as green businesses and jobs, regional sustainability initiatives, and Eco-City volunteer and demonstration projects.

The EAP's Implementation chapter builds on these themes by focusing on six strategic sectors of sustainability: 1) Civic; 2) Business; 3) Financing; 4) City Government; 5) EPC Roles and Responsibilities; and 6) Regional Partnerships. Each sector plays a critical role in achieving the EAP's goals and implementing its specific programmatic actions.

A. Regular Review and Prioritizing of the EAP

The Environmental Policy Commission (EPC) will continue to serve as the primary guardian of the action plan as set forth in the Charter and the EAP. With assistance from the Office of Environmental Quality (OEQ) and the City's Environmental Coordination Group (ECG), the EAP tasks the EPC to "monitor, measure and report on the implementation of the Environmental Action Plan and refine it as circumstances and conditions change."¹³

Given the sheer number of action steps, the EPC will need to regularly review progress and reevaluate the EAP. In the short term perhaps the EPC and OEQ can identify the top policy and programmatic actions at the beginning of each fiscal year. In the long term, the EAP and Charter direct the EPC to update the EAP at least every five years and the Eco-City Charter every 10 years.¹⁴

B. Evolution within City Hall

Operations within many local and regional governments have changed with the ebb and flow of environmental policy models over the years. During the 1990s many cities consolidated traditional solid waste, water, and public work functions into new environmental services departments. After Alexandria's 1998 Quality of Life Summit the City Manager brought together these departments under the umbrella of a new department, Transportation and Environmental Services, which also included staff from City's Environmental Health. Last year after the 2008 Eco-City Summit the City Manager elevated the Division of Environmental Quality to the Office of Environmental Quality, which elevated the new OEQ Director to participate in regular department director meetings.

All of these changes are good initial steps towards sustainability; however, much more will need to occur in order to effectively implement the EAP. For example, the current Environmental Coordinating Group may need expanding and reconfiguring so that it can more effectively operate within the broader scope of sustainability, not just the environment. Most of the leading sustainability cities have dedicated sustainability departments or at least a coordinator that works with City departments to move them towards sustainability.¹⁵ Many of these positions and staff also lead initiatives outside of city hall, such as green business certification, community education, and volunteer corps.

¹³ Goal 5 under the Implementation Section of the EAP.

¹⁴ Goal 5, midterm action, under the Implementation Section of the EAP.

¹⁵ Refer to VA Tech's Implementation Report, Eco-City Studio, Fall 2008. See <http://ecocity.ncr.vt.edu>

Throughout the draft EAP the policy goals and action steps call for the development of several supplemental policies, plans, and strategies over the next 20 years as City operations evolve towards a sustainability model. Some of these plans, such as energy and perhaps climate change, might eventually become special programmatic master plans.

- Expand, enhance and implement the Transportation Master Plan with a focus on alternative transportation
- Develop a city wide environmentally sustainable comprehensive parking strategy
- Develop a green building policy for retrofitting all existing buildings
- Initiate an energy planning process that includes the feasibility study on the potential for renewable power generation within the city
- Initiate a process for establishing a City Energy Master Plan
- Create a City fleet management plan to minimize the emissions of greenhouse gases from city vehicles.
- Revise the City's strategic plan and master plan to incorporate principles of sustainability from the Eco-City Charter and EAP as the requirements for all land use decisions.
- Finalize and release the Urban Forestry Master Plan
- Revise and update the Solid Waste Management Plan
- Establish the City's Climate Action Plan (draft plan already done)

C. Next Steps

The most immediate implementation challenge for EPC and OEQ is where to start. The EPC's EAP cover letter sets forth its list of top priorities in order to maintain the momentum generated by the Eco City Alexandria Project. Many of these priorities highlight the dozens of outreach and educational tasks involving local businesses, schools, and civic/neighborhood groups, such as establishing an Eco-City Award program, mapping green assets, and developing a network of green businesses.¹⁶ One of the legacies from Virginia Tech is the outreach tools it created from the successful formats of the Eco-City Cafes and Open Houses to its website and Eco-City Alexandria Blog.

While EPC and OEQ will play major roles in moving these initiatives forward, they will need renewed support from others within city hall, especially in areas of communication, e-news lists, web page development, and event support. EPC has a draft outreach strategy that offers a good framework, but the City must devote regular attention to messaging and take full advantage of the web infrastructure created by Virginia Tech.

Another critical activity is to build on the steady citizen interest by forming an informal Eco-City Volunteer Corps. Based on attendance at the recent Eco-City Cafes and Open Houses, there seems to be approximately 150 Alexandrians who are firmly interested and ready to serve. Organizing this group around a series of demonstration pilot projects could be a critical turning point in the evolution of Eco-City Alexandria.

EPC and OEQ will also need to devise a more robust tracking and performance measurement system. OEQ already has a preliminary matrix of all short term action steps and is working with relevant City departments to identify a point of contact and offer some preliminary analysis about potential costs and funding sources. Pursuant to the EAP the EPC must also develop an EAP scorecard that translates these internal details into a digestible format for the general public. While these are good preliminary steps, in the next six months EPC and OEQ should develop a more robust set of performance measurements. They should also spend a more time on the targets to ensure the action steps are the right ones to move the city closer to meeting these targets.

¹⁶See cross cutting strategy No. 7: "Create a city-wide civic sustainability information and education strategy that engages schools, nonprofit and community based/neighborhood organizations in eco city initiatives and sustainability practices through a variety of communication and outreach activities (e.g., eco city cafes, summits, open houses, blogs, web sites, etc)."

V. Appendices

- **Appendix 1: Consolidated list of targets**
- **Appendix 2: Timeline of community events**
- **Appendix 3: Matrix of existing and adopted city plans.**
- **Appendix 4: Glossary of terms**

principle

Chapter 1: Transportation

Encourage modes of transportation that reduce dependence upon the private automobile by promoting mass transit and pedestrian- and bike-friendly transportation networks. The city will integrate transportation options with land use decisions in order to ensure a healthy environment while continuing economic growth.

Targets

By 2020:

- Beginning in 2012, reduce the number of daily Vehicle Miles Traveled (VMTs) on a per capita basis by 5% every five years.
- Increase the number of commuters who use public transportation by 25% using 2000 Census data as the baseline.

By 2030:

- Create three high capacity transit corridors as set forth in the 2008 Transportation Master Plan.
- Increase the number of non-single occupant vehicle (SOV) commuting trips to 50%.

Goal 1:

Move aggressively toward a culture of city streets that puts "people first" by implementing development and transportation projects consistent with the following level of precedence: pedestrians, bicyclists, public transportation, shared motor vehicles, and private motor vehicles.

Short-Term Actions (2009 – 2011)

- Implement actions outlined within the following completed plans: Transportation Master Plan, Bicycle and Pedestrian Mobility Plan, and An Environment for a Healthier Alexandria, and treat these actions as high priorities. The City will take advantage of all potential funding sources, in particular following through with the improvements listed in the Congestion Mitigation and Air Quality Improvement Program and the Regional Surface Transportation Program.*
- Pass a resolution adopting the principles of Complete Streets (as recommended by the Transportation Master Plan) and Low Impact Development in road projects wherever practicable.
- Continue to conduct audits of the streetscape to improve safety for vehicles, pedestrians, and cyclists, and remove street clutter that contributes to the causes of accidents.*
- Continue to improve facilities for cyclists by*:
 - o Adding 2 miles of bikeways annually and piloting innovative projects on an annual basis as outlined in the Transportation Master Plan;
 - o Conducting a feasibility study for a bike sharing program; and
 - o Increasing bike storage and bike parking as outlined in the Transportation Master Plan, and continuing to offer temporary bicycle parking at special events.

Mid-Term Actions (2012 – 2020)

- Complete the capital projects contained in the Transportation Master Plan that refer to pedestrians and cyclists, such as:
 - o Complete the Shared Path Network by 2020;
 - o Complete the Bike Network by 2020; and
 - o Offer safety lessons for cycling and walking to all school age children by 2012.
- Continue to increase the number of commuters using mass transportation and increase by 25% using 2000 Census data of the numbers of commuters taking public transport by 2020.
- Provide an efficient network of express bus routes that take commuters to their destinations in a travel time that does not exceed 125% of the time traveled in a SOV.
- Implement the Complete Street principles, including green infrastructure, when improving roads in the city, where practicable.

Long-Term Actions (2021 – 2030)

- Be prepared to implement a new transportation system that better addresses travel patterns of residents, commuters, and visitors.

Goal 2:

Educate individuals and organizations on the availability of transportation alternatives that will reduce dependency on single occupancy vehicles.

Short-Term Actions (2009 – 2011)

- Continue, expand, or implement current transportation and bike pedestrian education programs, such as*:
 - o Programs that encourage children to walk or cycle to school;
 - o Cycling proficiency program with a test for all school age youth; and
 - o Local Motion workshops and other related transportation demand management programs.
- Meet with local associations—residential and commercial—to discuss and promote the merits of reduced dependency on private vehicles.*
- Use existing informational tools, such as Local Motion, Alexandria eNews, FYI Alexandria, local media, the EPC, and other organizations to promote the benefits of transportation alternatives.*

*Denotes actions already underway

Goal 3:

Improve and expand an integrated rapid transportation system that includes intercity passenger rail, heavy rail, trolleys, streetcars, and buses.

Short-Term Actions (2009 – 2011)

- Continue to improve the experience of current and potential transit users by*:
 - Continuing the development and deployment of transit information technologies and the eventual coordination of these systems with other regional service providers to provide a seamless delivery to users;
 - Undertaking a study of rapid transit needs across the city; and
 - Improving access to transit by requiring all new buses added to the DASH Bus fleet to have bicycle racks.

Mid Term Actions (2012 – 2020)

- Retrofit all existing DASH buses with bike racks.
- Implement a real-time information system for buses.
- Study the design of circulator bus routes and interlinking local routes to maximize efficiency and reduce wait times.
- Develop a DASH policy that requires all new buses to be low emission, hybrid, or CNG vehicles.
- Explore the feasibility of constructing a street car line that would connect to Arlington and serve the Beauregard Street corridor.
- Create a fully integrated public transport information system accessible across the normal range of digital media, to be in place by 2015.
- Establish one rapid transit route in operation by 2012 and a further two routes in use by 2017, thereby meeting the need for three routes as expressed in the Transportation Master Plan.
- Add a Metrorail station to the Potomac Yard development by the time occupancy of the development reaches 70%.
- Develop plans to have the rapid transit routes converted to zero emission vehicles by 2020.
- By 2012, develop benchmarks and baselines to achieve Transportation Master Plan goals, especially ways to assess VMTs, SOV usage, and commuter journey modes.
- By 2012, create a plan with financial incentives and disincentives designed to deter single occupancy vehicle trips, and monitor the plan's effects.
- Review the Transportation Master Plan every three years and revise as necessary in order to anticipate changing transportation needs and react in a timely manner.

Long-Term Actions (2021 – 2030)

- Plan and implement an intelligent mix of transport styles to encourage residents, workers, and tourists to use alternative transportation. Develop regional control centers to monitor the flow and volume rate of vehicles.
- Coordinate with key stakeholders to accommodate the increase in freight and high-speed passenger rail.

Goal 4:

Develop a city-wide environmentally sustainable comprehensive parking strategy.

Mid-Term Actions (2012 – 2020)

- Implement the King Street Retail Area recommendations for parking without sacrificing environmental principles.
- Reduce parking ratios and encourage shared parking.
- Encourage people who work in Alexandria to use alternative modes of transportation by developing incentives and disincentives that discourage employee parking (e.g., eliminating monthly parking subsidies, prohibiting retail employees to park long term at parking meters).
- Use green infrastructure techniques in the new comprehensive parking strategy.¹

Long-Term Actions (2021 – 2030)

- Support the King Street trolley and other alternative modes of moving people into the historic and retail districts easily and quickly.

¹ Cross reference Landuse and Green Building sections

^{*} Denotes actions already underway

principle

Chapter 2: Green Building

Alexandria's government, businesses, and citizens impact our environment through the choices they make when renovating existing structures and constructing new ones. These choices manifest themselves in the quantity and types of energy we use, the impact we have on our water quality, the amount of waste we create, the amount and quality of green space available to us, and our public health.

Targets

By 2020:

- All new buildings to achieve LEED Gold standards.
- 60% of all existing buildings achieve a 20% energy consumption reduction.

By 2025:

- Existing City buildings in the aggregate are 25% more energy efficient.
- All new buildings will achieve LEED Platinum standards.

By 2030:

- All new buildings will be carbon neutral.

Goal 1:

Building on the City's Green Building Policy, all development, either new or renovation, should be constructed with the lowest ecological impact as is reasonably practical by advancing energy-efficient green construction, sustainable building location, site design, and emerging technologies.

Short-Term Actions (2009-2011)

- Establish and promote green building standards for new commercial and residential development. Use nationally recognized criteria, such as those of the Leadership in Energy and Environmental Design (LEED) in establishing such standards.*
- Pursue conformance with green building standards as part of the Development Special Use Permit process.
- Provide green building and site design education and training to development staff in appropriate City departments.
- Arrange for Plan Review staff to receive certification in at least one nationally recognized green building standard.

Mid-Term Actions (2012-2020)

- Develop a green building policy for retrofitting all existing buildings, including residences and buildings in historic districts. Use nationally recognized criteria, such as those of the Leadership in Energy and Environmental Design (LEED), the Passive House Institute US, and the Environmental Protection Agency's ENERGY STAR criteria, in establishing such standards.
- Initiate a pilot study to look at ways renovations can be undertaken in a sustainable way, noting the special needs of property in a historic district.
- Establish low impact development guidelines and ensure that new buildings meet these guidelines, where appropriate. Consider the impact of maintenance and public funding issues in applying such policies.
- Require that all property owners provide full energy audit results at time of sale or legal transfer of the property.
- Develop incentives for energy conservation through tax policy, fees, and green funding.
- Require all new buildings to incorporate alternative energy systems (e.g., wind, solar) on the roof, consistent with the building design, or otherwise ensure that each rooftop maximizes its productive space (e.g., green infrastructure, green roofs, and urban agriculture) by 2020.

Long-Term Actions (2021-2030)

- Require all new construction by 2030 to be carbon neutral.
- Upgrade all existing City buildings to be 25% more efficient by 2025.
- Require that when seeking to replace existing roofs property owners either integrate alternative energy systems into the space or otherwise ensure that each rooftop maximizes its productive space (e.g., green roofs or urban agriculture) by 2030.
- Require that when property owners are retrofitting surface parking lots, they maximize its productive space (e.g., green infrastructure) by 2030.
- Encourage universal design standards for buildings and homes to accommodate persons with disabilities and facilitate aging in place.

Goal 2:

Expedite the Commonwealth's adoption of further green building standards/building codes and expansion of local government authority to adopt green building ordinances, programs, and policies.

Short Term Actions (2009-2011)

- Request the Commonwealth's adoption of the latest International Code Council (ICC) Building Code amendments (which include elements to increase energy conservation measures) by 2011.
- Identify and encourage enhanced green building measures that may be added to the next Virginia State Amendments to the ICC Building Code.

^aDenotes actions already underway

Mid-Term Actions (2012-2020)

- Seek local authority to adopt additional green building regulations and require energy efficient technologies such as smart metering technology and energy audits at time of sale or legal transfer.

Goal 3:

Promote green building practices, share information and provide educational, technical, and financial assistance to the building industry, businesses, and residents.

Short-Term Actions (2009-2011)

- Identify a local non-profit that can provide green building information and technical assistance to citizens.
- Incorporate information and technical assistance into existing city programs and processes.

Mid-Term Actions (2012-2020)

- Encourage the installation of the latest smart metering technology by offering incentives and technical assistance.
- Encourage design teams for all new development to include a professional experienced in sustainable development practices at the start of the project and throughout design and construction.
- Create a Green Building Clearinghouse that provides educational, financial, and technical assistance regarding green building practices.
- Create a fund for residents and businesses to provide low-interest loans for green renovations.
- Use the City's buying power to get volume discounts on green building materials for residents and businesses.

Goal 4:

The City will lead by example in green building practices.

Short-Term Actions (2009-2011)

- All new construction and renovation of City buildings, where feasible, will meet a LEED Silver rating or performance-based standards such as those of the Passive House Institute US, as a minimum.
- Identify a potential demonstration project for the City to achieve LEED Platinum status.
- Conduct a feasibility study to install, in phases, a green roof on City Hall.*
- Encourage city-wide support for the conservation and improvement of the city's existing built resources while maintaining the unique character of the city's districts.*

Mid-Term Actions (2012-2020)

- All new construction and renovation of City buildings, where feasible, meet a LEED Gold, passive house rating, or equivalent standard.
- Conduct training sessions with boards and commissions whose mission involves building and construction (Planning Commission, Board of Zoning Appeals, Boards of Architectural Review) regarding green building requirements, technology and sustainability.

*Denotes actions already underway

principle

Chapter 3: Air Quality

Alexandria faces significant challenges in improving outdoor air quality including those presented by emissions from vehicles, older industrial facilities, and the regional transport of air pollution. Given that one in eight city residents has a respiratory illness, the city should influence and control emission sources in a manner that reflects the choices and wishes of the community.

Targets

- Reduce fugitive emissions from the ash loading operations at Mirant Potomac River Generating Facility by 25% and coal yard operations by 20% by 2011.
- Reduce stack PM emissions at Mirant Potomac River Generating Station by a minimum of 20% by 2013.

Goal 1:

Maintain and continue efforts to obtain tangible air quality improvements with the overall goal of compliance with National Ambient Air Quality Standard (NAAQS).

Short-Term Actions (2009 – 2011)

- Continue efforts to comply with all NAAQS to reduce exposure to ambient air pollution.*
- Continue existing compliance efforts with major point sources to reduce air pollution in Alexandria.*
- Produce an easy-to-read publication (including maps and GIS tools) that detail existing emission inventory data on stationary source emissions in the city.*
- Continue and expand education for city staff in the use of City vehicles and equipment by establishing an Air Quality Action Day Plan for City operations.*
- Post "NO IDLING" educational signs at or near Metro or other drop-off locations such as schools and transportation hubs where idling is prevalent.

Mid- to Long Term-Actions (2011 – 2030)

- Continue to work with local, regional, state, and federal governments to improve air quality.
- Continue to expand, enhance, and implement the Transportation Master Plan with a focus on alternative transportation in order to reduce mobile emission sources.
- Continue operation of air pollution monitoring stations in the city and expand monitoring to include PM2.5.
- By 2015, provide real-time information to residents on ozone and PM on the City's website, where feasible.

Goal 2:

Reduce off-road/mobile emissions by promoting more environmentally efficient lawn care and construction equipment.

Short-Term Actions (2009 – 2011)

- Convene a work group of City staff and equipment providers/businesses to discuss the pending U.S. Environmental Protection Agency (EPA) regulation of two- and four-stroke engines, with a long term goal of banning the sale and use of gas-powered garden equipment.
- Educate citizens on the environmental impacts of old lawn/mobile equipment using existing city and community outreach activities and publications (e.g., FYI, web sites, civic association newsletters, etc.).

Mid-Term Actions (2012 – 2020)

- Examine the feasibility of implementing a residential financial incentive program to support the replacement of gas-powered lawn mowers and other lawn care equipment.²

GOAL 3:

Engage stakeholders in air quality management efforts.

Mid- to Long-Term Actions (2012 – 2030)

- Expand the City's Air Quality Action Day program by establishing an educational outreach package for local businesses.
- Expand and enhance outreach to the community on the implications of poor air quality and actions that can be taken to mitigate the hazards thereof.
- Partner with the Alexandria schools to incorporate the topic of air quality, such as the Clean Air Partner's On the Air education program, into the curriculum.

² Also See Implementation Goal 3.

*Denotes actions already underway

GOAL 4:

Promote and support high mileage/low emissions vehicles to reduce emissions and improve local air quality.

Short-Term Actions (2009 – 2011)

- Encourage the development of a Green Taxi fleet by setting tight miles per gallon standards for new vehicles.

Mid-to Long-Term Actions (2012 – 2030)

- Promote and support state and federal regulations and standards related to National Ambient Air Quality Standards and emissions.
- Expand the City biodiesel purchase program to include other alternative fuels.
- Provide incentives to residents who purchase zero emission vehicles.
- Partner with the U.S. Department of Energy's Clean Cities Program to adopt community-wide practices that contribute to the reduction of petroleum consumption.
- Identify and apply for grants to retrofit diesel-powered vehicles and construction equipment.
- Promote new infrastructure to support zero or low emission vehicles, such as hydrogen, electric, or plug-in hybrids.³

³ Also see Energy Goal 5.

⁴ Denotes actions already underway

principle

Chapter 4: Water Resources

Alexandria's past, present, and future are indelibly linked to the Potomac River and the quality of life the river sustains. Water quality in Alexandria will be managed in a sustainable manner consistent with good stewardship of the local streams, the Potomac River and the Chesapeake Bay for the public health, ecological, and recreational benefit of current and future generations.

Targets

By 2010:

- Obtain a funded OEQ outreach position to manage MS4 and Eco-City outreach.

By 2015:

- Establish mechanism for long-term dedicated funding for the purpose of maintaining and improving stormwater infrastructure by 2013.
- Complete Cameron Run Master Plan.
- By 2015, reduce per-capita water consumption by 10%, as estimated from wastewater volume conveyed from the city to its treatment facilities.

By 2020:

- Complete 90% of the in-stream portion of the Four Mile Run Master Plan.
- Retrofit 70% of feasible City facilities with BMPs and explore water reuse operations.

By 2030:

- Retrofit 100% of feasible City facilities with BMPs.

Goal 1:

Enhance the ecological integrity of waterways and promote citizen awareness of water quality and resource issues, particularly with regard to regulatory requirements of the Municipal Separate Storm Sewer System (MS4) permit.

Short-Term Actions (2009 – 2011)

- Continue compliance with Commonwealth and Federal statutes, and continue to improve the City's Municipal Separate Storm Sewer System (MS4).
- Establish a citizen stream monitoring and clean-up program, and encourage active participation by Alexandria City Public Schools (ACPS).
- Promote best management practices (BMPs) for stormwater through workshops (e.g., rain barrels, rain gardens, proper application of fertilizers and pesticides) and demonstrations (e.g., "water wise" garden tours, increased access to green roofs).*

*Denotes actions already underway

Mid-Term & Long-Term Actions (2012-2030)

- Continue to work in cooperation with neighboring jurisdictions to achieve and maintain water quality standards in our streams.
- Restore and stabilize stream banks of all urban streams to promote healthy habitat, biotic integrity, and to minimize erosion.
- Engage citizens to assist in the improvement of riparian buffers through continued efforts toward invasive species eradication and enhanced planting programs.
- Preserve, protect, and enhance existing wetlands in the city.
- Fund and complete implementation of Four Mile Run Master Plan and demonstration project.
- Implement the Cameron Run/Holmes Run feasibility study to improve biotic integrity and water quality.
- Continue and expand water quality education of citizens by providing information via the City's website, radio, television, and signage at park entrances where visitors are anticipated to have direct contact with Alexandria waterways.

Goal 2:

Maintain and enhance stormwater and sanitary infrastructure and stream systems to minimize environmental degradation.

Short Term Actions (2009 – 2011)

- Continue identifying sewer separation opportunities through the Area Reduction Plan.*
- Support and provide information to the Stormwater Working Group in seeking mechanisms to finance infrastructure improvements.*
- Continue stream stabilization and restoration efforts (Cameron Run/Holmes Run Watershed Feasibility Study, Four Mile Run Master Plan and Demonstration Project, Strawberry Run Stream Restoration) and complete programs to improve water quality (e.g., bioretention area retrofits) and quantity reduction capabilities (e.g., Cora Kelly Green Roof).*

Mid-Term and Long-Term Actions (2012-2030)

- Establish long-term dedicated funding mechanisms such as storm water utility fees or other taxes to improve and maintain stormwater infrastructure.⁴
- Update the flood management program to take into account anticipated rises in Potomac River levels and the increased intensity of storm-related flooding due to climate change impacts.⁴
- Develop and fund city-wide efforts for floatable controls, including education, outreach, and infrastructure controls.
- Retrofit all City facilities with stormwater BMPs.
- Fund and implement the Four Mile Run Master Plan and demonstration project and continue implementation of Cameron Run/Holmes Run feasibility study to maintain flood protection infrastructure.
- Reduce the amount of sewage discharged into the Potomac River by a public awareness campaign to encourage recreational boat owners to use the sewage pump-outs located at the marinas in the city and through inspection by the Health Department.

Goal 3:

Promote, require, and invest in water conservation infrastructure by updating residential, commercial and industrial water infrastructure and improving public outreach to promote efficient use of available water resources.

Short Term Actions (2009-2011)

- Focus water conservation outreach and homeowner incentives in areas served by combined sewer systems.
- Explore a reclaimed water reuse partnership between the City and Alexandria Sanitation Authority.*

⁴ Also see Implementation Goal 3.

⁵ Also see Climate Change Goal 4.

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Explore requiring water conservation measures beyond those required by the current code.
- Identify and remove barriers to policy formation and code revisions to facilitate installation and approval of water reclamation techniques as part of development, redevelopment, and retrofit projects.
- Identify candidate City buildings for a gray water demonstration project. Begin incorporating rain harvesting and gray water use into future development, redevelopment, and retrofit projects.
- Educate businesses that have intensive water use about retrofit opportunities and require upgrades to water recycling or other conservation technologies through the SUP process.
- Collect statistics and track per capita water use and develop long-term conservation targets.
- Promote individual water conservation opportunities through incentives, disincentives (i.e., rebates and taxes), and outreach to the general public (e.g., EPA's Water-Sense Program).
- By 2012, the Alexandria Health Department and the Office of Building and Fire Code Administration should work together to produce a guidance document for architects and engineers on what requirements must be met in order to construct a building employing water recycling technologies.

Long-Term Actions (2021-2030)

- Retrofit at least five City-owned buildings with a gray water recycling system or another recycling system.
- Explore, with the Alexandria Sanitation Authority, the technical and economic feasibility of using reclaimed wastewater from Alexandria's sewage treatment plant for irrigation of some of the larger open spaces in the city.

Goal 4:

Eliminate the harmful impact of the combined sewer systems in the long-term, and minimize them in the short term.

Short-Term Actions (2009-2011)

- Continue to comply with Virginia Pollutant Discharge Elimination Permit (VPDES) for CSO discharges.
- Continue to be proactive in enhancing efforts to continue to implement the Area Reduction Plan.

Mid-Term & Long-Term Actions (2012-2030)

- As development occurs in areas served by combined sewers, require developers of new buildings to build separate sanitary sewer and stormwater infrastructure as a condition of development approval.
- Study the effectiveness of overflow storage, low-impact development, and sewer separation to achieve federal CSO requirements and incorporate any of these methods into the City's CSO eliminations strategy determined to be cost-effective.
- Study funding options for the City's CSO elimination strategy, including State revolving funds.
- Optimize waterfront development opportunities and address the need for adaptation to global climate change.

principle

Chapter 5: Environment and Health

Sustainability is not just about the health of the earth; it is also about human health. Indoor and outdoor air quality, water quality, land use planning, transportation, toxic chemical exposure, noise and light pollution, food safety and accessibility, vector control, and the safety and habitability of buildings directly impact human health and the natural environment.

Targets

By 2012:

- 95% of the restaurants in Alexandria will be totally smoke-free.

By 2020:

- 80% of the workplaces in Alexandria employing more than 25 persons will be totally smoke-free.

By 2025:

- 50% of the restaurants and grocery stores in Alexandria will qualify for designation as eco-friendly restaurants or grocery stores.
- 50% of commercial buildings where more than 25 persons are employed will participate in the Healthy Work Places program.

By 2030:

- 25% of Alexandria children will walk or cycle to school
- Increase the number of non-single occupant vehicle (SOV) commuting trips to 50%.
- Reduce the percentage of Alexandria children and adults that are overweight or obese to less than 29%.
- Reduce the incidence of asthma in Alexandria by 50%.

Goal 1:

Promote respiratory health and improve indoor air quality in both new and existing residences by improving ventilation and reducing exposure to air contaminants including secondhand smoke, radon, lead, mold, and other contaminants.

Short-Term Actions (2009 – 2011)

- Further develop the Health Department's Respiratory Health Complaint Investigation Program by reassigning a portion of existing Environmental Health Division staff resources by September 2009, and including a budget supplement to meet the costs of FY 2010.*
- Educate citizens about potential threats of asbestos, mold, radon, second-hand smoke, lead and other indoor air contaminants. Include publications, and programs designed for non-English speakers. By December 2009, produce a handout aimed at individuals renovating their properties which advise them of these hazards.*
- By September 2010, gather better data on the incidence of respiratory illness in the city. The hospital and a local university's Masters of Public Health (MPH) program might help to gather this data. This data will be needed for the next Community Environmental Health Assessment, as part of the planned larger community health assessment that will end by 2011.

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Increase the Health Department's outreach efforts on respiratory health issues through:
 - An improved respiratory health website;
 - Outreach at community events; and
 - Distribution of information on respiratory health issues through school nurses, child care providers, pediatricians, physicians, and hospital emergency department nurses.
- Create a network of school nurses, child care providers, pediatricians, physicians, and hospital emergency department nurses that will refer adult asthmatics and the parents of asthmatic children to the Health Department for assistance in identifying asthma triggers in their homes.
- Improve the coordination of agencies dealing with respiratory health and housing issues through the City's Code Compliance Committee.
- Obtain grant funding to hire a respiratory health specialist and expand the Health Department's Respiratory Health Complaint Investigation Program into a proactive Healthy Homes program that can conduct environmental health assessments and provide small grants to low income residents for interventions to remove triggers for respiratory illness.

Long-Term Actions (2021-2030)

- Develop permanent, stable funding for the Healthy Homes Program to assure long-term progress on asthma and other respiratory illnesses.

Goal 2

Improve indoor air quality health, in both new and existing work places by improving ventilation and reducing exposure to air contaminants including organic solvents, secondhand smoke, lead, radon and mold to promote respiratory health.

Short-Term Actions (2009-2011)

- By FY 2010, , revise the Health Department regulations governing nail salons to put more emphasis on indoor air quality, including ventilation and reducing exposure to volatile organic compounds (VOCs).*
- By 2010, create a Smoke-Free Alexandria program through the Health Department and the Partnership for a Healthier Alexandria's Environmental Health Work Group that encourages restaurants and work places in the city to go completely smoke-free and recognizes those that do.*
- By 2011, reinstitute a smoke-free restaurant program (now called "Smoke-Free Alexandria") and increase the number of participating restaurants by 20 % over the number participating under the previous plan.*
- Continue to support state legislation to allow localities to completely ban smoking in bars, restaurants, and other public places.

Mid-Term Actions (2012-2020)

- Adopt a policy requiring the City to contract for meeting space, food, or catering services only from hotels and restaurants that are completely smoke-free.
- Promote the concept of smoke-free buildings at the DSUP/SUP stages of development or alteration of buildings.
- Discourage the use of building materials that that often contribute to indoor air quality problems such as the offgassing of volatile organic compounds (VOCs) that often contribute to indoor air quality problems.
 - o By 2012, transform the Smoke-Free Alexandria program into a voluntary Healthy Work Places program for employers in the city to promote respiratory health in the work place. This program would recognize workplaces that maintain a healthy work environment by adopting procedures that minimize indoor air pollutants and promote a healthy lifestyle for employees.

Long-Term Actions (2021-2030)

- Develop permanent, stable funding for the Healthy Work Places Program to assure long-term progress on asthma and other respiratory illnesses.

Goal 3:

In both ACPS and private schools and daycare facilities, promote respiratory health and improve indoor air quality by implementing EPA's Indoor Air Quality Tools for Schools or similar program.

Mid-Term Actions (2012-2020)

- By 2012, pilot the Indoor Air Quality Tools for Schools, or a similar program, in one school in the city.
- By 2020, implement the Indoor Air Quality Tools for Schools, or a similar program, in 50 % of the city's public schools.
- Conduct respiratory health outreach and indoor air quality assessments for private schools and daycare facilities.

Goal 4:

Encourage active, healthy lifestyles by providing safe opportunities to walk and cycle in order to reduce obesity and chronic diseases such as diabetes, heart disease, stroke, and respiratory disease.

Short-Term Actions (2009-2011)

- Implement the Bike and Pedestrian Mobility Plan, focusing on Safe Routes to School, improving pedestrian and bicycle infrastructure, and increasing the number of cyclists and pedestrians.*
- Work across City departments to develop a Pedestrian Design Guide to be issued by the City engineer in 2009.*

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Build community partnerships that promote regular outdoor physical activity such as walking or bicycling.
 - The City and its community partners should continue to apply for grant monies to work on marketing and educational programs that promote regular outdoor physical activity like walking and bicycling, including Safe Routes to School.
 - The Environmental Health Work Group of the Partnership for a Healthier Alexandria will coordinate with the Pedestrian Bicycle Coordinator to target bicycle and pedestrian education and safety promotion efforts.
- Encourage community access to open spaces and other recreational areas by:
 - Enhancing web-based and printed materials that include park, playground, bike and walking routes, and recreation center information.
 - Creating walking guides to Alexandria showcasing the city's flora and fauna, geology, green initiatives, history, etc.
- Improve community pedestrian and bike infrastructure to support increased recreational and transportation walking and biking by completing the implementation of the Bike and Pedestrian Mobility Plan.
- Create a "No Child Left Inside" program among ACPS, RPCA, and possibly even private Alexandria schools, to encourage and promote healthy lifestyles for Alexandria's youth and to foster lasting connections to the natural environment.
- Decrease the proportion of pedestrian and cyclist injuries and fatalities due to motor vehicles by:
 - Collaborating with ACPS to review the feasibility of adding a program to their driver's education curriculum that targets pedestrian and bicycle education efforts (such as Mobility Education - <http://www.mobilityeducation.org/>);
 - Installing more automated red light cameras to ticket motorists who are speeding or running red lights; and
 - Implementing aggressive and sustained enforcement of traffic laws and increasing public education efforts on bicycle and pedestrian safety.
- Increase the City's role as an advocate for public health by:
 - Including more health considerations and health specific language in planning documents;
 - Providing financial incentives to City employees that walk or bike to work;
 - Hiring a part-time employee to work on healthy lifestyle/built environment issues in the Health Department and in collaboration with the Department of Planning & Zoning by 2012.
 - Explore the potential for developing a simple environmental health impact assessment process which will assure that the relevant and potential human health issues related to vector control, water quality, air quality, food supply, toxic exposures, and the built environment are addressed in review of area development plans and special use permits.

Goal 5:

Educate citizens about and increase equitable access to safe, healthy, and organic food, particularly for children and pregnant women, and encourage local and regional food production.

Short-Term Actions (2009-2011)

- By FY 2010, create a food system resource map using a Geographic Information System to include existing stores, markets, restaurants, and other food related programs to direct future efforts to increase access to accessible food.*
- Explore opportunities to expand and promote farmers' markets, especially in low-income neighborhoods.

Mid-Term Actions (2012-2020)

- Continue to encourage the development of additional farmers' markets in the city on different days of the week and at different locations, especially near transit stops and with vendors offering safe organic products.
- Encourage farmers' markets to establish a system to accept WIC and food stamps to further the access of local, fresh produce to low-income residents.
- Create an outreach program to low-income residents that advertises the availability of fruits and vegetables, provides cost comparisons, and offers healthy recipes with in-season vegetables.
- Encourage the Cooperative Extension Service to hire a new extension agent for Alexandria who could:
 - o Teach residents about organic gardening and cooking with in-season vegetables;
 - o Teach residents about rooftop, raised bed, and container gardening;
 - o Increase participation in the Master Gardeners Program;
 - o Increase participation in the 4-H Club;
 - o Work with the schools to help develop "edible schoolyards"; and
 - o Work with preschools and childcare providers to develop "container gardens" or small-scale "edible school yards."
- Encourage ACP5 to use locally or regionally grown fruit and vegetables, whenever possible.
- Encourage local feeding programs (Meals On Wheels, ALIVE, Christ House, Salvation Army, Carpenter's Shelter, etc.) to use locally or regionally grown fruit and vegetables whenever possible, and encourage local farmers to donate foods to these programs.

Long-Term Actions (2021-2030)

- Increase the number of garden plots available in the city so that no one who applies for a garden plot is denied. These plots could be located on either City or private property and should be targeted for low-income areas.

*Denotes actions already underway

principle

Chapter 6: Energy

The quantity and sources of energy used by Alexandria's government, businesses and residents impact our environment and quality of life—whether it be through pollutants added to the air, negative effects on water quality or local contributions to climate change. Recognizing this, Alexandria commits to managing its energy—both the electricity that powers our buildings and homes and the fuel that powers our vehicles and other equipment.

Targets

By 2010:

- The City will purchase 5% of electricity needs through green certificates.

By 2015:

- Reduce the per capita energy use in Alexandria by 15%.
- Track energy use of 30% of multi-family residence units.

By 2020:

- 25% of the City's energy portfolio will consist of clean, renewable energy sources.

By 2025:

- Track energy use of 60% of multi-family residence units.

By 2030:

- 50% of the City's energy portfolio will consist of clean, renewable energy sources.
- Track energy use of 100% of multi-family residence units.

By 2050:

- 80% of the City's energy portfolio will consist of clean, renewable energy sources.

Goal 1:

Initiate an energy planning process to evaluate energy use needs and impacts within the city, and the effectiveness and return-on-investment of steps to reduce energy use and mitigate greenhouse gas emissions.

Short-Term Actions (2009 – 2011)

- In FY 2010 EPC, City staff, and other interested parties will convene workshops to identify issues and develop questions for a feasibility study on the potential for renewable power generation within the city. Speakers will include experts in engineering, law, and economics with experience in the potential and feasibility of renewable-powered local electricity generation networks.
- Determine the amount of energy that can be produced locally and sustainably by 2020 and 2030.
- The City government will initiate a process for establishing a City Energy Master Plan by 2010. City staff will conduct a scoping exercise that outlines and identifies boundaries of the plan focusing on household, business, and government energy use in the city, and is mindful of the targets adopted in the Commonwealth of Virginia 2007 Energy Plan and the 2008 Metropolitan Washington Council of Governments - National Capital Area (MWCOG-NCA) Climate Change Report.
- Identify energy reduction strategies through maximizing energy efficiency and conservation by 2020 and 2030.

Mid-Term Actions (2012-2020)

- Create and utilize an energy efficiency metric to ensure the City maximizes its return-on-investment with respect to measures designed to reduce energy consumption and greenhouse gas emissions.

Goal 2:

Reduce energy consumption through conservation and the adoption of more energy efficient technologies and practices by the City, its residents, and businesses.

Short-Term Actions (2009-2011)

- Direct City employees to regularly shut down their computers and other office equipment at the end of each workday.*
- Develop a checklist and other resources for homeowners and businesses to perform their own energy audits, aimed at quick and easy modifications that could yield significant reductions in energy usage.
- Limit the projected growth in all sectors of citywide energy use to 4% by 2011, and consider adopting the goals of Virginia's 2007 Energy Plan. Evaluate consistency with MWCOG Energy Strategic Plan.
- Lengthen the allowable payback period for the City's energy efficiency investments from 7 years to 15 years to be more consistent with the City's cost of capital, and increase funds for those investments for FY 2010 by \$50,000.
- The sedans or hybrids purchased by the city in 2009 will have an average city fuel economy 20% greater than Corporate Average Fuel Economy (CAFE) requirements.
- The City will partner with local vendors, experts, and others to promote the use of products and services that reduce energy use, such as drying racks, cold-water laundry detergent, and power strips. The City will seek to implement this objective by sponsoring awareness campaigns and reducing cost of adoption.

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Require that all property owners provide full energy audits at time of sale or legal transfer of the property.
- Establish tax incentives and financial support mechanisms to promote energy efficiency improvements and modifications for residential units and businesses.
- Conduct a feasibility study to establish a carbon tax designed to reduce energy consumption and greenhouse gas emissions.
- Require multi-family residential buildings to track and report monthly energy use in individual units.
- Build or retrofit at least one City office building to passive housing energy use standards.
- Create a City Fleet Management Plan (FMP) to minimize the emission of greenhouse gases and other pollutants from City-owned and operated vehicles, as well as construction and landscape care equipment. The FMP shall consider all emissions generated over the expected life of a vehicle.
- Coordinate with utility companies to provide customers with information comparing their consumption with average use across Alexandria by category (e.g., residences, offices, restaurants, etc).

Long-Term Actions (2021-2030)

- Update the Transportation Master Plan to achieve the goal of having 50% of all personal trips be by walking, bicycling, or public transport by 2030.

Goal 3:

The City's energy portfolio will be renewable and clean by 2050.

Short-Term Actions (2009-2011)

- In FY 2009 and 2010, the City will purchase 5% of its electricity needs through green certificates, which promote the use of renewable power.
- Purchase renewable energy credits generated for compliance with state-level renewable portfolio standard requirements equivalent to 6.5% of the City's operational needs in 2010 rising steadily to 20% in 2020.
- Use sustainable biodiesel for all of the City diesel fleet operations.

Mid - Long Term Actions (2012-2030)

- At least 50% of the City's energy portfolio will come from renewable and clean energy sources by 2020, and raise that percentage to at least 80% by 2030.

Goal 4:

Encourage the use of clean renewable energy resources, such as wind, geo-thermal, and solar, to reduce the City's carbon footprint.

Short-Term Actions (2009-2011)

- Develop information to be published on the Health Department's website about geothermal closed-loop heat pump wells by 2011.
- Provide information to the public regarding renewable energy resources through the City's website, flyers, etc.

Mid-Term Actions (2012-2020)

- Conduct a feasibility study for facilitating the establishment of infrastructure necessary for city distribution and use of clean renewable technology (e.g., smart grids, solar/wind-powered street lights, plug-in stations for electric cars, etc.).
- Establish building codes and property tax incentives to promote and regulate the development of green roofs, including use of roof space for reducing run-off, energy generation, energy efficiency, and gardening.⁶

Mid- and Long-Term Actions (2012-2030)

- Work with the Metropolitan Washington Council of Governments to develop and adopt plan to upgrade the region's electrical grid to support micro-generation.

⁶See also Building Green Goal 1.

*Denotes actions already underway

Goal 5:

Support interdepartmental planning and prioritization of energy management and investment activities.

Short-Term Actions (2009-2011)

- EPC will endorse the creation of the City's recently empanelled Energy Conservation Committee (ECC) as a model for promoting and instilling the principles of the Eco-City Charter, including the objective of interdepartmental cooperation and planning, in the pursuit of sustainability.*
- Through the City Manager's Office, make City Department participation and representation in the ECC mandatory in order to assure attainment of the energy goals of the Action Plan and the reduction of government expenditures on energy services.
- In FY2009 and FY2010, ECC will propose goals and activities for itself for the next 5 years and present these to the City Council. The goals should include plans for promoting energy conservation awareness and education of residents and business owners.
- In 2009, the City will conduct its plan for energy audits of a number of major City facilities across a variety of building types (recreational, managerial, public safety).
- ECC will conduct outreach to City staff to increase awareness of energy conservation strategies by educating building operators and occupants. All media forms will be used to ensure that all City staff are reached.*
- The City will use its website and other multimedia tools to advertise and describe the purpose of the ECC and its activities.

Mid-Term Actions (2012-2020)

- Conduct annual energy audits of major City buildings.

principle

Chapter 7: Land Use and Open Space

The City's land use and open space policies must harmonize its built and natural environments to ensure that growth does not jeopardize environmental sustainability and preserves Alexandria's character. The City's land use policies will accommodate increases in people and jobs through green development.

Targets

By 2015:

- Preserve and/or acquire the remaining 35 acres of open space to complete 100-acre goal of the Open Space Master Plan.
- Ensure that all plantings on City property are non-invasive and incorporate native Plants.
- Design and install a pedestrian bridge to link Arlington and Alexandria sides of Four Mile Run.

By 2020:

- Achieve 40% tree canopy coverage.

By 2030:

- Ensure that 25% percent of all Alexandria school children get to and from school by walking or riding bicycles.
- Ensure that 50% percent of Alexandrians commute to work by non-SOV means.
- Reuse the site of the coal-fired power plant.

Goal 1:

Continue to coordinate land use and site design decisions among City departments to ensure compatibility with existing City plans that promote walking, cycling, and taking public transportation.*

Short-Term Actions (2009-2011)

- Ensure that land use decisions incorporate smart growth principles that provide incentives and disincentives to reduce vehicle use and vehicle ownership.
- Incorporate, where feasible and appropriate, improvements to bike and pedestrian facilities into ongoing Small Area Plans to ensure compatibility with the Bike and Pedestrian Plan.*
- Continue to develop and approve Small Area Plans that increase density in and around Metro stations and other transportation hubs.*
- Promote more pedestrian, bike, and transit usage during land use planning of Alexandria's major thoroughfares, including Van Dorn Street and Beauregard Street.*
- Continue to incorporate retail streets and/or small-scale retail uses into neighborhood plans, where appropriate and feasible, to increase walking destinations and opportunities for small businesses.*

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Create self-sufficient neighborhoods by locating public, small-scale retail, and community facilities near the populations they serve and near public transit and other amenities to make their use more energy efficient.
- Develop incentives to encourage residents to live near their workplace.
- Promote more pedestrian and bike transportation features (e.g., underground parking, street front retail, and parking access behind buildings) in the land use planning for Alexandria's major thoroughfares, including Van Dorn, Duke, and Beauregard Streets, Eisenhower Avenue, and Route 1 planning efforts.
- Increase bike storage and bike parking in areas designated by the Transportation Master Plan as Bicycle Parking Priority Zones (e.g., near Metro stations, schools, high-density residential, and retail locations) and at special events.
- Complete City's current City Bikeway and Trail network through development review, grants, and CIP.
- Rethink ways to incorporate green economy/industry into planning process as a way to enhance economic sustainability and promote green jobs.
- Create benchmarks to measure achievement as to both qualitative and quantitative metrics, in the following areas:
 - o Creation of and enhancement of walkable streets, sidewalks, and non-SOV bicycle and pedestrian amenities and connections;
 - o Open space acquisition, preservation, and enhancement, including parks, community gathering places, privately owned open space, natural areas, trail connections and extensions, and crown coverage and habitat protection; and
 - o Amount of floor area planned for that is connected to walkable destinations, transportation, and community amenities.

Long-Term Actions (2021-2030)

- By 2030, reuse the site of the coal-fired power plant, imagining such possibilities as a renewable, clean energy generation facility, regional transit center for river-based transportation, open space, arts center, or other community-based function.

GOAL 2:

Ensure that all City development or redevelopment projects and all plans, policies, and ordinances regarding land use reflect the sustainability vision and principles of the Eco-City Charter.

Short-Term Actions (2009-2011)

- Devise a sustainability checklist based on criteria and principles from the Eco-City Charter that Planning & Zoning can use in determining the compatibility of Small Area Plans and new development and redevelopment projects.
- Prepare GIS maps to identify safest routes for children to walk to their schools, supporting the Walking School Bus Concept.
- Incorporate open and green space and sustainability standards, where appropriate (e.g., LEED, Sustainable Sites criteria, Low Impact Development principles) into Small Area Plans and the City's Green Building Policies.

Mid-Term Actions (2012-2020)

- Revise City's Strategic Plan and any future revision of City's Master Plan to incorporate sustainability principles of Eco-City Charter and Environmental Action Plan as requirements for all land use decisions.
- Implement the recommendations of adopted plans:
 - Small Area Plans
 - Transportation Master Plan
 - Open Space Master Plan
 - Urban Forestry Plan (proposed for adoption June 2009)
 - Economic Sustainability Report
- Ensure that newly adopted and revised Small Area Plans, and new development and redevelopment projects are consistent with the vision and principles of the Eco-City Charter and Environmental Action Plan.
- Review existing City policies, guidance, ordinances, and codes, including parking regulations, to eliminate conflicts and enhance opportunities to further the goals of sustainability.

*Denotes actions already underway

GOAL 3:

Protect and enhance Alexandria's open space and green infrastructure including wildlife habitat, parks, trails, tree canopy, and watersheds. Incorporate the natural environment into the built environment.

Short-Term Actions (2009-2011)

- Finalize and release the Urban Forestry Master Plan. Develop a multi-year action and funding plan to implement Plan recommendations.*
- Explore a policy that expands and supplements current tree canopy coverage standards through a combination of incentives, regulations, and in-lieu fees.
- The City will lead by example by utilizing low impact landscape practices where possible, such as perennial and native plant species, rain gardens, reduced fertilizer and pesticide usage, and encouraging the removal of invasive species.*
- Continue work on completing a GIS inventory of trees located in public rights of way and other public lands, and identify locations for new trees.*
- Promote and expand Living Landscape Fund to include "Adopt-a-Tree," "Celebration Tree," and/or other similar program activities, where individuals or organizations can purchase trees through the City and have them planted and maintained throughout the city.
- Continue to design and develop shaded parking lots through existing Special Use Permit/Development Special Use Permit process; expand to include the retrofitting of existing parking lots.*
- Identify potential locations to establish new school and community gardens.
- Set minimum standards for open space and green space in Small Area Plans and other City plans that can be met in part through green roofs, green decks over underground parking, or green surface lots.*
- Continue progress on protecting the 35 remaining acres, through acquisitions, easements, and dedications, to achieve the City's 100-acre open space goal.*
- Continue the Open Space Pocket Park program with the design and implementation of pocket parks on East Del Ray Avenue and South Early Street.*
- Continue progress on Four Mile Run Restoration Master Plan by completing the design competition for the Four Mile run pedestrian Bridge, finalizing the design guidelines and redeveloping the recently-acquired Four Mile Run open space properties in accordance with relevant area plans.*

Mid-Term Actions (2012-2020)

- Continue implementing the Urban Forestry Plan.
- Achieve 40% crown coverage in the city by 2020.
- Seek authority to require all new developments, including single family homes, to provide 40% crown coverage on site. Require no less than 40% crown cover when sites are developed or redeveloped, within these parameters:
 - When trees are cleared from a site, increase replacement requirement for removal of large caliper trees.
 - Change crown coverage assumptions in City requirements to reduce the credit allocated for younger, smaller trees.
 - Set a minimum amount of the total crown coverage to be achieved through on-site trees and require payment to Living Landscape Fund for failure to achieve full requirement.
- Work with community partners to add 500 street trees a year throughout the city to achieve full street tree stocking levels by 2020.
- Develop an appropriate standard, planting program, and areas for street trees, as with an underground trench; and replace existing street trees as needed to ensure their long-term viability throughout the city.
- Expand urban forestry training to residents and designate more “Tree Stewards” to maintain street trees.
- Expand the Living Landscape Fund to provide for maintenance, infrastructure, shrubs, and other landscaping.
- Update the City’s trails map, identifying existing trails and proposing additional trail connections and extensions.
- Research, develop, and implement green infrastructure policies, guidelines, and regulations. Fund green infrastructure as part of City’s capital expenditures.
- Complete a survey of native vegetation within city (“Alexandria Flora Project”) and promote project and results on City’s web site.
- Design and install a pedestrian bridge linking Arlington and Alexandria sides of Four Mile Run by 2015.
- Complete the implementation of the City’s current Open Space Master Plan, including protecting the 35 remaining acres, through acquisitions, easements, and dedications, to achieve the City’s 100-acre open space goal by 2013.
- Develop a goal for acquiring and/or protecting additional green space (after achieving the first 100 acres), consistent with the Open Space Master Plan and with guidance from the Open Space Advisory Group.
- By 2015, ensure that all plantings by Recreation, Parks, and Cultural Activities Department (RPCA) are non-invasive, flood- and drought-tolerant, 80% perennial plants, and that native plants are used wherever possible.
- Work with Alexandria schools and RPCA to design and implement expansion of community-and school-based gardens by maximizing conversion of unused open space on public property to habitat enhancement and increase in availability of edible gardens.

*Denotes actions already underway

Long-Term Actions (2021-2030)

- Conduct an analysis of the city's resource-carrying capacity.
- Ban the sale of invasive plants within the city based on the Virginia Department of Conservation and Recreation list of invasive species.

Goal 4:

Ensure that future land use and open space planning and project decisions will not create or perpetuate social injustice, nor compromise the City's historic character.

Short-Term Actions (2009-2011)

- Continue to ensure representation and participation by affected groups in the Master Plan and Small Area Planning processes. Continue outreach efforts to engage low income and minority residents in land development project decisions within their neighborhood.*
- Continue to identify opportunities for affordable housing and mixed income housing in Small Area Plans throughout the city.*
- Ensure that mixed income development incorporates spaces for on- or near-site community support services (e.g., child care), where feasible and appropriate.*
- Continue to consider the importance of location of open space and public transportation to potential mixed income sites when preparing Small Area Plans or reviewing development projects.*
- Incorporate sensitivity for the city's historical character, properties, landmarks, and archeological endeavors in planning decisions.*

Mid-Term Actions (2012-2020)

- Encourage universal design standards for buildings and homes to accommodate persons with disabilities and facilitate aging in place.⁷

Goal 5:

Conduct outreach and education on sustainable land use practices, policies, and programs.

Short-Term Actions (2009-2011)

- Provide ongoing training, seminars, and workshops for City staff and residents about sustainable land use practices, policies, and programs, and identify and publicize existing learning opportunities available through local colleges, universities, and other sources.

Mid-Term Actions (2012-2020)

- Support public outreach and education on Smart Growth, especially the benefits of increased density, car-free forms of transport, green buildings, resource conservation, and local power generation. The outreach plan should include citywide strategies and neighborhood-scale activities.

⁷ Also see Building Green Goal 1.

* Denotes actions already underway

principle

Chapter 8: Solid Waste

Recognizing that managing waste is a public health issue as well as a quality of life issue, Alexandria will maintain its well-preserved public image by managing, handling, and disposing of solid waste in an environmentally sustainable manner. Alexandria will manage waste as a hierarchy of uses....

- PRIORITY ONE: REDUCE
- PRIORITY TWO: REUSE
- PRIORITY THREE: RECYCLE
- PRIORITY FOUR: RESOURCE RECOVERY (E.G., CONVERT TO ENERGY, COMPOSTING, ETC.)
- PRIORITY FIVE: PROPER DISPOSAL

Targets

By 2020:

- Exceed the goal of 35% diversion through increased waste reduction and reuse.
- Increase the recycling rate to achieve a goal of 50%.

Goal 1:

Exceed the City's goal of 35% diversion through increased waste reduction and reuse by 2020.

Short-Term Actions (2009-2011)

- Discourage the use of bottled water in City facilities and at City functions.
- Encourage the Chamber of Commerce to work with local businesses to discourage the use of plastic or "one-use" bags and encourage the use of reusable bags as part of the "Proud to be a Green Business" initiative.
- Promote and educate the building industry about the need to recycle material recovered from construction and demolition sites by including information on how and where to recycle materials in all permit applications by 2010.

Mid-Term Actions (2012-2020)

- Conduct a feasibility study to implement a pilot "bag-n-tag" program or similar "pay as you throw" program to incentivize waste stream reduction, recycling and diversion.
- Provide citizens with a contract template or other materials to help citizens choose contractors or private businesses that reduce the amount of building and construction material waste and maximize the reuse of the materials.

Long-Term Actions (2021-2030)

- Develop a program to require the recycling of construction and demolition (C&D) debris.

*Denotes actions already underway

Goal 2:

Increase the recycling rate to achieve a goal of 50% by 2020.

Short-Term Actions (2009-2011)

- Expand the number and type of materials collected in the recycling curbside program (e.g. plastic tubs, aluminum foil/trays, empty aerosol cans, and rigid plastics).
- Expand the multi-family (including condominiums and rental apartment complexes) recycling program by mandating recycling at commercial and multi-family developments. Change the enforcement ordinance/code to give the City the authority to fine property owners and managers for noncompliance with existing and new recycling requirements, as recommended by the Solid Waste Management Plan.
- Increase recycling in City-run facilities and educate City employees about this effort. Require compliance of all City-run facilities with new and existing recycling requirements. A pilot program in City Hall will be initiated and retrofit containers will be used as recycling bins in the parking facility. When the recycling contract is renegotiated in 2009, all City-run facilities will be covered.

Mid-Term Actions (2012-2020)

- Develop an Adopt-a-Building recycling program for commercial and multi-family buildings.
- Require recycling at publicly and privately sponsored community events as a condition of Special Events permit.
- Establish penalties for businesses and multi-family dwellings that fail to meet recycling requirements.

Long-Term Actions (2021-2030)

- Mandate, through permitting or code enforcement, that all Alexandria businesses implement a recycling program and report their progress to the City.
- Work with "Green Business" initiative to recognize those businesses with highest recycling rates with awards. Promote "Green Businesses" on the City website or other promotional materials.
- Study the feasibility of requiring all city events requiring a Special Events permit to be zero-waste events.

Goal 3:

Increase the diversion of compostable solid waste from disposal by improving and expanding the City's existing compostable waste recycling program.

Short-Term Actions (2009-2011)

- Promote residential composting and grass-cycling through a partnership with Community Gardens, Master Gardeners, Virginia Cooperative Extension, expansion of composting workshops, and hosting a video on composting on the City's Solid Waste web page.
- Support and promote initiatives, such as "Proud to be Green Businesses," to encourage composting of food waste by commercial entities.

Mid-Term Actions (2012-2020)

- Coordinate with neighboring jurisdictions to study the feasibility of waste facilities closer than Hagerstown, MD with the goal of implementing a curbside compostable waste recycling program.⁸

Long-Term Actions (2021-2030)

- Expand residential curbside collection of compostable landscaping waste to eliminate bagged landscaping waste.

Goal 4:

Develop an outreach strategy to educate the public on new and existing recycling mandates through multiple communication and education strategies.

Short-Term Actions (2009-2011)

- Develop and launch a recycling education poster campaign at Metro stations and DASH buses and bus stops.
- Hire a full-time recycling coordinator to manage the commercial and multi-family recycling program, and to assist property owners and managers with implementation.
- Expand the City's Solid Waste webpage and provide printable materials to educate residents on recycling programs.
- Utilize the Volunteer Bureau and other resources to solicit volunteers to help with waste reduction outreach at Alexandria City Public Schools (ACPS) and businesses.

Mid-Term Actions (2012-2020)

- Promote the hierarchy of reduce, reuse, and recycle to residential and business sectors.
- Expand outreach to schools and multi-family dwellings regarding the implementation of reduce, reuse, recycling programs, and proper disposal of household hazardous waste.

Goal 5:

Maintain programs for ensuring that solid wastes are managed in accordance with federal and state laws and regulations in a manner that protects health, safety and the environment.

Short-Term Actions (2009-2011)

- Expand the drop-off hours for electronic and household hazardous waste to reduce the materials contributing to the toxicity of the waste stream, and produce educational materials (with an emphasis on modern light sources that contain mercury) that stress the importance of using this facility and other methods of hazardous waste disposal.
- Utilize mapping (e.g., Geographic Information Systems (GIS)) technology to optimize trash truck routing, thereby reducing fuel costs without impacting the level of service.

⁸See also Implementation Goal 6.

^{*}Denotes actions already underway

Mid- and Long-Term Actions (2012-2030)

- Examine the feasibility of collecting household hazardous waste and electronic waste as part of curb-side collection.
- Conduct outreach to citizens on ways to reduce the use of hazardous products and provide information on proper disposal of household hazardous waste and electronic waste.
- Evaluate alternatives for long-term options for the disposal of solid waste.

principle

Chapter 9: Global Climate Change and Other Emerging Threats

Alexandria must be adaptive and responsive to emerging or unforeseen environmental threats – such as climate change – that could strain infrastructure, deplete natural resources, disrupt the economy, or threaten public health. Failure to respond quickly and appropriately to such threats will likely have severe consequences for the health and economy of Alexandria and its citizens.

Targets

By 2012:

- Reduce Business As Usual (BAU)⁹ emissions by 10% below 2012 level.

By 2020:

- Reduce emissions by 20% below 2005 levels.
- 60% of all currently existing buildings will achieve a 20% energy consumption reduction.
- 25% of the City's energy portfolio will consist of clean, renewable energy sources.

By 2025:

- All new buildings will achieve LEED Platinum standards.

By 2030

- By 2030, all new buildings will be carbon neutral

By 2050:

- 80% of the City's energy portfolio will consist of clean, renewable energy sources.
- Reduce emissions by 80% below 2005 levels

Goal 1:

Adopt targets and establish implementation framework for reducing greenhouse gas emission reductions for 2012, 2020 and 2050.

Short-Term Actions (2009-2011)

- Adopt the proposed greenhouse gas emission reduction targets outlined in the Metropolitan Washington Council of Governments' July 2008 draft Climate Change Report.*
- Continue to inventory greenhouse gas emissions within the city using the International Council for Local Environmental Initiatives (ICLEI) computer program and finalize the emission reduction targets.*
- Assign the Environmental Coordinating Group (ECG) to propose methods to achieve the emission reduction targets and to begin drafting a Climate Action Plan that will include exploring methods for making the targets binding.
- Establish City Climate Action Plan.

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Support and work with local legislators for adoption of California's Greenhouse Gas Vehicle Program.
- Implement Climate Action Plan.
- Integrate climate change planning into the local air quality planning efforts.
- Replace all publically-owned street lights in the city with energy-efficient (such as light emitting diodes (LED)) or renewable-energy lights.
- Update the GHG Emission Inventory every three years and the Climate Action Plan on an as-needed basis.
- Examine the carbon sequestration potential of the tree canopy in the City and opportunities for carbon banking on a regional basis.
- Identify the economic opportunities associated with climate change planning such as recruiting high tech, green firms, the creation of green jobs, etc.

Goal 2:

Institutionalize the consideration of the effects of possible climate changes into long-term planning.

Short-Term Actions (2009-2011)

- Conduct a risk analysis of the effects of global climate change on Alexandria.
- Empower the City's Environmental Coordinating Group (ECG) to develop adaptation planning strategies for the city.

Mid-Term Actions (2012-2020)

- City management, staff, Environmental Policy Commission (EPC) members, and others will begin to regularly participate in long-term (i.e., 5, 20, and 50 years) climate adaptation planning activities such as scenario exercises and retreats.
- Convene a diverse group of stakeholders (perhaps as an EPC subcommittee) including City staff, civic groups, scientists, and businesses to monitor climate change data and information and to provide policy guidance and strategies for the city on climate change and adaptation.
- Continue to monitor data and factual information on climate change and modify the Climate Action Plan and climate adaptation plans accordingly.

Goal 3:

Prepare and educate city residents and business owners for a carbon-constrained economy and other climate change impacts.

Short-Term Actions (2009-2011)

- The City will disseminate educational materials and establish a website on the causes and effects of climate change, how people can reduce their climate impact, and how greenhouse gas reduction policies may affect the availability and prices of energy and other goods.
- The City will emphasize the benefit of increasing development density as a method for reducing greenhouse gas emissions in its discussions with citizens and business.¹⁰

Mid-Term Actions (2012-2020)

- Gather and publish environmental performance metrics to identify trends in water quality, average sea level, air quality metrics, energy use, and temperature.
- Establish a voluntary program for city residents, schools, and businesses to report their efforts in reducing their environmental impact and create an awards program to incentivize participation.

Goal 4:

Increase the City's preparedness to respond to the possible effects of climate change and environmental emergencies.

Mid-Term Actions (2012-2020)

- Update the flood management program to take into account anticipated rises in Potomac River levels and increased intensity of storm-related flooding.
- Continue to support the work of City and Health Department emergency planners in developing plans that take into account climate change-related emergencies such as water and food supply disruptions caused by severe drought, loss of electricity, damage to or contamination of the water distribution system, and climate change-related outbreaks of diseases.
- Maintain a strong Mosquito Control Program in the city by continuing to eliminate breeding habitats for mosquitoes due to the increased risk of mosquito-borne illnesses.

Goal 5:

Examine and address the environmental hazards imposed by pharmaceutical disposal in waterways and drinking water supply.

Mid-Term Actions (2012-2020)

- Partner with MWCOG, Alexandria Sanitation Authority, the Alexandria Health Department and the Drinking Water Suppliers of Alexandria to monitor the hazards of pharmaceutical disposal. Provide annual feedback on the state of the science to inform EPC when actionable activities are warranted.
- Inform residents about how to properly dispose of pharmaceuticals.

¹⁰ Also see Land Use and Open Space Goal 1.

¹¹ Denotes actions already underway

Long-Term Actions (2021-2030)

- When science-based solutions have been identified, the City should take appropriate actions to address the hazards of pharmaceutical disposal.

Goal 6:

Anticipate and plan for potential emerging environmental threats, such as nanotechnology, nitrogen loading, and acidification of waterways.

Mid-Term Actions (2012-2020)

- Ensure that City Staff, EPC, and other climate change groups examine studies, data, and other information on emerging potential environmental threats and provide policy guidance to the City and its residents.

principle

Chapter 10: EAP Implementation by Sustainability Sector

Improving environmental quality, conservation and the public welfare requires a harmonized approach to implementation, as well as collaboration both within and around Alexandria. The primary responsibility of environmental stewardship shall be equally shared by all Alexandrians.

CHARTER PRINCIPLE: ECO-CITY CHARTER ROLES AND RESPONSIBILITIES

The Eco-City Charter serves as a guide for moving the city towards a sustainable future. Fulfilling this Charter requires coordinated participation and commitment by the EPC, City government, and the community. The Charter's success depends on each of these parties taking an active and innovative role as stewards and guardians of this Charter's principles and vision.

While each of the previous EAP chapters contain specific implementation ideas and action steps, the Implementation Chapter focuses its activities on the following six sustainability sectors:

1. Civic Sustainability—developing outreach and education programs and resources for citizens, school, etc. and building the necessary nonprofit and community infrastructure to share implementation responsibility with city leaders and staff
2. Business Sustainability—cultivating and organizing a new Eco-City business sector for Alexandria that could provide green businesses and green collar jobs
3. Financing Sustainability—identifying new sources of revenue and adapting existing public and nonprofit resources to finance and fund Eco-City activities
4. City as Sustainability Leader—ensuring that City operations, facilities and programs also follow the sustainability visions and principles of the Charter
5. EPC roles and responsibilities—identifying activities for EPC and refining its structure and approaches towards implementation of the EAP.
6. Regional Sustainability—developing partnerships with adjacent communities that share the same water, air, and commute sheds, etc.

*Denotes actions already underway

Goal 1:

Provide education and outreach to citizens and local schools and increase community participation to help achieve environmental goals and objectives.

Short-Term Actions (2009-2011)

- Hire an additional staff person to work on environmental education and outreach on Eco-City objectives.
- Establish Internet education and participation resources and tools, including an Eco-City blog.
- Draft an Eco-City Outreach Plan for EPC and City staff.
- The City and EPC will conduct face-to-face meetings with major community and neighborhood groups to raise awareness about and support for Eco-City Alexandria.
- The City and EPC will conduct an Open House on Eco-City Alexandria.
- Engage a broad range of stakeholders – citizens, schools, nonprofit organizations, civic associations, religious organizations, and private partners – to become volunteers in activities to protect, restore, and educate citizens about the city's natural resources such as water monitoring, stream and park clean-ups, restoration projects, inner-city outings, and removal of invasive species and planting trees.
- Develop GIS "green" maps for outreach and education purposes, such as environmentally-related City projects, services, alternative transportation, restoration projects, and air quality.*
- Develop and implement a plan to target volunteer support for implementing Environmental Action Plan projects.*
- Increase collaboration and participation with other City boards and commissions.
- Coordinate Eco-City volunteering with other city events, such as Spring for Alexandria, and other activities beyond Earth Day.*

Mid-Term Actions (2012-2020)

- Design and develop an Eco-City Alexandria Outreach and Education Center where Eco-City activities could be held for EPC, City staff, and local schools; the Eco-City Center could also house demonstration activities and workshops for home and business owners to learn how they can make their properties and operations more sustainable.
- Identify 2-3 Alexandria civic/home owner associations to work with each year as Eco-City Adopt a Neighborhood that could pilot test innovative elements/aspects of the Environmental Action Plan.
- Explore possible partnership with Arlingtonians for a Clean Environment (ACE) to expand into Alexandria or charter separate entity.
- Create an inventory of existing partnership organizations and nonprofits and their sustainability/green activities and programs that could become potential partners for a citywide Eco-City nonprofit network.
- Implement an Eco-City outreach strategy for the EPC, City staff and other partners and adopt an annual list of collaborative and separate activities.
- Work with ACPS and private schools in Alexandria to focus on the greening of school facilities and operations, and to help provide resources for curriculum development, awards, and extracurricular activities about sustainability.
- Expand an asset map of all existing green/sustainability places and activities (City, civic, and business) using GIS and make it accessible to the general public via the web and other vehicles.
- Create a formal group of citizen volunteers to work with EPC and City staff through various working groups and task forces (e.g., Eco-City Ambassadors or Stewards).
- The Partnership for a Healthier Alexandria will work with EPC to continue connecting environment and health efforts and developing initiatives related to the Eco-City recommendations.

*Denotes actions already underway

Goal 2 - Business Sustainability:

Provide education and outreach to local businesses and related organizations to help achieve environmental goals and promote the development of green jobs and businesses within the city.

Short-Term Actions (2009-2011)

- Establish a series of Open House events for businesses to showcase their application of green practices to other businesses and citizens, and to provide networking opportunities.
- Establish internet education and participation resources and tools for providing information on green business practices.*
- Establish a leadership group of business organizations, managers, and owners to lead business community efforts to help achieve the City's environmental goals and objectives..
- Examine the feasibility of establishing a Green Business certification program for one or more business sectors within the city.
- Examine the feasibility of leveraging the city's restaurant, hospitality, and tourism industries by combining green business practice standards and accomplishments with marketing initiatives.
- Create an Eco-City Award to recognize outstanding sustainability efforts by members of the city's business community.*
- Identify and support public-private partnerships in order to create the foundation for the development of a green workforce in the city.

Mid-Term Actions (2012-2020)

- Take inventory of existing businesses practicing sustainability, and develop a directory for consumers and other companies.
- Partner with the Alexandria Food Safety Advisory Council and other partners to develop an "Eco-Friendly Food Initiative" for restaurants and grocery stores and provide incentives for businesses to participate in the program.
- Establish a green business network through the Alexandria Economic Development Partnership (AEDP), Inc., Chamber of Commerce, and others, that is designed to market green businesses in Alexandria (especially the restaurant and tourism industry).
- Establish green business certification, standards, and awards programs.
- Develop a green zoning overlay to critically evaluate potential sites and industries and begin the process of green job incubation.
- Develop a green business attraction and development strategy that offers appropriate incentives and technical assistance to help establish a green economy in Alexandria.

Goal 3 - Financing Eco-City/EAP Activities:

Identify and promote action steps for increasing financial investment in sustainability.

Short Term Actions (2009-2011)

- Estimate financial investments necessary to undertake major environmental action plan steps.
- Form a task force of stakeholders to examine the means and consequences of implementing economic measures such as tax incentives and disincentives, subsidies and fees to increase the City's resources that support sustainability initiatives and foster changes in citizens' behaviors.
- Meet with City Council, staff, and public to explore establishment of an Eco-City Fund that would provide money for citizens at below-market interest rates for sustainability projects such as green home improvements within the city.

Mid-Term Actions (2012-2020)

- Seek authority to establish a menu of sustainability financing mechanisms, such as carbon or utility taxes and user fees, such as "pay as you throw."
- Link traditional City taxes and fees (e.g., stormwater, parking permits, property taxes, etc.) to sustainability performance, with lower taxes and fees for more sustainable homes, vehicles, etc.
- Provide homeowners and businesses with incentives to install a variety of sustainability technology (from energy efficiency and generation to low impact development and green infrastructure).
- Issue Eco-City bonds to fund the implementation of EAP actions.
- Ensure CIP expenditures are consistent with Eco-City principles and help implement Environmental Action Plan.

Goal 4 - City as Sustainability Leader:

Continue steps to improve the City's own green culture as an example for all Alexandrians to follow.

Short-Term Actions (2009-2011)

- Continue institutional and funding support for the Eco-City process, including maintaining a collaborative relationship between the City, EPC, Virginia Tech, and the public to secure the advancement of the principles agreed to and adopted in the Eco-City Charter.
- Increase City staff knowledge of and coordination on environmental activities.
- Hold a retreat for City staff to discuss sustainability efforts.
- Establish a volunteer program to enlist City employees in helping meet environmental objectives in City operations.
- Develop a City "Green Purchasing Policy" that includes materials such as bio-based, recycled, and environmentally preferable products.

*Denotes actions already underway

Mid-Term Actions (2012-2020)

- Create an Eco-City Coordinator's position to help coordinate with all City departments in the implementation of Eco-City plan.
- Institute a green purchasing program for the city, and advocate the adoption of its standards to the private sector.
- Require special events in the city to be eco-friendly and set forth sustainability requirements in the City's Special Events Policy.¹¹

Goal 5 - EPC Roles and Responsibilities:

The Environmental Policy Commission, in collaboration with the Office of Environmental Quality, monitor, measure, and report on the implementation of the Environmental Action Plan and refine it as circumstances and conditions change.

Short Term Actions (2009-2011)

- Re-examine EPC's composition and membership with respect to new Eco-City demands.
- Invite input and participation on Earth Day Committee by members of local high school environmental clubs.
- The City and EPC will prioritize and develop a process and structure for EPC input and participation in the activities of other volunteer committees, including, but not limited to, those working on Small Area Plans, budget and financial affairs, transportation, waterfront, planning and zoning, industrial development, parks and recreation, public health, and water quality.
- The City and EPC will establish an annual report card on key environmental quality and performance metrics, and on action steps accomplished by the City and will publish these results.
- The EPC will work with the City to provide prioritized EAP action items depending on available resources.

Mid-Term Actions (2012-2020)

- Update EAP every five years and the Eco-City Charter every ten years as per the Eco-City Charter and revise each as is necessary.

Goal 6 - Regional Relationships and Partnerships:

Establish policies and processes that foster regional collaboration on sustainability programs and projects with Alexandria's neighboring jurisdictions, the regional council of governments, and the federal government.

Short Term Actions (2009-2011)

- Review existing regional plans and programs to determine if they align with the Eco-City Action Plan and where they do, establish regular communications for information sharing and action with state, regional, and federal partners (e.g., Metropolitan Washington COG, Northern VA Transportation Authority, and Northern VA Regional Commission, U.S. agencies) and adjacent jurisdictions (e.g., Fairfax and Arlington County).

¹¹See also Solid Waste Goal 2.

¹²Denotes actions already underway.

Mid-Term Actions (2012-2020)

- Strive to meet the USCM Mayors Climate Protection Agreement goals and similar goals set by the MWCOG related to emission reductions.
- Coordinate with neighboring jurisdictions to explore the possibility of implementing a curbside organic waste recycling program.

*Denotes actions already underway

APPENDIX # 1: TARGETS BY DATE

The Environmental Policy Commission (EPC) also set “discussion” targets for each principle as a way to lay the groundwork about performance measures and eventual development of an EAP Score Card. Note the targets in the current draft include measures from existing plans or preliminary numbers to merely generate reactions and further discussion.

2010:

- By 2010, obtain a funded OEQ outreach position to manage MS4 and Eco-City outreach.
- By 2010, the City will purchase 5% of electricity needs through green certificates.

2011:

- Reduce fugitive emissions from the ash loading operations at Mirant Potomac River Generating Facility by 25% and coal yard operations by 20% by December 2011.

2012:

- By 2012, 95% of the restaurants in Alexandria will be totally smoke-free.
- Beginning in 2012, reduce the number of Daily Vehicle Miles Traveled (VMTs) on a per capita basis by 5% every five years.
- By 2012, reduce Business As Usual (BAU) emissions by 10% below 2012 level¹.

2013:

- Reduce stack PM emissions by a minimum of 20% by December 2013 at Mirant Power Generating Station.
- By 2013, establish mechanism for long-term dedicated funding for the purpose of maintaining and improving stormwater infrastructure.
- By 2013, preserve and/or acquire the remaining 35 acres of open space to complete 100-acre goal of the Open Space Master Plan².

2015:

- By 2015, complete Cameron Run Master Plan.
- By 2015, a 10% reduction in per-capita water consumption as estimated from wastewater volume conveyed from the city to treatment facilities.
- By 2015, reduce the per capita energy use in Alexandria by 15%.
- By 2015, track energy use of 30% of multi-family residence units.
- By 2015, ensure that all plantings on City property are non-invasive and incorporate native Plants.
- By 2015, design and install a pedestrian bridge to link Arlington and Alexandria sides of Four Mile Run.

¹ Business As Usual (BAU) targets in this section are based on targets set by Metropolitan of Washington Council of Governments (MWCOC).

² This target is in the Open Space Master Plan.

2020:

- By 2020, increase the number of commuters who use public transportation alternatives by 25% using 2000 Census data as the baseline.
- By 2020, all new buildings to achieve LEED Gold standards³.
- By 2020, 60% of all existing buildings achieve a 20% energy consumption reduction.
- By 2020, complete 90% of the in-stream portion of the Four Mile Run Master Plan.
- Retrofit 70% of feasible City facilities with BMPs by 2020 and explore water reuse operations.
- By 2020, 80% of the workplaces in Alexandria employing more than 25 persons will be totally smoke-free.
- By 2020, 25% of the City's energy portfolio will consist of clean, renewable energy sources.
- By 2020, achieve 40% tree canopy coverage.
- By 2020, exceed the goal of 35% diversion through increased waste reduction and reuse.
- By 2020, increase the recycling rate to achieve a goal of 50%.
- By 2020, reduce emissions by 20% below 2005 level⁴.

2025:

- By 2025, existing City buildings in the aggregate are 25% more energy efficient.
- By 2025, all new buildings will achieve LEED Platinum standards⁵.
- By 2025, 50% of the restaurants and grocery stores in Alexandria will qualify for designation as eco-friendly restaurants or grocery stores.
- By 2025, 50% of commercial buildings where more than 25 persons are employed will be participating in the Healthy Work Places program.
- By 2025, track energy use of 60% of multi-family residence units.

2030:

- By 2030, create three high capacity transit corridors as set forth in the 2008 Transportation Master Plan.
- By 2030, increase the number of non-single occupant vehicle (SOV) commuting trips to 50%⁶.
- By 2030, all new buildings will be carbon neutral⁷.
- Retrofit 100% of feasible City facilities with BMPs by 2030.
- By 2030, 25% of Alexandria children will walk or cycle to school

³ Reformatted from EPC GB Work Team from a goal to target; date changes from 2018 to 2020 for consistency and moved from Platinum to Gold at the ECG meeting

⁴ Business As Usual (BAU) targets in this section are based on targets set by Metropolitan of Washington Council of Governments (MWCOC).

⁵ Proposed at ECG meeting to have a phase in period from LEED Gold to Platinum to Carbon Neutral

⁶ Using 2009 Metropolitan Washington Council of Governments survey data as baseline

⁷ Lack of consensus on 1) whether the building should be just carbon neutral or emission free; at ECG meeting the group consensus was to set target for 2030 and not 2020.

2030 (con't):

- By 2030, increase the number of non-single occupant vehicle (SOV) commuting trips to 50%⁸.
- By 2030, the percentage of Alexandria children and adults that are overweight or obese will have been reduced to less than 29% (currently 58%).
- By 2030, the incidence of asthma in Alexandria will be reduced by 50%.
- By 2030, 50% of the City's energy portfolio will consist of clean, renewable energy sources.
- By 2030, track energy use of 100% of multi-family residence units.
- By 2030, ensure that 25% percent of all Alexandria school children get to and from school by walking or riding bicycles.
- By 2030, ensure that 50% percent of Alexandrians commute to work by non-SOV means.
- By 2030, reuse the site of the coal-fired power plant.

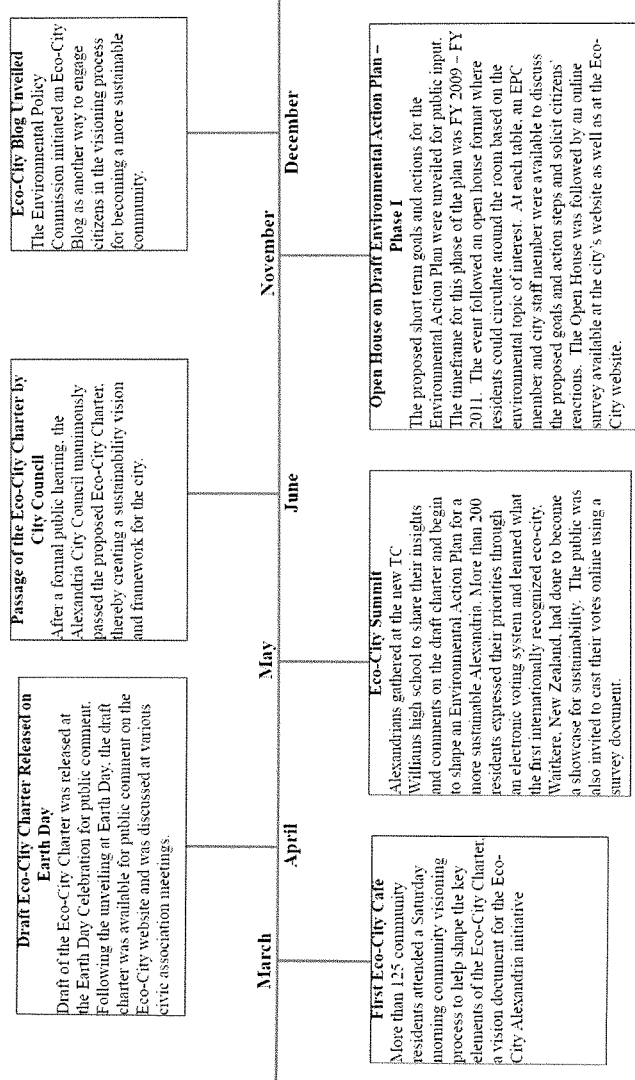
2050:

- By 2050, 80% of the City's energy portfolio will consist of clean, renewable energy sources.
- By 2050, reduce emissions by 80% below 2005 level⁹.

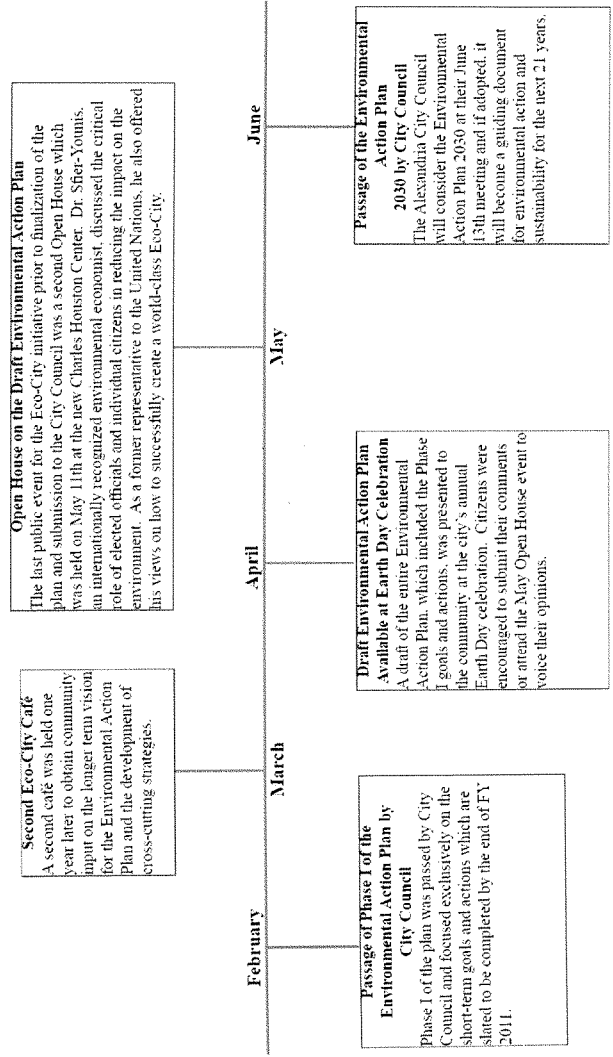
⁸ Using 2009 Metropolitan Washington Council of Governments survey data as baseline

⁹ Business As Usual (BAU) targets in this section are based on targets set by Metropolitan of Washington Council of Governments (MWCOG).

Public Engagement Timeline for Eco-City Alexandria
2008



Public Engagement Timeline for Eco-City Alexandria
2009



This matrix is a compilation of existing and adopted city plans that address related issues to those of the Environmental Action Plan; such as water quality, land use planning, and transportation. In order to maintain consistency and clarity, the plans have been organized according to the diagram of Constellation of Plans.

**Constellation of Plans
City of Alexandria**

| Document Name | City Department | Adoption Date | Document Link | PDF |
|---|-----------------|---------------|---|---|
| 2004-2015 Strategic Plan | City Council | 14-Sep-04 | http://alexandriava.gov/council/info/default.aspx?id=4338 | http://alexandriava.gov/uploads/default/councilinfo/strategicplan.pdf |
| Goals | | | <p>Quality development and redevelopment that is well planned and consistent with Alexandria's vision.</p> <p>A city that respects, protects and enhances the natural environment.</p> <p>An integrated multi modal transportation system that gets people from point "a" to point "b" efficiently and effectively.</p> <p>A strong city economy that is growing in varied small businesses and job opportunities.</p> <p>A caring community that is diverse and affordable.</p> <p>The city government is financially sustainable, efficient and community oriented.</p> <p>In partnership with the Alexandria City Public Schools that are among the best in Northern Virginia.</p> | |
| Alexandria Open Space Plan | RP&CA | 25-Jun-05 | http://www.alexandriava.gov/planning/info/default.aspx?id=27806 | http://www.alexandriava.gov/uploads/default/open_space_plan/050605/OSPlan05.pdf |
| Goals | | | <p>Goal 1. Protect and enrich existing parks</p> <p>Goal 2. Develop innovative opportunities for creating additional open space</p> <p>Goal 3. Review and complete implementation of the Potomac River Waterfront Plan and include additional parkland where appropriate</p> <p>Goal 4. Protect, expand, and connect stream valleys and other environmentally sensitive areas</p> <p>Goal 5. Create an open space network in new development areas</p> <p>Goal 6. Protect and preserve institutional open space</p> <p>Goal 7. Maximize use of public school open space areas</p> <p>Goal 8. Preserve and protect cemeteries</p> <p>Goal 9. Create public open space from vacant land</p> <p>Goal 10. Link and expand pedestrian, bicycle and trail system</p> <p>Goal 11. Enhance streetscapes and gateways</p> <p>Goal 12. Expand citywide street tree program and protect existing trees and woodland areas</p> <p>Goal 13. Encourage the creation of Civic Parks at and adjacent to Metro stations</p> <p>Goal 14. Beautify interchanges and highway corridors</p> <p>Goal 15. Protect privately owned open space</p> | |
| Strategic Master Plan for Parks, Open Space, & Recreation | RP&CA | NA | http://alexandriava.gov/planning/info/default.aspx?id=12965 | http://alexandriava.gov/uploads/default/recreation/open_space/050605/SMR05.pdf |
| Goals | | | <p>1. Assist in the development of an Alexandria Open Space Public/Private Advocacy Group. An additional 100 acres of open space should be acquired in the next ten years to ensure the current 1.8 acres per 1,000 residents is maintained.</p> | |

| | |
|---|--|
| <ol style="list-style-type: none"> 2. Connect the community through an effective trails system by developing fifteen miles of new trails in the next ten years 3. Establish equal opportunity/proximity to parks, recreation facilities and programs, citywide. Parks and a recreation facility are needed in the far west end of the city. 4. Assist in developing innovative opportunities for creating additional open space with other city departments and citizens. 5. Protect and enhance the urban forest and beautification of the city. 6. Protect and enrich existing parks. 7. Provide the highest level of safety in parks and recreation facilities. 8. Assist in the implementation and completion of the Polomac River Waterfront Plan as it relates to public park land 9. Assist in protecting and expanding stream valleys and other environmentally sensitive areas. 10. Assist in maximizing use of public school open space areas to satisfy local needs. 11. Assist in enhancing streetscapes and gateways 12. Continue to explore funding options for acquisitions and protection of properties. | <ol style="list-style-type: none"> 1. Provide the highest level of safety in parks by creating maintenance standards for all assets within the parks and recreation system. 2. Develop design standards and guidelines for renovation and the development of new parks and facilities based on actual and emerging user demands. 3. Acquire more land for game fields for both adults and youth. 4. Manage existing capacity of fields. 5. Seek more user investment to offset maintenance costs of fields when user groups want higher levels of maintenance above what the city is currently providing. 6. Acquire land for parks in under served areas of the city for neighborhood parks, especially in the west end of the city. 7. Encourage private sector acknowledgment of their role in providing more parks in high-density areas. 8. Enhance open space requirements for new developments. 9. Curtail granting of encroachments in RPA's and adjacent areas. 10. Increase partnership teams with schools, private institutions and the city to design solutions for new and renovated properties. 11. Improve infrastructure of some parks by investing \$10,000 per acre for lighting, drainage, parking, irrigation and fencing. 12. Enhance existing park maintenance partnerships 13. Create a dedicated funding source for capital improvements, and land acquisition. |
| <p>Parks</p> | <ol style="list-style-type: none"> 1. Explore the feasibility of enlarging Chiquapan Recreation Center to become the multigenerational center the residents desire. 2. Begin planning for the renovation of Patrick Henry and Charles Houston Recreation Center. 3. Explore the feasibility of acquiring property and constructing a new neighborhood recreation center on the city's west side to support its population density. 4. Develop feasibility studies and business plans for each new or renovated recreation facility. This will achieve the maximum usage and productivity of each center. These studies will match program needs of the neighborhoods served by the facility. 5. Create design standards for indoor and outdoor recreation facilities to maximize its resources used by the greatest number of users. 6. Through effective partnerships with schools and other public and private agencies, the city could increase recreation space both indoor and outdoor to support the recreation needs of youth and adults. This will require all partners to be involved in the planning process of new or renovated indoor and outdoor recreation space. 7. Where appropriate, develop a free or subsidized recreation rider program to support user access to all recreation centers in the city to support greater access and usage. |
| <p>Recreation Facilities</p> | |

| | |
|--|---|
| <p>1. Establish Core and Non-Core programs. The staff must set consistent standards for how programs are delivered and define methods they will use for evaluating user satisfaction for the services provided.</p> <p>2. Create a pricing philosophy and standards for all departmental programs and services, city wide. To accomplish this, staff needs to review the true costs of services in terms of benefits received. This will require the city to update its pricing policy as well as to seek new earned income opportunities to offset operation costs. This may require the city to partner with the private or not-for-profit sector to assist in delivering programs while maintaining low user fees. A grant writer would assist the department in additional funding opportunities.</p> <p>3. Establish customer service standards for all operations.</p> <p>4. Establish citywide communication standards to encourage participation in programs and events for all age groups.</p> <p>5. Enhance evaluation methods and maintain statistical records to support programming opportunities.</p> <p>6. Enhance partnership opportunities to assist in offering recreation opportunities to a broader range of citizens.</p> | <p>1. Review and update all department policies every five years to support the goals of the department and to maximize public access to services.</p> <p>2. Develop technology standards that provide for efficiency of operations and service delivery.</p> <p>3. Provide volunteer opportunities in the department that provide lifetime experiences for members of the community when they volunteer their services. A dedicated staff person should oversee the volunteer opportunities.</p> <p>4. Enhance human resource standards through licensing, accreditation, certification and training of personnel.</p> <p>5. Enhance private or not-for-profit partnerships that provide services beyond the city's capability and/or for efficiency purposes.</p> <p>6. Enhance and support the role of commissions, committees and advisory groups to maintain a constant flow of information both into and out of the Department.</p> |
| <p>Recreation Programming</p> | <p>PRZ</p> <p>http://alexandria.gov/transportation/development/transportation/2015-2016</p> <p>http://alexandria.gov/transportation/development/transportation/2015-2016</p> |
| <p>Land Use</p> | <p>PRZ</p> <p>To have a harmonious set of land uses that preserves the predominant character of Alexandria as a city of residential neighborhoods with a lively and attractive mix of commercial, institutional and community, retail, and recreational activity, and maintains an appropriate economic base.</p> <p>To preserve and enhance residential neighborhoods.</p> <p>To preserve and enhance the historic aspect of the city.</p> <p>To preserve the residential and commercial diversity which has historically characterized Alexandria.</p> <p>To preserve and increase parking (for both active and passive uses) and open space throughout the city.</p> |
| <p>Goals</p> | <p>NYRC</p> <p>Mar-06</p> <p>http://www.alexandria.gov/transportation/development/transportation/2015-2016</p> <p>http://www.alexandria.gov/transportation/development/transportation/2015-2016</p> |
| <p>Four Mile Run Master Plan</p> | <p>Provide a minimum 100-year event flood protection</p> <p>Examine the current extent of the 100-year flood-prone area.</p> <p>Consider flood protection for areas not currently protected.</p> <p>Create a "dynamically stable stream channel" using natural stream channel design techniques</p> <p>Improve corridor habitat and ecology to support native terrestrial and aquatic plant and animal species.</p> <p>Develop upstream strategies to improve water quality in the stream and the environmental quality and long-term viability of a restored levee corridor.</p> |
| <p>Guiding Principles</p> | <p>Improve overall corridor aesthetics and viewshed opportunities</p> <p>Encourage urban design that develops the corridor's aesthetics and reflects the excitement of the watershed diversity for this resource.</p> <p>Incorporate "green design" principles for all design and development activities within and adjacent to the corridor.</p> <p>Incorporate innovative and creative urban design and watershed solutions.</p> <p>Enhance existing recreational opportunities.</p> <p>Create new recreational opportunities that afford interaction with the waters of Four Mile Run.</p> <p>Develop urban life opportunities along the Four Mile Run corridor.</p> |

| | | | |
|---|--|------------------|--|
| | <p>Encourage appropriate siting of recreational facilities in the context of the overall project goals. Connect the project to the efforts underway in the watershed to improve the water quality of Four Mile run. Entegrate the corridor with surrounding communities and proposed adjacent urban development efforts. Create a balance between the natural elements of a restored corridor and urban activity areas in order to generate a lively, safe and well-used public resource. Coordinate with other ongoing planning activities, such activities include the Four Mile run MultiJurisdictional Plan, the local Chesapeake Bay Preservation Act programs, the local Affordable Housing Initiatives, master planning efforts such as the Alexandria and Shrimpton Planning efforts, and other planning and economic development initiatives. Create a place for people to reconnect with water and nature within an urban context. Increase pedestrian and bicycle access and amenities. Increase connectivity between the two communities. Enhance the corridor's effectiveness as a non-motorized and mass transit corridor. Provide interpretive opportunities to educate and inform the public about the stream corridor. Stres the interrelatedness of positive individual, institutional, and political actions and behavior change with improved water quality and habitat in the corridor. Think big—create a plan that provides the parameters for change over time as opportunities become available. Provide a mix of short-term discrete improvements blended with long-term large-scale corridor changes.</p> | | |
| <p>Integration & Balance</p> | | | |
| <p>Access & Connectivity</p> | | | |
| <p>Education & Interaction</p> | | | |
| <p>Planning horizon</p> | | | |
| <p>Urban Forestry Master Plan</p> | | | |
| <p>Goals</p> | <p>Develop an integrated, coordinated approach to the management of the urban forest that is supported by all concerned organizations, City departments, businesses, developers, community and civic groups, and citizens. Ensure that the protection and management of the urban forest are citywide priorities. Achieve the goals and carry out the implementation strategies of the Open Space Plan, the Recreation, Parks, and Cultural Activities Strategic Plan, and the 1997 Master Plan related to landscape trees and urban forest ecosystems on major transportation corridors, boulevards and pathways, other City streets, parks, plazas, natural open spaces, and school properties. Secure sufficient funding and management resources to maintain and enhance the urban forest. Assure that the urban forest is sustainable by maximizing and expanding the urban tree canopy through tree planting to produce a multi-aged and diverse tree community. Enact the Plan's recommendations using education as the primary means of implementation, incentives as the next, and regulations as the last resort. Develop a plan that is adaptable and responsive to change, providing recommended benchmarks and schedules for implementation.</p> | | |
| <p>Water Quality Management Supplement</p> | <p>No goals specified in plan.</p> | <p>12-Jan-01</p> | <p>http://www.alexandria.gov/planning/UrbanForestryMasterPlan/UrbanForestryMasterPlan.html</p> |
| <p>Environmental Management Supplement (Article XIII)</p> | | <p>11-Apr-06</p> | <p>http://alexandria.gov/files/info/infocenter/faq/faq-2314.pdf</p> |
| <p>Purpose</p> | <p>(A) It is the policy of the City of Alexandria, Virginia to protect the quality of water in the Chesapeake Bay and its tributaries and, to that end, to require all land uses and land development in the City to: (1) Safeguard the waters of the Commonwealth from pollution; (2) Prevent any increase in pollution of state waters; (3) Reduce existing pollution of state waters; and, (4) Promote water resource conservation.</p> | | |
| <p>Holmes & Cameron Run Restoration Plans</p> | | | |
| <p>Plans does not exist.</p> | | | |

| | | | |
|--|--|---|---|
| <p>Plan 19 Improve Air Quality in the Washington DC-MD-VA Region</p> | <p>7-Mar-08</p> | <p>http://www.mwcoq.org/submitmain.html</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7442</p> |
| <p>Goals/Benchmarks</p> | <p>Total reductions by 2008 of 599 tons/year of PM2.5-Direct. Total reductions by 2008 of 77,330 tons/year of nitrogen oxides (NOx) Total reductions by 2008 of 23,615 tons/year of sulfur dioxide.</p> | | |
| <p>15 Small Area Plans</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | |
| <p>Description</p> | <p>Alexandria West/Bradlock Road Metro Station, Eisenhower East, Fairlington/Bradlee, Hunting Creek, King Street/Eisenhower Ave, Landmark/Van Dorn, Northeast, Northridge/Rosemont, Old Town, Old Town North, Potomac West, Potomac Yard/Potomac Greens, Seminary Hill/Strawberry Hill, SW Quadrant, Taylor Run/Duke St</p> | | |
| <p>Strategic Master Plans (Small Area Plans and City Element Chapters)</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7444</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=7444</p> |
| <p>Historic Preservation</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=7446</p> |
| <p>Goals</p> | <p>To identify historic resources throughout Alexandria To protect and preserve historic resources through sensitive management that prevents their destruction, damage and neglect. To guide development in a manner that is compatible with the historic character and resources of the site and surrounding neighborhood. To promote public awareness and appreciation of historic resources and Alexandria's heritage.</p> | | |
| <p>Urban Design</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=7442</p> |
| <p>Alexandria Waterfront Plan (Master Plan Amendment)</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=7436</p> |
| <p>King Street Retail Strategy</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=6973</p> |
| <p>Goals</p> | | | |
| <p>Old Town North Urban Design Guidelines</p> | <p>P&Z</p> | <p>http://alexandriava.gov/planning/info/default.aspx?id=7518</p> | <p>http://alexandriava.gov/WorkAreas/howcontent.aspx?id=7433</p> |
| <p>Goals</p> | | | |

| | | | | |
|---|------------------------|--|---|---|
| <p>Comprehensive Transportation Master Plan</p> | <p>School (Tabaco)</p> | <p>RM4. Implement strong parental component to complement existing youth prevention education programs to increase level of involvement, encourage to participate in community efforts to prevent tobacco use and encourage youth to discuss smoking with their kids.</p> | <p>10-Apr-08</p> | <p>http://www.alexandriava.gov/transportation/transportationmasterplan.pdf</p> |
| <p>Guiding Principles</p> | <p>T&ES</p> | <p>1. Alexandria will develop innovative local and regional transit options. 2. Alexandria will provide quality pedestrian and bicycle accommodations. 3. Alexandria will provide all its citizens, regardless of age or ability, with accessibility and mobility. 4. Alexandria will increase the use of communications technology in transportation systems. 5. Alexandria will further transportation policies that enhance quality of life, support livable, urban land use and encourage neighborhood preservation, in accordance with the City Council Strategic Plan. 6. Alexandria will lead the region in promoting environmentally friendly transportation policies. 7. Alexandria will ensure accessible, reliable and safe transportation for older and disabled citizens.</p> | <p>10-Apr-08</p> | <p>http://www.alexandriava.gov/transportation/transportationmasterplan.pdf</p> |
| <p>Transportation Management Plans</p> | <p>P&Z</p> | <p>16-May-07</p> | <p>http://www.alexandriava.gov/transportation/transportationmanagementplans</p> | <p>Article XI, Division B, Development Approvals, Section 11-700 - Transportation Management Special Use Permits, Electronic plan not available</p> |
| <p>Pedestrian & Bike Mobility Plan</p> | <p>T&ES</p> | <p>NA (28-Nov-07) DRAPPT</p> | <p>http://www.alexandriava.gov/localmotion/info/default.aspx?d=11418</p> | <p>http://alexandriava.gov/uploadedfiles/localmotioninfo/6/BikeandBicyclePlan12007.pdf</p> |
| <p>Goals</p> | <p>Overall Goal</p> | <p>Walking will be the safest, most convenient and enjoyable way to get around in Alexandria.</p> | <p>Engineering: The City will provide a continuous, connected and accessible network that enables pedestrians—particularly children and those with mobility impairments—to move safely and comfortably between places and destinations.</p> | <p>Encouragement: The City will encourage mobility for all pedestrians by removing barriers to accessibility and promoting walking as a means of improving health and active lifestyles.</p> |
| <p>Goals</p> | <p>Concept Goal 1</p> | <p>Education: The City will develop Safe Routes to School Programs and awareness initiatives that address pedestrian safety, rights and responsibilities.</p> | <p>Enforcement and Safety: The City will create a safe pedestrian environment through effective law enforcement, detailed crash analysis and implementation of safety countermeasures.</p> | <p>1-Jul-04</p> |
| <p>Solid Waste Management Plan</p> | <p>T&ES</p> | <p>1-Jul-04</p> | <p>http://alexandriava.gov/transportation/transportationmasterplan.pdf</p> | <p>Goal 1: Establish a planning process and document that meets Virginia statutory and regulatory requirements, that fosters public participation, and that ensures that the City's solid waste management needs will be met.</p> |
| <p>Goals</p> | <p>Goal 2</p> | <p>Identify and/or maintain mechanisms to ensure that needed solid waste collection services are available throughout the City.</p> | <p>Goal 3: Identify and provide for the availability of facilities to ensure that options for solid waste disposal are available throughout the City.</p> | <p>Goal 4: Identify, implement, and/or maintain programs for ensuring that solid wastes are managed in accordance with Federal and State laws and regulations in a manner that protects public health, safety, and the environment.</p> |
| <p>Goals</p> | <p>Goal 5</p> | <p>Maximize diversion of recyclable solid waste from disposal by using techniques that provide and promote recycling programs and that encourage private sector recycling.</p> | <p>Goal 6: Ensure that those providing solid waste services meet standards of customer service excellence policies.</p> | <p>RP&CA</p> |
| <p>Landscaping Objectives</p> | <p>RP&CA</p> | <p>Apr-07</p> | <p>http://www.alexandriava.gov/transportation/transportationmasterplan.pdf</p> | <p>No purpose or goals clearly specified.</p> |

| | | | | |
|--------------------------------------|-----|-----------|---|---|
| Erosion & Sediment Control Ordinance | PRZ | 16-Jun-07 | http://www.alixandria.gov/psv/psvinfo/default.aspx?ID=3872 | http://www.alixandria.gov/uploadedFiles/psvinfo/ESOrdinance.pdf |
|--------------------------------------|-----|-----------|---|---|

No purpose or goals clearly specified in the ordinance.

**APPENDIX # 4
GLOSSARY TERMS**

Note: This glossary includes terms that appear in the Environmental Action Plan that may not be familiar to the average reader, as well as the names of relevant programs and initiatives (with hyperlinks included). This glossary offers brief, simple definitions of the terms. The names of specific plans (e.g., City of Alexandria’s Open Space Plan) are not included.

GENERAL TERMS

Alternative transportation modes – transportation mediums that create a lower carbon footprint, including but not limited to public transportation, bicycles, and walking.

Best Management Practices (BMPs) – innovative and improved environmental protection practices that apply a systems management approach by evaluating the effectiveness of how individual practices, taken as a whole, improve environmental protection; BMPs are common to stormwater management and water quality, but can apply to other aspects of environmental management.

Board of Architectural Review (BAR) – a citizen panel that reviews applications in a historic district to alter, renovate, or demolish buildings; BARs enforce the architectural design guidelines of historic districts.

Bus Rapid Transit (BRT) – a permanent or semi-permanent public transportation system wherein buses run on roadways in lanes dedicated for their exclusive use. BRT systems can be free-standing, but are often integrated into a regional or statewide transportation plan

Capital Improvement Program (CIP) – a medium-range plan for developing, replacing, and managing public infrastructure.

Circulator Bus Routes – a bus route serving specific, well-known area(s) or neighborhood(s) with buses arriving at regular intervals.

Combined Sewer Overflow (CSO) – CSO results from heavy rainfall affecting combined sewer systems that collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Combined sewer systems transport all wastewater to a sewage treatment plant, where it is treated and discharged to a water body. During heavy rainfall, wastewater volume in such a system can exceed its capacity or that of the treatment plant, which results in the release of untreated water into the city’s streams and waterways. CSOs are a major water pollution concern.

Complete Streets – roadways that are designed and managed to provide safe, attractive, and comfortable transportation options for all users. The use of the Complete Streets principles encourages streets to be redesigned to accommodate different streetscapes and transportation modes.

Compressed Natural Gas (CNG) – a fossil fuel substitute for gasoline or diesel. CNG is environmentally cleaner and safer than other fuels.

Community Garden – public or quasi-public space that citizens can lease to grow fruits and vegetables.

Congestion Mitigation – strategies to relieve automobile congestion at choke points or during rush hours; examples include tolls, High-Occupancy Vehicle (HOV) lanes, and High-Occupancy Toll (HOT) lanes.

Container Gardens – planters that are used to grow vegetables and fruits.

Crown Cover – usually expressed as a percentage, it defines the degree to which the full leafage of trees covers the area of the ground beneath it. American Forests recommends 40-percent minimum crown coverage for urban areas.

Eco-Sustainable Villages or Neighborhoods - communities with development patterns that exhibit the essential characteristics of mixed use, walkability, bikeability, transit convenience, low impact development, green infrastructure, and energy efficiency.

Edible Schoolyard – an organic gardening and landscaping program at schools that is wholly integrated into its curriculum, culture, and food program. By introducing students, teachers, and volunteers to the facets of farming, the program aims to stimulate participants to recognize the links between sowing, preparing, serving, and eating food and community and environmental sustainability.

Geographic Information System (GIS) – a collection of computer hardware, software, and data to capture, store, analyze, and display geographically based information.

Geothermal Closed-Loop Heat Pump Wells – wells that pump heat from the Earth to power a system of central heat or air conditioning for buildings.

Green Building – a system of techniques used to build structures that are environmentally friendly, such as green roofs, water-saving devices, and natural materials.

Greenhouse Gases (GHG) – gases that absorb and subsequently emit the heat reradiated back from the Earth toward space, causing the Earth to warm as if in a greenhouse. Common greenhouse gases in the Earth's atmosphere include water vapor, carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons.

Green Infrastructure – a versatile term that describes a variety of products, technologies, and practices that use natural systems to enhance a community’s environmental quality. Examples include an interconnected network of protected land and water resources, which support native species, maintain ecological processes, and contribute to the health and quality of life of community residents.

Green Roof – a roof system that features a high-quality waterproofing membrane and vegetation four to six inches deep. Green roofs absorb rainwater, insulate and cool buildings, and lower the ambient air temperature in the vicinity.

Green Taxi – a taxicab powered exclusively by clean special fuel. The types of fuels include: compressed natural gas, electricity, ethane, hybrid gasoline/electric, hydrogen, hythane, liquefied natural gas, liquefied petroleum gas, methane, solar, human powered, or a combination of two types of clean special fuels.

Historic Districts – areas of a city that have been designated historic by applicable laws and ordinances, to which special architectural guidelines and regulations concerning development apply.

Indoor Air Quality (IAQ) – the measurement of pollutants and particles inside buildings. Common sources of indoor air pollution include building materials, fossil fuels, tobacco, and mold.

Light Emitting Diodes (LED) – an electronic light source that provides lower energy consumption, a longer lifetime, smaller size, and faster switching.

Low Impact Development (LID) – a planning and design approach to managing stormwater runoff, emphasizing conservation and natural features to protect water quality. The approach uses small-scale hydrologic controls of filtering, detaining, and storing water to replicate the pre-development hydrology of a watershed.

Municipal Separate Storm Sewer System (MS4) – systems that carry polluted stormwater runoff into local waterways. The Environmental Protection Agency has set water quality standards for treatment of urban stormwater before discharge.

Nitrogen Loading – the process by which nitrogen pollutes surface water and groundwater through agricultural and lawn runoff, fossil fuel burning, and other anthropogenic sources.

Non-invasive Plants – vegetation that is native to a given area.

Offgassing – the evaporation of volatile chemicals from such materials as paints, stains, carpets, insulation, flooring, and cabinets that can adversely affect indoor air quality.

Particulate Matter (PM) – a complex mixture of very small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

Pay as You Throw – a program that charges users for disposed trash by weight, volume, or number of bags/containers; such a program provides an incentive to reduce consumption and increase recycling and reuse.

Ppm (parts per million) – a common way to measure pollutant concentrations in air and water.

Pocket Park – a small park, sometimes less than ½ acre in size, that provides open space within an urban neighborhood.

Rain Barrels – barrels installed alongside buildings to capture rainwater runoff from roofs and gutters that would normally become stormwater runoff; water probably saved and maintained in the barrel can be used later for watering lawns and gardens.

Rain Gardens (also known as bio-retention cells) – a natural or artificial shallow depression containing water-absorbing soils and deep-rooted native plants and other similar types of vegetation to capture stormwater runoff. The garden and immediate areas are engineered to maximize collection of runoff from hard surfaces, like roofs, sidewalks, and driveways, and hold the water for a short period before allowing it to infiltrate naturally into the ground. It is a part of a community's green infrastructure.

Shared Parking – a parking area used by different customers during different times of the day or week, such as by office workers during the day and residents during the evening.

Smart Growth – an urban planning and transportation philosophy that concentrates growth in designated centers to avoid sprawl and maximize open space and critical environmental areas; it actively promotes compact, transit-oriented, walkable, bicycle-friendly land use, including neighborhood schools, complete streets, mixed-use development with a range of housing choices, to create distinctive, vibrant, and diverse communities.

Special Use Permit (SUP) – a permit that must be obtained to build in a community when any variation from the zoning ordinance is involved.

Stormwater Management – techniques for controlling runoff from weather events; in addition to drainage channels and storage, such techniques include rain gardens, high-efficiency irrigation, and permeable surfaces.

Tree Canopy – the aboveground cover of foliage that trees provide.

Tree Steward – volunteers dedicated to improving the health of trees in a community by providing educational programs, tree planting, and tree maintenance assistance.

Universal Design – the design of products and the physical environment so that they are accessible to everyone, not just persons with disabilities. The seven principles of the concept are: equitable use, flexibility in use, simplicity and intuitiveness, perceptible information, tolerance for error, low physical effort, size and space for approach and use.

Vehicle Miles Traveled (VMT) – the number of total miles traveled by all motor vehicles over a given time period in a given area. It is the most all-encompassing indicator of travel consumption.

Volatile organic compound (VOC) – indoor or outdoor organic chemical compounds that can vaporize and enter the atmosphere; methane is a common VOC.

ORGANIZATIONS, INITIATIVES, AND PROGRAMS

Air Quality Action Day

Alexandria Economic Development Partnership (AEDP)

Alexandria Flora Project

Alexandria Food Safety Advisory Council

Alexandria Public School System (ACPS)

Arlingtonians for a Clean Environment (ACE)

Congestion Mitigation and Air Quality Improvement Program

Corporate Average Fuel Economy (CAFE)

Earth Day Committee

Eco-City Charter

Environmental Health Work Group

EPA's Clean Cities Program

EPA's Water Sense Program

Healthy Work Places Program

International Code Council (ICC)

International Council for Local Environmental Initiatives (ICLEI)

Leadership in Energy and Environmental Design (LEED)

Living Landscape Fund

Local Motion

Master Gardeners Program

Mayors Climate Protection Agreement (USCM)

Metropolitan Washington Council of Governments

Mirant Potomac River Generating Station (PRGS)

National Ambient Air Quality Standard (NAAQS)

No Child Left Inside

Northern Virginia Transportation Authority

Northern Virginia Regional Commission

Regional Surface Transportation Program

Safe Routes to School

Stormwater Working Group

Tools 4 Schools

Virginia Pollutant Discharge Elimination Permit (VPDES)

This environmental action plan is the result of a collaborative effort between the City of Alexandria, its Environmental Policy Commission, and Virginia Tech's Urban Affairs & Planning Program in Alexandria.



Design by Kimberley Hodgson
Josephine Villacreses

**Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission**

Questions for Euille

Questions from:

Senator Barbara Boxer

1. Mayor Euille, how does your background in business inform the policies you promote to support sustainable development on a local level?

2. Mayor Euille, Alexandria has laid out a very exciting and comprehensive approach to sustainable municipal development in its Eco-City Plan.

Could you please describe how the public was involved in the creation of this planning document?

Dear Ms. Majors:

Senators Boxer and Inhofe asked Alexandria, Virginia Mayor William D. Euille to provide some additional answers to his testimony of July 12. His response follows:

"As a businessman and a builder for the Federal Government, I am very committed to protecting our environment at all levels of government. And in the era of "green economy" globally, it makes sense that Alexandria does all it can to make certain that we are doing our "fair share" in terms of green jobs and energy efficiency."

Senator MERKLEY [presiding]. Thank you very much, Mayor.
Our next witness is Hon. John Lowery, State Representative from Arkansas.

**STATEMENT OF HON. JOHN LOWERY, REPRESENTATIVE,
DISTRICT 6, ARKANSAS HOUSE OF REPRESENTATIVES**

Mr. LOWERY. Thank you, Mr. Chairman, Ranking Member and distinguished panel here. It is a great opportunity to be here today.

Let me tell you a little bit about my district. What we are assuming here is that the Waxman-Markey bill will generate economic growth and help local communities. That is the assumption, and that is the prognosis. But let me talk to you a little bit today about the reality of the impact this bill, as written, would do to certain segments of the economy and to my district.

My district has a diverse assortment of companies that employ our citizens. These are oil refiners, oil and gas related entities, timber industries, chemical companies, service industries, financial institutions, retailers and agriculturally related businesses that are, primarily, small family farms, poultry growers, tomato farmers, cattle farmers and such.

With the presumption, and certainly we are not opposed to the addition of jobs and an increase in economic development in other parts of the country, but let me tell you what this will do dramatically to us.

One of our larger employers in South Arkansas is Lion Oil Company. Twenty years ago, independent businessmen purchased this refinery from a California-based company that was willing to give it up or shut it down. They salvaged it. They retained it. They have spent millions of dollars environmentally on this plant, making it efficient, and have grown the plant and grown its market.

The impact Waxman-Markey and the cap-and-trade credits would impose on them is a \$180 million price tag. That would be the tax for them to continue to operate. That is an undue burden on them. That would be the loss of 1,200 direct jobs and up to 3,000 indirect jobs related.

Also, Murphy Oil is a company that is headquartered in El Dorado, Arkansas. And they choose to be. They have refineries in Louisiana and Wisconsin, have offices in other parts of the United States, but they choose to locate in El Dorado, Arkansas. And they bring some very valuable jobs. This would cost them approximately \$400 million annually.

So, what I am here today to talk about is the impact of not betting on the come, but what is reality if this is enacted, of what it would do, and it would devastate us.

Recently, we had the loss of over 1,800 jobs because Pilgrim's Pride, a poultry producer, went bankrupt. Shut down the plant, laid them off and sent them home. We cannot stand any more unemployment and the taxes, of undo taxes, to our particular region.

So I am here today to plead the other side, if you will, of what is known, and not the unknown. Certainly we all are for new ideas, new technology. The State of Arkansas is looking at these, natural gas, transportation, biomass, cellulosic fuel and alternatives there. We are all for that. But I can tell you, if this legislation and these policies are enacted as they are, it is going to have a dramatic im-

pact. Our unemployment now, because of the poultry-related layoffs, is up to 10 percent on my county. They would skyrocket to over 20 percent if we have additional layoffs in the impact of this.

So, I am here to talk for the little man, if you will, not the policies and not the State. But I am a realist. And the reality of this is a severe impact.

I am a Democrat. This is not a partisan issue. It is a divisive issue that separates, I am afraid, different parts of our country and would be very divisive. We do not need that in this economic downturn. We need to all be pulling together.

I think also the impact this would put on the energy industry would severely jeopardize our national security. That has not been discussed here today, but that is a very real probability. As you take products off the market, as you shut refineries down, where are they going to come from? India? China? The Middle East? So, we have to think about National security as well.

That completes my remarks. I have other things to submit to the record, Mr. Chairman, if appropriate, to substantiate my testimony.

[The prepared statement of Mr. Lowery follows:]

TESTIMONY OF REPRESENTATIVE JOHN LOWERY
ARKANSAS HOUSE DISTRICT 6
BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Chairman Boxer, Ranking Member Inhofe and Members of the Committee, my name is John Lowery. I am a Democrat, serving my third term as Representative of Arkansas House District 6. The population of my district is approximately 27,734. I serve as Chair of Revenue and Tax Committee. I also serve on Agriculture, Forestry, Economic Development, and Natural Resource Committee and Joint Energy Committee. I am also testifying in my role as Chairman of the Committee of Concerned Citizens Against Cap-and-Trade. The Committee was formed in direct response to the threat that the Waxman-Markey bill will be to my district and to the State of Arkansas.

My district has a diverse assortment of companies that employ our citizens. These include oil refiners, oil and gas related entities, timber industries, chemical companies, service industries, financial institutions, retailers and agriculturally related businesses that are primarily small family farms.

Today's hearing title presumes that the Waxman-Markey bill will generate economic growth and help local communities. And that might very well be the case for the West coast and the Northeast. Unfortunately, this bill will devastate my region. It will kill jobs, harm our school system, throw back our economic progress gained the last few years, and imposes a disproportionate burden on Arkansans.

We should work constructively to improve the environment but we have to do it in a way that accounts for regional differences and is honest about what this type of legislation could mean for every day working men and women. During the debate, Congress seemed focused only on ways to lessen the appearance of increased electricity rates. That's important since no one wants to see higher prices, especially during an economic downturn. However, I never hear people in Washington talk about the real issues – which is how a bill like Waxman-Markey will change our way of life. People that live in cities and along the coasts probably welcome those changes since they don't have far to travel, have different types of jobs, and lifestyles than Southerners and Arkansans, in particular. These are not partisan issues, but common sense ones shared by our Congressman Mike Ross. As a proud Democrat, I suspect he probably would have liked to support his committee chairman, Speaker of the House, and President. However, after all the press releases, sound bites, and prejudged studies from politically connected interests he had to ask himself a simple question: is this bill good or bad for Arkansas? Based on the facts and of what is rather than what might be based on “what ifs” Mr. Ross concluded it was bad for his constituents. I reached the same conclusion and intend to explain why El Dorado Mayor Dumas, Union County, and a growing number of constituents oppose the Waxman-Markey bill.

First, proponents argue that the bill could possibly spur the creation of new “green” jobs. I hope they're right, but hope doesn't our food on the table. What I do know is that the bill will destroy existing and high paying jobs that are here today and serve as the backbone of our community. Last month, Steve Cousins of Lion Oil

Company testified before the House Energy and Commerce Subcommittee on Energy and Environment. I ask that his testimony be made a part of the record. Steve stated that the Waxman-Markey would force the shuttering of their unionized refinery and the destruction of 1,200 direct jobs and approximately “3,600 other individuals that depend directly on Lion’s plant for their livelihoods.” This might seem to be a sensational statement. Yet, the burdens placed on our local companies are sensational.

At a conservative \$20/ton of CO₂e, the bill would require Lion Oil to pay \$180 million per year to operate, stay in business, and maintain its workforce. However, Lion’s average annual net profit over the last 23 years is only \$13 million. Waxman-Markey presents local business with the “choice” of either shutting down or going to banks to assume hundreds of millions of dollars in loans to stay in business. Is this a wise policy? Should the federal government dictate the terms of survival for local businesses and in so doing, enrich Wall Street? That would be like a federal policy telling a family upside down on their house to rely on credit cards to pay their mortgage.

Second, the Waxman-Markey bill would not only kill high paying jobs but will harm our school system. This federal government policy would force our local companies to shut down and in so doing, harm our young people. Like most rural communities, southern Arkansas’s biggest employers represent our largest tax base. The taxes they pay fund our school system. This bill would not only harm them when they’re young, it could impact their ability to go to college.

A few years ago, Murphy Oil Corporation decided to invest even more in our community by funding a scholarship program called the El Dorado Promise. The

Promise entitles any child graduating from the local high school a college education. The program's impact has been extraordinary and has received national media attention. I would like to include a document on the Promise in the record. Before the Promise in 2006, local college attendance was at 60%, which is 4 percent lower than Arkansas' and 6 percent lower than the national average. Today, college attendance for El Dorado high school students is at 95%. After decades of decline, our school enrollments are growing by 4 percent. After the Promise, students and families from 28 different states and 10 foreign countries have moved to El Dorado, Arkansas.

It might be popular for some in Washington to demonize oil and gas, fertilizer and chemical companies, and farmers but where I come from; they are an integral part of our communities. The Waxman-Markey bill would change all that. By attacking them, and shutting them down, the bill is attacking our friends and neighbors and greater community.

Third, we oppose Waxman-Markey because it places a disproportionate impact and cost on Arkansans and the South. The bill makes refiners pay for about half (45 percent) the emission reductions called for under the bill (which covers about 85 percent of all U.S. emissions) while they are only responsible for about ten percent of those emissions. This is the very scheme that jeopardizes Lion Oil's future in Arkansas. Waxman-Markey assumes that Lion Oil would simply pass those costs on to consumers. This is a faulty assumption for a host of reasons. However, let's assume that the bill's proponents are correct and all companies are the same size, that there is no domestic much less international competition among fuel providers, and that all firms are awash

with money with equal access to low-cost capital and therefore an easy pass-through to customers is realistic. In that case, Waxman-Markey would effectively require motorists to pay for about half the emission reductions under the bill. Unlike utilities, refiners receive virtually no free allowances to offset the increased costs, and since those costs are assumed to easily be passed through, then the motorist is left holding the bag.

Higher fuel costs disproportionately hurts Arkansans. According to the State Energy Office, Arkansas ranks fifth highest in fuel consumed per registered vehicle. Since motorists pay for the bill and Arkansans – by virtue of rural, lifestyle, and economy – drive more than most, we would have to pay more than most. So not only would this bill destroy our economy, communities, and way of life, it would make us pay more to do it.

Another segment that will be adversely affected is hard working farm families. Families that have passed down from generation to generation a way of life that is still valued in South Arkansas. Many are poultry farmers, cattle farmers, and tomato farmers. I have a letter from Arkansas Farm Bureau stating their opposition to changes through legislation that will jeopardize their livelihood.

The Waxman-Markey bill acknowledges that it will raise energy and commodity prices, place domestic employers at a disadvantage, and that people will lose their jobs. It includes various provisions intended to address those harmful impacts. Most Arkansans don't want to find out if these new federal programs to reengineer our local communities and way of life would be effective or not. We work hard. We hunt and fish and attend church services together. We like our values and want to pass them on to our

children and grandchildren. The Waxman-Markey bill would harm our local employers, jeopardize existing and high paying jobs, imperil our school system, and place a disproportionate impact on Arkansans.

I appreciate the opportunity to share our views with you today and would be pleased to answer any questions you may have.

**Randy Veach***President*

July 17, 2009

The Honorable Barbara Boxer
Chair - Senate Environment and Public Works Committee
410 Dirksen Senate Office Bldg.
Washington, DC 20510-6175

Dear Senator Boxer and Members of the Committee:

The impact of the climate change issue before you will be felt in every sector of agriculture. Every farmer in America uses energy and as input costs increase, this is one more burden that agriculture will have to bear. The House passed legislation, H.R. 2454, did not address the concerns we have about increased energy, fuel and fertilizer costs that will come as a result of its implementation. The offsets provided in that bill did little to mitigate the increased farm costs that will result.

Protection of the environment is foremost in the minds of every farmer and rancher but the legislation passed in the House could cost farm and ranch families their businesses. We value the land, water and air of the country not just for its aesthetic value but because our very livelihood depends on its health.

A number of agricultural sectors and areas of the country will not be able to benefit from offsets provided in H.R. 2454. Not all commodities or areas of the country are able to take advantage of potential offsets, but all of agriculture will suffer from higher production costs. While some claim the legislation is good for agriculture, the fact is most fruit and vegetable producers will not qualify for offset benefits. Not all farmers will have the capacity to site wind turbines and livestock operations have limited resources to adopt methane capture and other expensive methods.

The agriculture producer cannot simply raise costs to cover these added expenses. The already thin profit margins that exist for farmers and ranchers would dwindle, possibly even disappear. Even if farmers could simply pass on these costs, do we really want consumers to pay higher prices in the grocery store? This does not take into account the competitive disadvantage that our farmers will face against China and India who would have no such input increases.

While we recognize the need to preserve the environment, we strongly urge the committee to reconsider the passage of any climate change legislation that does not provide realistic solutions. We urge you to oppose the passage of any legislation that does not provide adequate protection for both the environment and the business of agriculture.

Thanks you for your consideration of this important issue.

Sincerely,

A handwritten signature in cursive script that reads "Randy Veach".

Randy Veach
President

cc: Sen. Blanche Lincoln
Sen. Mark Pryor

RESOLUTION # 394

“BE IT RESOLVED BY THE QUORUM COURT OF THE COUNTY OF UNION, STATE OF ARKANSAS THAT:”

WHEREAS, there is now pending before the United States Congress an act entitled the American Clean Energy and Security Act (ACES) which if passed will require crude oil refineries located in the United States to purchase carbon credits in order to comply with the act and to continue the operation of their plants;

WHEREAS, Lion Oil Company, a petroleum refining company located in El Dorado, Arkansas, provides 1200 direct jobs in South Arkansas and indirectly is responsible for 3600 US jobs;

WHEREAS, ACES is a direct attack on the oil refining industry in the US in that it provides only a small fraction of the carbon allowances the industry needs while most other US industry and electric utilities are given 90 to 100% of the allowances they need to comply with the act;

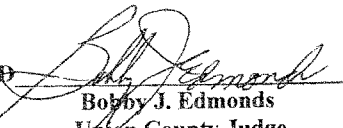
WHEREAS, if ACES in its current form is passed in the US Congress it will result in the loss of these jobs and significantly impact the economic and social fabric of Union County, Arkansas to the detriment of the citizens that call Union County and South Arkansas home:

NOW, THEREFORE, BE IT RESOLVED that:


The Quorum Court of Union County, Arkansas does hereby unanimously express its opposition to the passage of ACES in its present form and declares its full support for a vote by the US House of Representatives in opposition to the bill. The Quorum Court of Union County, Arkansas does further express its appreciation to Congressman Mike Ross for his vote against this bill and his efforts to have it defeated while in committee.

Thus done and entered on this the 11th day of June, 2009.

APPROVED


Bobby J. Edmonds
Union County Judge

ATTEST:


Shannon Phillips
Union County Clerk

RESOLUTION NO. 1333

**A RESOLUTION RELATIVE TO A FEDERALLY-
MANDATED CARBON CAP-AND-TRADE SYSTEM**

WHEREAS, pending legislation in the United States Congress to implement a cap and trade emissions trading system would establish a cap on greenhouse gas emissions, require those who emit greenhouse gases to purchase government credits to offset emissions, and allow those emitters to trade or sell those credits; and

WHEREAS, implementing a national cap-and-trade system will in effect impose an additional tax on every sector of the economy that directly emits a capped emission, including the industrial sector, electricity generation sector, transportation sector, and residential and commercial sectors which would be detrimental to the future of this Nation and the people of El Dorado and South Arkansas; and

WHEREAS, the cap-and-trade proposals not only burden every American with a huge new energy tax, but will inevitably lead to the loss of jobs due to the forced carbon mandates on every sector of the economy; and

WHEREAS, the cap-and-trade proposals create a host of new federal mandates leading to excessive regulation and more government intrusion into every industry that emits greenhouse gases

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF EL DORADO, ARKANSAS that this Council opposes the implementation of a cap-and-trade system on greenhouse gas emissions as proposed in the American Clean Energy and Security Act of 2009, and urges Congress not to enact this or similar legislation that may be proposed in the future.

APPROVED AND ADOPTED this 9th day of July, 2009.


MIKE DUMAS, MAYOR

ATTEST:


ANTHONY MCKINNON, CITY CLERK

August 26, 2009
Responses to Follow-Up Questions
Environment and Public Works Committee Hearing of July 21, 2009

Questions for Lowery:

Responses to questions:

Senator James M. Inhofe

1. *Can you explain more about how the Lion Oil Refinery has partnered with the community?*

Lion Oil employs 1200 people with an indirect job impact of an estimated 3600 other jobs primarily in South Arkansas. In addition Lion provides a payroll in Arkansas of \$60 million with direct payments of \$600 million per year to Arkansans, Arkansas companies and Arkansas Utility providers for labor, goods and services. This represents a huge irreplaceable part of the economic engine driving the economy of South Arkansas and a significant part of the overall Arkansas economy. Lion Oil is a unionized facility organized under the Union of International Operating Engineers for over 50 years. Lion Oil's average hourly wages are \$23.79 per hour which is significantly higher than the 1997 average Arkansas hourly wage of \$13.97 per hour.

Lion provides employees with full medical benefits and a strong package of other benefits including a profit sharing and 401K plan, life insurance, student scholarships and other benefits to improve the quality of life of our employees.

Lion Oil also supports the local community and many state wide charitable organizations. (see Exhibit A)

2. *What has been your constituent's reaction to Waxman Markey in your state and in your district since the bill has passed the house?*

The main concern of my constituents regarding the passage of Waxman-Markey in the U S House of Representatives has been the concern over the loss of established domestic jobs that will be loss and the transfer of those jobs overseas.

The second concern and consideration of the loss of domestic jobs is that global CO2 emission will, in fact, increase as foreign countries such as China and India who have emphatically stated they will not sign on to any agreement to limit their emission, increase their production when domestic refineries and other domestic manufacturers close down due to a burdensome tax.

Senator David Vitter

1. *Mr. Lowery, as a fellow Southerner, I have grave concerns with the idea of implementing any kind of cap-and-trade scheme that would increase the cost of energy on consumers and businesses. Can you discuss some of the industry we have down in the South that would be hit the hardest by the current proposals in Congress?*

Some of the industries on the South that would be hit the hardest by proposals in Congress are timber industries, agricultural related business, chemical companies, oil refineries, even small family farms, and small domestic oil and gas producers. These industries are already under economic stress and the result of additional energy costs would do irreparable harm. I am afraid many of these businesses would not recover resulting in shutdowns and additional increase in unemployment. The costs of energy on consumers and businesses are expected as a result of Waxman-Markey. The passage of Waxman-Markey would add 90% to a family of four's electricity rate, add 58% to the price of gasoline at the pump, 55% to the price of natural gas, and 56% to the price of heating oil.¹ Our unemployment rate here in Union County, Arkansas, has already reached 10.9% which represents 2,075 unemployed workers.²

2. *Mr. Lowery, in your testimony you discuss the transfer of wealth from South into areas of the Northeast and West Coast. I personally feel that we already "bailed-out" the financial institutions in those areas of the country, including Wall Street, enough. Can you tell me how in your dealings with those in Arkansas how they feel about this transfer of wealth?*

Any transfer of wealth through government legislation is unacceptable. As I sat and listened to the other panelists when I testified before your committee, the thought came to me: I was the only one on the panel not asking for government subsidies to "create" jobs. I was the only panelist simply asking to "leave us alone." The transfer of wealth from one region to another not only is unfair to the region from which it is transferred from, but creates division in our country. I do not believe we want to create "regional resentment" in our nation when many have worked too hard to make us "one." This nation needs to come together as one nation in order to recover from this devastating economy. To transfer jobs and tax dollars from one region at the "expense" of another is violating a cardinal rule of unity. It is absurd to transfer revenue raised from cap-and-trade to provide "tax cuts" and alternate energy research and development when there is no proof there will be a "net" gain of benefits from the transfer.

¹ The Heritage Foundation

² According to July's statistics – Arkansas Department of Workforce Services

3. *Are you aware of any provisions in Waxman-Markey that will make up for the lost revenue and increased energy costs to rural communities for public functions such as schools, that you eluded to in your testimony?*

The result of Waxman-Markey does not provide, in my opinion, for any loss of revenue or jobs. Instead, due to the increase of energy costs, to rural communities and school systems, many small school districts will probably have to be consolidated into larger metropolitan school districts. Utility costs along with the increased rising cost of transportation will have a significant impact on districts in the "Delta" region of the South and who have a high enrollment of minority students. Higher taxes and costs on industry will only erode the property tax base that finances local school districts. Industries affected will shut down and property values will decline.

Senator Mike Crapo

1. *In your testimony, you stated that Lion Oil will have to pay \$180 million per year to operate, stay in business, and maintain its workforce, yet Lion Oil's average annual net profit over the last 23 years is only \$13 million. Those are telling statistics.*

You also touched upon the importance of Murphy Oil to your district and the contributions it makes to your district. Could expound upon how many jobs Murphy Oil creates in your district and how many jobs would be lost as a result of cap-and-trade?

The value of having a Fortune 100 global company such as Murphy Oil headquartered in a rural town of 20,000 in south Arkansas is immeasurable. It's important to understand that the south Arkansas region has suffered from economic depression over the last decade, losing manufacturing businesses to places like Mexico and China, and with them good-paying jobs and population. While Murphy employees over 7,400 people throughout the United States, the company has chosen, for over 50 years, to call El Dorado, Arkansas "home," employing some 450 at its corporate office. These are professional, well-paying jobs that serve as an anchor for a community determined to preserve and savor a classic American way of life.

El Dorado personifies the spirit of the American South: a revitalized downtown full of one-of-a kind dining, retail and festival experiences; businesses who still invest in the town's redevelopment and prosperity; and a resilient population with faith in the future thanks to Murphy Oil's "El Dorado Promise." The company established this unique scholarship program in 2007 with a \$50 million investment, allowing every graduate of our local school district to attend any college of their choice on the company's dime. This extraordinary gesture gave our community a second wind, visible through the local voters taxing themselves to implement a \$32 million economic development plan that included building a new community center, as well as voting to increase school taxes in order to construct a new high school.

However, while many good things have happened in our area, we have certainly not been immune to the current global recession, as evidenced by the recent closing of a local chicken plant, leaving 1,200 people without jobs. Our community is teetering on the brink of success and failure, and it is very clear that we cannot afford the massive blow to our fragile economy that the cap and trade legislation would bring.

Make no mistake, Murphy's operations will be threatened if this legislation passes. Our state is proud of this company and our community's vitality is dependent upon it. To understand that this bill has the power to jeopardize good corporate citizens like Murphy, Lion, and others – companies provide high-paying jobs, excellent benefits, and vital support for the communities in which they're located – is daunting.

Respectfully Submitted,
The Honorable John Lowery
Representative
Arkansas House of Representatives

EXHIBIT A

Attachment to Responses from John Lowery

LION OIL COMMITMENTS

**United Way of Union County
El Dorado Boys and Girls Club
The Self Culture Club
El Dorado Baseball Booster Club
El Dorado Service League
Civitan Club
Sr. Citizen's Day at Oak Ridge Nursing Home
Union Complex-Youth team Sponsorship
American Lung Association of Arkansas
Northwest Environmental Studies Academy/2 scholarships
Boy Scouts of America
TOUCH/Union County Health Program
Turning Point (Women's Shelter)
El Dorado American Legion Baseball
Senior All-Night Party
SHARE Foundation
EHS Soccer Booster Club
University of Arkansas Chemical Dept
Healthworks' Fitness Center
American Heart Association
Arkansas Executive Summit
American Red Cross
El Dorado Chamber of Commerce Fantastic 4th
Special Olympics of Arkansas
SouthArk Outdoor Expo/South Arkansas Community College
El Dorado Chamber (Renovation of Barton Library)
El Dorado Police Department – SWAT Team
El Dorado Service League/"Start Smart" Program
American Jr. Diabetes Foundation
New Teacher Breakfast
S.I.G.H.T (Sight Impaired Group Help Team)
Golden K Kiwanis**

PAGE 2

**Union County Community Fdn./So. Arkansas Heritage Fund
Hannah Medical Center
Parkers Chapel Football Activity Fund
Musicfest
El Dorado Christmas Parade
Pride and Progress Club/Jimmy Reed Scholarship
Fraternal order of Police, El Dorado Lodge (Christmas Shop with Cop)
American Cancer Association
Union County Girls Softball
El Dorado Odyssey of the Mind World Championship
Arkansas Museum of Natural Resources
El Dorado Rotary Club
Arkansas Association of the Deaf
Campfire Girls USA
Arkansas Sheriffs' Youth Ranches
The Salvation Army (Back to School Supplies)
Smackover Football Booster Club
Desk and Derrick Club
NAACP/El Dorado Branch
Union County Jr. Livestock Sale
Junction City Dixie Youth Baseball
South Arkansas Hoya Basketball Association
El Dorado Union County Youth Fast Pitch Softball
NIE (Newspapers in Education)
Martin Luther King South Arkansas Concert Sponsor
Economics Arkansas/Trivia Challenge
South Arkansas Symphony
Chesley Pruitt Memorial Golf Tournament
El Dorado Police Benefit Golf Tournament
Share Benefit Golf Tournament
Union County Softball Complex
Metro Plan/Clean Cities
El Dorado Jaycees
Cerebral Palsy of South Arkansas
L. C. Ross Memorial Scholarship
Arkansas Independent Colleges and Universities
Shriner's Circus
El Dorado Soccer Team**

PAGE 3

El Dorado Chamber of Commerce Building Fund
The ARC of Arkansas
Grand Marais Festival
Parkers Chapel Seniors Auction All Night Party
American Legion Baseball
El Dorado Lions Club
Mt. Holly FCCLA/Career Leaders
Smackover All-Stars
Boys and Girls Club of Ouachita County
Spearsville(Pre-School Building) Grade School
El Dorado School District

Senator MERKLEY. Thank you very much, Representative Lowery.

I ask for unanimous consent that your additional articles be submitted for the record. Not seeing any objection, we will do that.

[The referenced information follows:]

4500 NORTH WEST AVE. • P. O. BOX 231 • EL DORADO, AR 71731 • (870) 863-1400



July 20, 2009

Arkansas State Representative
John Lowery Jr.
200 North Jefferson, Suite 620
El Dorado, Arkansas 71730

Dear Representative Lowery,

El Dorado Chemical Company manufactures nitrogen-based fertilizers and chemicals in South Arkansas. Due to the relative cost of domestic energy, the U.S. fertilizer industry currently supplies less than one half of U.S. farmers' nitrogen fertilizer needs, down from 85 percent domestic supply during the 1990s. Based on the current language of The American Clean Energy and Security Act of 2009, the annual cost of green house gas emission allowances and related operating and capital costs would increase El Dorado Chemical's competitive disadvantage versus imports. While the bill has language for border adjustments to protect U.S. industries from low-priced imports from countries without energy policies such as China, Russia and Venezuela, the protections are too weak and ten years will elapse before the first competitive review. By this time, the impacts on El Dorado Chemical will be too severe and could result in closing the El Dorado facility and loss of over 150 jobs directly associated with the site.

Respectively,

Gregory Withrow
Gregory Withrow
General Manager
El Dorado Chemical Company

El Dorado, Arkansas

A Legacy of Private Support for Public Education

El Dorado, in Southern Arkansas, is Arkansas' Original Boomtown, thanks to the 1920s oil rush that brought 30,000 people to the region. El Dorado personifies the spirit of the American South: a revitalized downtown full of one-of-a-kind dining, retail and festival experiences; big business who still invests in the town's redevelopment and prosperity; and a resilient population with faith in the future thanks to the "El Dorado Promise". El Dorado welcomes "home" those passionate to preserve and savor a classic American way of life.

Today, our beloved community is not immune to the global recession, and we have felt the impact of job loss due to manufacturing closures. Regardless of the challenges we face, we are blessed with citizens who care and want to move El Dorado forward, and who believe the key to this community's vitality lies in educating its children.



El Dorado Education Foundation



Founded in 1996, the El Dorado Education Foundation was established with a \$1.6 million endowment to enhance the quality of the educational experience for the El Dorado School District through providing teacher grants for special projects as well as teacher excellence awards. To date the Foundation has awarded over \$570,000 in grants for teachers to implement innovative projects in the classroom.

Partnering with the El Dorado School District, the Foundation funded and established endowed chairs of math, science, foreign language, and literacy – the first program of its kind in the United States public school systems. Structured in a similar fashion to university chairs, these programs concentrate upon building students' academic skills in these critical areas to help prepare them for the challenges of a 21st-century future.

Murphy Education Program



The Murphy Education Program was established in 1997 by Murphy Oil Corporation under the direction of former President and CEO, Claiborne Deming. This unique program is designed to promote academic excellence in the El Dorado public school system. The Program provides direct financial incentives to students in grades 1 - 12 who score above average on standardized tests and provides senior year academic letter jackets. Since its inception, \$1.1 million has been awarded to students.

El Dorado Promise Scholarship Program



EL DORADO
PROMISE

In January 2007, El Dorado Public Schools Superintendent Bob Watson announced the establishment of a scholarship program called the *El Dorado Promise*. This exceptional scholarship program reaches beyond the boundaries of economic need and academic ability to pay up to 100% of college tuition and mandatory fees for potentially every graduate of El Dorado High School.

Established and funded by Murphy Oil Corporation, the El Dorado Promise can be used at any accredited two-or-four year college or university, public or private. Students may use the scholarship at higher education institutions in or out of state. In January 2009, the program announced more flexibility in how the Promise funds can be used. If students have other tuition scholarships in addition to the Promise, they may elect to use their Promise funds for other school expenses, such as room and board.

The Promise is available to all students who graduate from El Dorado High School, reside in the district, and have been an El Dorado Public School student since at least the ninth grade. The scholarship amount is determined by length of attendance in the El Dorado Public School District. For example, graduates who have attended all 13 years at EPS will receive 100% of the scholarship. Students who attend 9 – 12 grades at EPS will receive 65% of the scholarship. The maximum amount of the Promise scholarship is based on the maximum level resident tuition payable at an Arkansas public university. For more information, visit www.eldoradopromise.com.



**EL DORADO
PROMISE**

THE EL DORADO PROMISE TURNS TWO

The inseparable link between quality education and the economic vitality of a community was underscored during Governor Beebe's recent ArkansasWorks Summit. Developing a force of educated, highly qualified employees is critical to attracting businesses and keeping them here. Our future depends on it.

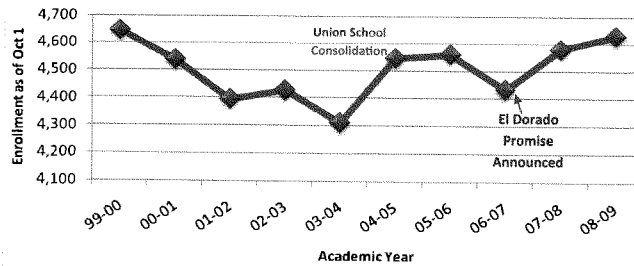
The El Dorado Promise, announced in January 2007, has had an immediate positive effect on the El Dorado Public Schools and many of its students and families. While we face great challenges in swimming against this strong economic current, El Dorado residents can be confident that we are on the right path.

Today, our students have hope that college *is* an option. Today, students are gaining the knowledge they need to help them succeed in college. Today, a seed is being planted, of which its fruits are infinite possibilities.

EL DORADO PUBLIC SCHOOLS ENROLLMENT

While it will take years to fully realize the true impact of the Promise in our community, the most immediate effects of the El Dorado Promise are evident in the El Dorado Public Schools and for its graduates. By the numbers:

- ✓ **4,628** – Number of students in the district, reflecting an enrollment increase of over four percent since announcement of the Promise.
- ✓ **28** – The number of states, in addition to Arkansas, from which families have moved to attend school in El Dorado. Additionally, families from 10 foreign countries have chosen El Dorado.
- ✓ **37** – New students who enrolled through school choice this year. Because they will not be eligible for the Promise without moving into the district, the quality of education available to students in the El Dorado Public Schools is exemplified in their choice.



Senator MERKLEY. While I am mentioning that, Senator Webb has submitted a statement for the record as well, and I ask for unanimous consent that that be added to the record as well. Without objection, we will do that.

[The prepared statement of Senator Webb was not received at time of print.]

Senator MERKLEY. And now we are to another Mayor, Mayor Palmer. Welcome.

**STATEMENT OF HON. DOUGLAS H. PALMER, MAYOR,
TRENTON, NEW JERSEY**

Mr. PALMER. It is a pleasure to be there. The camera guys left me just as I was about to speak, but I am going to move forward anyway.

[Laughter.]

Mr. PALMER. It is a pleasure to be here. I want to thank Chairman Boxer and Senator Sanders. He has been an outstanding advocate on this issue, along with my Senators in New Jersey, Senator Lautenberg and Senator Menendez, and my own Governor, Governor Corzine, who has shown true leadership.

I have remarks that are entered into the record. I just want to speak as a Mayor and give some of my thoughts, especially after hearing the interchange between both sides of the aisle.

You know, as Mayors, we do not have the luxury of really being partisan. We are where the rubber meets the road. We have to deal with our constituents each and every day.

And I was listening to the debate, I thought about the saying that says, you know, we may have all come over here in different ships but we are in the same boat now. Quite frankly, no matter what party you are in or where you are from, we actually are in the same boat.

In 2007, as president of the United States Conference of Mayors, we held the largest meeting of Mayors as it relates to climate change in this history of our country. When we came back, we heard about the polar ice caps and the polar bears looking for places to go. And I said to myself, if I come back to Trenton, New Jersey, and go into the neighborhood and tell the people we need climate change because of the polar bears, they would say, you know what Mayor, you have lost your mind.

We need real climate change. If you are talking about climate, we want the climate to change in our neighborhoods. We want to create jobs. We want to feel safe.

I recognize that this is an issue that some areas are father ahead of than others. So, I instituted a Trenton Green initiative, and brought everyone together. I do not want to say everyone, but you could imagine who was brought together as we looked at this issue because it is really a grassroots issue, and change is really going to come from the grassroots.

We set up this committee, and fortunately we pushed for an Energy Environment Block Grant with which you, Senator, and others were very helpful, which was giving money to cities so that we can do the retrofits. We cannot tell our citizens that they need to retrofit, we cannot tell our businesses that they need to retrofit, if we do not do our due diligence and retrofit public buildings.

The Energy Environment Block Grant which the Conference of Mayors championed, and which you were a champion of, is helping us, especially when we have it now with ARRA. We are able, in Trenton, to convert our 3,000 traffic signals to LED, which will save us \$130,000 a year, every year. We were also able, with this money, to retrofit a new courthouse, a rehabilitated courthouse which is going to also create jobs.

But when you talk to the citizens every day and they say to you, why should I care about climate change, I just say back to them, you are a senior citizen, you are on a fixed income, you own a home, do you care about your energy costs? Do you know that you can reduce your energy costs? I care about that. Your grandson, you are talking about how he needs a job, he is not working. We can have jobs in terms of retrofitting and weatherization, which is what we are doing. They care about those things.

And if you talk to a young mother or father about their child having asthma and why does it continue to happen and what we need to do to clean up the environment, then you see that this is an issue that really touches each and every one of us.

I have confidence in this committee, and in the Congress and Senate, that you will have dialogue. You will go and battle your points, but at the end of the day, really have a red, white and blue, and not just a green policy, and one that will have as a centerpiece as well not only reducing carbon emissions, but also putting money into the grassroots levels, into cities through an Energy Environment Block Grant as was mentioned. Not just 1 year, but for 40 years, so that we can use that money and plan appropriately and so that we can also use some of that money to do the kinds of things for small businesses as it relates to revolving loan funds so that they can help their businesses go green. too.

I think we all want to do it. I think it is just a matter of how do we do it.

So, I am confident that working with all of you, and the Mayors across this country who have shown the leadership from the very beginning, such as Mayor Greg Nickels, who started 140 members to sign the climate agreement and now we are almost 1,000 Mayors that are saying that we are going to reduce greenhouse gases and also create jobs.

This can be done. We have a report, Global Insight, which talks about how we can create the 4.2 million jobs doing a multitude of things. It is all about getting on with the business at hand. I know our citizens would like to see that.

We have shown tremendous success with young people who are now being trained and doing work in making their communities better, and not just having a green collar job, but also developing green collar careers as a result of it.

Thank you.

[The prepared statement Mr. Palmer follows:]



Testimony by:

The Honorable Douglas H. Palmer
Mayor of Trenton
Past President of The United States Conference of Mayors

Submitted to:

Senate Committee on Environment and Public Works
Subcommittee on Green Jobs and the New Economy

"Clean Energy Jobs, Climate-Related Policies and Economic Growth—State
and Local Views"

July 21, 2009

Introduction

Chairmen and Members of the Committee, I am Douglas H. Palmer, Mayor of Trenton and Past President of The United States Conference of Mayors. We thank you for this opportunity to appear today on behalf of The U. S. Conference of Mayors, the national organization of the nation's mayors who represent the more than 1,200 U.S. cities with a population of 30,000 or more.

The Conference expresses its appreciation to the Committee and Subcommittee for holding this hearing today, especially as you continue to work towards the enactment of landmark energy and climate legislation during this Congress. The nation's mayors believe that strong energy and climate legislation is not only essential to slow the mounting threats of climate change, but also necessary to accelerate the nation's move to a green economy that will provide a new direction while creating millions of new green jobs.

On behalf of the Conference and its member mayors, we also want to express our appreciation to the Members of this Committee and others in Congress who have supported our call for an Energy Efficiency and Conservation Block Grant (EECBG) Program. We thank you for your commitment to fund this program as part of the American Recovery and Reinvestment Act.

As a New Jersey mayor, I am especially proud of the leadership of our Congressional delegation, which includes Senator Lautenberg and Senator Menendez, specifically their strong commitment to locally-based climate solutions through the EECBG program. In fact, it was Senator Menendez who joined with Chairman Sanders to initiate the provisions that created this program as part of the Energy Independence and Security Act of 2007. We wish also to commend and support Senator Sanders for his additional work on the Green Jobs Act.

As this Committee develops its climate legislation, we especially want to recognize Chairman Boxer and other Members on this Committee for your support of the EECBG program. Last year, this Committee approved comprehensive climate legislation that included a strong, multi-year funding commitment to this priority initiative.

Pending Climate Legislation

Directing funds through the EECBG program to locally-developed, community-based energy and climate strategies is a top priority for the Conference as this Committee develops its comprehensive energy and climate legislation. As such, the mayors strongly urge your support for provisions to accomplish this.

Last month during the Conference's 77th Annual Meeting in Providence, the nation's mayors renewed their support for comprehensive national climate legislation, including a cap and trade system and funding support for the EECBG program. Our resolution on this legislation is attached.

We see such a commitment in your energy and climate legislation as part of a broad, multi-pronged national strategy to reduce our nation's future carbon emissions. We know this will be a multi-decade effort, requiring active engagement and action by all levels of governments, the non-profit and private sectors and citizens in their communities. The national effort must begin in this Congress with enactment of strong and comprehensive climate legislation.

Mayors believe that the scale and complexity of climate protection requires an all-hands-on-deck response, and certainly no single level of government can address it. This explains why mayors and other local officials have been so single-minded in urging Congress to embrace and invest for the long term in local climate actions. The record of local action shows that, at the local level, we are making progress, but not at the pace needed to curb emissions at the levels required to avoid major economic, social and climate disruptions.

The nation's organizations of local elected officials are united on this question, and are urging this Congress to invest in locally-based energy and climate solutions. The Conference of Mayors is joined by the National League of Cities and National Association of Counties in urging Congress to direct a share of allowances to provide a sustained and predictable funding commitment to the EECBG program to support local climate action.

Our support for comprehensive legislation is based on the reality that a top-down, command and control regulatory regime is not sufficient on its own to meet the climate protection challenges that our nation faces. Quite the contrary, we need a mix of actions at all levels of government and in our non-profit and for profit sectors, including a mix of incentives and dictates as well as a mix of governmental roles, all moving toward our emission reduction goals. This balanced approach is especially critical – especially during the early stages of our climate protection work – to our shared agenda of expedited greenhouse gas reductions and green jobs creation.

U.S. Conference of Mayors Climate Protection Agreement

Mayors throughout the U.S. have been working on energy and climate protection, including the development of "green jobs" for some time, although we didn't always use this phraseology. Mr. Chairman, having served as a local elected official for more than two decades, including Trenton Mayor since 1990, I had the privilege to serve with one of your successors and Mayor Kiss' immediate predecessor, former Burlington Mayor Pete Clavelle. He was a local elected leader, who gave a strong and early voice to what is now a national movement on climate protection and sustainability,

At the Conference and among the nation's mayors, our leadership on climate protection came to the forefront under the leadership of Seattle Mayor Greg Nickels, now the current President of the Conference of Mayors, when he joined with 140 of his colleagues more than four years ago to pledge local actions to achieve the goals of the

Kyoto Protocol. This action launched a broad, mayoral-led national movement for action at all levels of government on climate protection.

This year, we will reach a significant milestone in this commitment to local action on climate protection, as we welcome the 1000th mayoral signatory to the Mayors Climate Protection Agreement. Today, more than one quarter of our population – more than 83 million people – resides in cities where a mayor has pledged action to curb their city's greenhouse gas emissions. Two years ago, we achieved the 500th milestone when my colleague, Tulsa Mayor Kathy Taylor, joined as a signatory to this agreement.

This Mayors Climate Protection Agreement also urges actions at the federal and state level to support mayors and their work on climate protection. Specifically, it calls for action by Congress to enact national climate legislation.

With the governors' panel just before my remarks, I should point out that our agreement also calls for state level action, and I want to commend my governor, Jon Corzine, for his strong leadership on these issues.

Through the work of mayors throughout the country, we have an understanding of what can and cannot be accomplished absent a full partnership with the federal government. This explains our strong support for immediate action on comprehensive legislation that will move us forward on a shared agenda to address our climate challenges.

For my part, I was a willing signer of the Mayors Climate Protection Agreement, even though my city labored for years to deal with shifts in the national and regional economy, including the de-industrialization of cities like mine and others. Initially, it was not immediately clear to me how the many economic and social challenges before my city could be at least partially addressed by action on climate protection. But the social and economic costs of doing nothing, along with the potential to create new local industries generating green jobs of the future, led me to take up these issues in earnest.

As the organization's president beginning in late 2006, I worked to make enactment of an energy and climate protection block grant the Conference's top priority. Given my own experience and certainly local challenges we face, especially in this economy, we have to accelerate a shift to a greener economy through a strong and enduring partnership with our national government that invests in local action. Thanks to you, Mr. Chairman, and so many others, this effort led to the enactment of the EECBG program, which at its core was all about climate protection. For many mayors, this initiative was always about the development of green jobs and green industries in their communities.

USCM Green Jobs Report

Mayors are absolutely certain and even confident that this shift to a greener economy will translate into additional jobs in our communities and throughout the U.S. We know that there is still much work to be done, especially at the local level – in our cities and

counties – to clear the path and speed the transition to a different energy future. If successful, we know our cities and other communities will be more sustainable and our citizens will benefit from an enhanced quality of life.

For many mayors including me, our climate-related actions – and there have been many – have often been inspired and motivated by the local economic development potential of a greener economy, one that is less carbon-dependent and generates additional green jobs and careers in our neighborhoods, cities, counties and regions.

This led the Conference to enjoin Global Insight to prepare a national study on the potential of green jobs, including analyses to support our efforts to measure our progress in developing green jobs at the metropolitan level. This October 2008 report, *U.S. Metro Economies – Current and Potential Green Jobs in the U.S. Economy*, prepared for the Conference’s Mayors Climate Protection Center, is the first of many analyses we will be undertaking on this issue.

We modeled three scenarios: increasing energy efficiency of new and existing buildings; shifting transportation fuels to a greater reliance on ethanol and biodiesel, and securing a much larger share of our electricity from alternative renewable energy.

Among the report’s key findings –

- There will be 4.2 million green jobs in the U.S. economy by 2038 if we achieve the goals of the scenarios, five times larger than the 2006 baseline of slightly more than 750,000 jobs nationwide.
- Green jobs will represent 10 percent of all new jobs by 2038, and will be the single largest source of new jobs in the economy.
- Where a metro area starts today, in terms of its current share of existing green jobs, is not necessarily where its economy will end up in thirty years, meaning that all local areas (metropolitan and non-metropolitan areas) have the opportunity to increase their relative share of the green economy.

A key feature of this analysis by Global Insight was the work they did to provide each U.S. metropolitan area with an estimate of current green jobs, what we are calling our metro green jobs index. Going forward, as we further refine existing data and develop new data and measures, local leaders will be able to track how their local areas are doing in developing and attracting green jobs, showing policy-makers and the public the quantifiable economic and employment benefits of a greener economy.

Over time, this will give us tools to “measure” the actual effects of our policies and investments. And, it will challenge those directly who assert that green jobs is simply a goal or vision, not a justifiable economic strategy.

This report and its analysis is just one part of the Conference's work on green jobs. Last month, thanks to support from the Wal-Mart Foundation, the Conference has invested directly in several city-led initiatives to develop green job training programs for their cities.

Notably, our Global Insight report is conservative, in that it does not provide a fully comprehensive assessment of the potential for green jobs in the U.S. economy. Let me cite two examples from the transportation sector not addressed in the report, since it is an issue area before this Committee.

Our scenario for green jobs in the transportation sector modeled the effects of switching to alternative fuels in vehicles, leaving out the many green jobs that will result as we reengineer our transportation infrastructure systems and operations to make them less carbon dependent. For example, *USA Today* reported last week on the explosive growth in car sharing programs over the last few years, one example of the many changes that are already underway in the transportation sector and in our communities and regions.

A compelling local example can be found in Denver Mayor John Hickenlooper, who chairs the Conference Transportation Steering Committee. The mayor was honored last month at our Providence Annual Meeting, winning our Mayors Climate Protection Award in the large city category for his leadership on rail transit development. Denver's FasTracks initiative is the largest single build-out of rail transit in the nation's history, leading to more than 100 miles of new rail transit service throughout the Denver metropolitan area.

This Committee's support for transportation funding eligibilities in earlier TEA laws helped lay the groundwork for this massive initiative in an earlier project, named T-REX, where a rail transit line was built simultaneously with improvements to Interstates 25 and 225. The FasTracks program and the T-REX project further underscore the importance of your upcoming debate on legislation renewing the SAFETEA-LU law, where mayors are pressing for greater local decision-making authority at the metropolitan level so that available resources can be deployed in new ways to promote such multi-modal solutions.

FasTracks will fundamentally redirect housing and development patterns in this vast and growing metropolitan area. When completed, this investment will reduce driving and congestion, curb oil dependency and greenhouse gas emissions and stimulate a host of related green-oriented investments and the thousands of green jobs that ultimately result from this initiative.

In my own city, more than one year ago, I set forth my "Trenton Green" initiative to put my city on a path to green collar careers, new green jobs and a greener economy. We went to work on a number of energy conservation, energy efficiency and renewable energy production initiatives, with a particular emphasis on developing green collar careers for our citizens. It is an effort that reaches out broadly to our citizens and

embraces new partnerships with the private sector, Non-profit agencies, the local utility, state government and its agencies, and the federal government.

We continue to move forward on this initiative, but the scale of the economic downturn we are facing is threatening our local energy and climate efforts. Again, I would underscore why a sustained and enduring commitment to the EECBG program, as we have proposed, is so critical to my efforts to weather this storm, and stay the course as we work to accelerate the development of green jobs and new green careers in my city.

My experience in Trenton is characteristic of so many cities and counties that were moving forward with their local green initiatives until recent economic conditions slowed or curtailed local investments and initiatives. In these cities and local communities, existing and new energy and climate strategies are being tested and launched, such as demonstrating new financing mechanisms using local property tax liens, the deployment of new technologies on public buildings and city operations, and activities that are helping grow new green businesses and green jobs. These are coupled with efforts to retrofit our vast inventories of buildings and reengineer our infrastructures and operations—all of which offer almost unlimited potential for green jobs; yet, the full implementations of such initiatives are threatened by prevailing economic conditions, as recent Conference surveys have shown.

With the significant commitments made in the ARRA law to the EECBG program, we are able to still move forward and make progress on these initiatives as we transition to a greener economy. We thank you in Congress and the new Administration for your leadership in making these investments in our future.

Metropolitan Economies and Green Jobs

Mr. Chairman, our nation's cities and their metro areas are the engines of our national economy. Our 363 metro areas are home to 86% of U.S. employment, over 90% of wage income and nearly 90% of our gross domestic product.

Therefore, we know that without the economic recovery of our cities and metros, there can be no U.S. recovery. Unfortunately, our cities and these metro economic engines are facing unprecedented economic conditions.

Earlier this year, the Conference released a forecast of metro unemployment for 2009, and this report found an amazing number – about one-third – of our metro economies will experience no employment gains for the decade. This is simply unprecedented. In a report last month on metropolitan employment, every one of the nation's 363 metro areas lost jobs.

These indicators remind us of the importance of why moving forward with a green economy is so important. Our success in this regard is linked to what happens in our metropolitan areas. In another Global Insight report prepared for the Conference, 94 percent of all U.S. economic growth over the next twenty years will occur in our nation's

363 metropolitan areas. These areas are where future energy demand will occur and where the battle to curb the growth in greenhouse gases will take place. It also means that our success in shifting to a green economy and the pace of green job development is fundamentally linked to what happens in these areas.

Again, this explains why we have been so vocal in advocating a commitment to the EECBG program, because it invests directly in the very cities and counties that underpin these metro economies. The EECBG delivery system ensures that a portion of the resources you distribute are place-based, investing directly in the very communities where we will succeed or fail in our shared agenda to curb climate emissions while growing our economy and creating green jobs.

Key Near-Term Policy Targets for Climate and Green Jobs

Mr. Chairman, the nation's mayors were strongly supportive of the ARRA commitments to green jobs and greener energy development and deployment, especially the legislation's commitment to the EECBG program. Today, most of the eligible cities and counties have filed their applications for these ARRA resources, with some already submitting their more detailed city and county energy conservation and efficiency strategies. Soon, we will begin to record and track the green jobs that result directly from this investment of resources as well as reduced carbon emissions that result from the range of EECBG-eligible projects and initiatives.

A large challenge before Congress is how we build upon this investment so that these activities prompt new strategies and structures to carry us beyond this infusion of initial resources. Certainly, it explains our strong interest in ensuring a continued funding commitment in the energy and climate legislation now under development in this Committee.

On behalf of the mayors, I wanted to share some of our thinking about our common efforts on energy and climate, as we move forward over the next several years. First, there is a need for investments in the easily achieved carbon reduction strategies. Much of the work of mayors has been about conservation as a top priority. The cheapest kilowatt or Btu is the one we don't consume. At the local level, this is all about human behavior and how we operate the systems we already have in place. Too often, these activities are discounted in the rush to debate out-year scenarios on power and energy development, overlooking the fact that our energy demand forecasts are driven by growth curves that could be systematically reduced by a stronger commitment to energy conservation, which is among the targets embedded in the EECBG program. For example, a vigorous standard for renewable energy's share of future electricity production becomes much easier to meet if future demand is reduced through the development of a strong conservation ethic in our local communities.

The nation's success in improving our recycling rates was grounded in a recycling ethic that grew from locally-based initiatives and public consensus at the local level for changes in our practices and behaviors. This grass-roots movement took hold and

fundamentally changed our assumptions about the future, what facilities were needed and the cost profile of these services.

We see similar gains in the energy and the climate area where additional policy focus on the simple goal of increasing energy conservation to reduce capital needs for future energy production and transmission, lowering the overall costs of achieving our climate goals in the out-years, and providing for carbon reductions today, not years in the future. To the extent that conservation measures go beyond behavior changes, the work will be more labor intensive – more green job producing – than other priorities. Dollars saved through these conservation and efficiency measures result in the recycling of more dollars within our local communities, as opposed to sending them to other places outside the local economy, including the purchase of foreign energy supplies. Mayors are looking for ways to keep a bigger share of their energy dollars at home to build local businesses and develop green jobs in our neighborhoods.

Similarly, the next cheapest kilowatt or Btu is the one produced from energy efficiency. Again, there is a body of evidence to support claims that a broad, national commitment to energy efficiency is another pathway to the production of more green jobs at less cost than new energy production.

Finally, we know that the most expensive kilowatt or Btu is the one that comes from new energy sources, and this is the one that is most problematic in reducing our total carbon emissions - unless it is generated from renewable resources.

As mayors, when we press you for a commitment to local energy and climate action, we are saying that we can't afford to overlook the powerful economic and climate benefits of conservation and the significant economic and climate benefits of energy efficiency. And, we are also saying that mayors have a strong track record in shaping human behavior, which is one of the underlying challenges we must address as we move forward.

This hierarchy of action that I have just outlined is something that your legislation needs to fully embrace. In so doing, our call to invest directly in communities and in local consensus solutions through the EECBG program and other mechanisms can be seen in a context that has significant economic and climate benefits, helping us achieve emissions reductions at more lower costs.

My earlier reference to car sharing offers an example. These programs have been shown to lower household transportation costs, save families money and reduce auto use and vehicle miles travelled, lowering carbon emissions in the transportation sector while reducing massive capital requirements in the future to widen existing highway facilities in our complex urban environments.

Closing Comments

The bottom line, Mr. Chairman, is that we are in the midst of a perfect economic storm and local governments simply do not have the resources to maintain current services, let alone increase their commitments and do more to accelerate our transition to a greener economy. New energy and climate programs at the community level are in the near-term and long-term interest of the nation and are the key to our future prosperity. But they are simply out of reach unless we have resources, such as those provided by the EECBG program, to help us build on the momentum that we have begun through the Mayors Climate Protection Agreement and other initiatives.

Simply put, we believe that the EECBG program is one of the most important policy commitments you can make to stimulate the creation of green jobs, investing directly in the places where most of the nation's unemployed workers reside and where our future prosperity will be shaped.

ARRA gave us a significant jumpstart on this path to a greener economy, including the potential for thousands of green jobs in the near future and potentially millions over the next several decades. As the Committee moves forward on climate and other important legislation, we urge you to support measures that will invest directly in our communities to ensure that we fully realize this vast potential and achieve our shared energy and climate goals.

Chairmen and Members of this Committee, the nation's mayors strongly support your efforts as you move forward on these issues, and we fully support your efforts to fashion strong legislation to meet vigorous carbon emission reductions goals for the nation.

On behalf of the nation's mayors, thank you for this opportunity to appear here today.



CALLING ON CONGRESS TO PASS MEANINGFUL CLIMATE PROTECTION LEGISLATION

WHEREAS, cities house more than half of the world's population and are responsible for more than 80% of greenhouse gas emissions; and

WHEREAS, mayors have the unique opportunity and significant responsibility to implement programs that result in real emissions reductions; and

WHEREAS, cities are also the first responders to the impacts of climate change as increases in temperature, changes in precipitation patterns and storm events, and sea level rise change the way we do business; and

WHEREAS, strong federal climate policy will position this country to be competitive in the global economy, drive investment in new, clean energy solutions and create new, local jobs, aiding in our national economic recovery; and

WHEREAS, federal policy must also enable and provide resources for local action that is critical to global greenhouse gas reductions; and

WHEREAS, The U.S. Conference of Mayors has established policy on city priorities for the design of a federal cap and trade system to regulate national greenhouse gas emissions, including:

- Setting an economy-wide cap on greenhouse gas emissions that results in real reductions in greenhouse gas emissions consistent with the scientific consensus, or 80 percent reduction below 1990 levels by 2050;
- Avoiding "safety valve" provisions, and instead integrate alternative flexibility measures to help control costs, such as the use of offsets;
- Incorporating an accelerated schedule toward full auctioning of emission allowances;
- Distributing revenues generated by a cap and trade program to recognize the important role that local governments play in climate protection.

WHEREAS, in May 2009, the US House of Representatives Energy and Commerce Committee passed the American Clean Energy and Security Act of 2009 (ACES Act); and

WHEREAS, the ACES Act establishes the Global Warming Pollution Reduction Program, including the creation of an economy-wide cap and trade system; and

WHEREAS, the ACES Act does incorporate the following key elements of a cap and trade program, which make progress toward meeting city priorities:

- Pollution caps to reduce total GHG emissions 83 percent below 2005 levels by 2050;
- Use of offsets as a cost containment measure;
- Increasing percentage of allowances to be auctioned over time; and
- Considerable provisions for consumer protection

WHEREAS, the ACES Act includes additional key provisions that will enable US cities to more effectively develop and implement local climate protection initiatives, including:

- New energy efficiency standards (codes) for buildings, appliances and industry;
- Building energy performance labeling program to address energy efficiency potential in existing buildings;

WHEREAS, the ACES Act Global Warming Pollution Reduction Program does not currently recognize the key role that local governments play in implementing climate solutions through direct allocation of credits or auction revenues,

NOW, THEREFORE BE IT RESOLVED, that the US Conference of Mayors calls upon the United States Congress to pass the American Clean Energy and Security Act of 2009 in advance of the United Nations Climate Change Conference 15th Conference of Parties meeting in Copenhagen in December 2009;

BE IT FURTHER RESOLVED, that the US Conference of Mayors urges Congress to amend the ACES Act in consideration of the critical role that cities must continue to play in advancing solutions to reduce greenhouse gas emissions and adapting and responding to changing global climate conditions, to include:

- Support for enforcement as well as adoption of local energy and land use codes;
- Eliminate federal and state barriers to local financing programs that use property tax mechanisms to finance efficiency upgrades;
- Allocate federal transportation dollars directly to local governments to support increased investment in transit as well as bicycle and pedestrian infrastructure;
- Direct allocation of credits or auction revenues to cities for investment in climate mitigation, through such initiatives as the Energy Efficiency and Conservation Block Grant program, as well as adaptation initiatives, consumer protection and workforce development programs.
- Direct some funding achieved through a cap and trade system toward assisting high greenhouse gas emitting generators of electricity and research and development firms, dedicated toward finding cleaner energy solutions;
- Include tax exempt financing for Investor Owned Utilities to finance utility plant retrofits for clean energy.



Key Findings

The Mayors/Global Insight Green Jobs Index

- The U.S. Conference of Mayors and Global Insight have created a national Green Jobs Index that calculates a baseline of current green jobs in the economy devoted to reduction of fossil fuels, the increase of energy efficiency, and the reduction of greenhouse gas emissions. This index will be updated periodically to track the creation of green jobs in the economy.
- The Index estimates that in 2006 there were just more than 750,000 Green Jobs in the U.S. economy.
- Over half of the green jobs were in the Engineering, Legal, Research and Consulting category (418,715 jobs), highlighting the importance of indirect jobs in the green economy.
- The second largest category was Renewable Power Generation (127,246 jobs). Agriculture and Forestry provided a significant contribution of 57,500 jobs.
- Green Jobs in 2006 were well distributed across the country. Approximately 85% were located in metropolitan areas, while the remaining were found in non-metro counties.
- The top ten metros with the highest number of Green Jobs account for 23% of all green jobs nationally. New York ranks first, with 25,021 jobs, followed by Washington D.C. (24,287); Houston (21,250); and Los Angeles (20,136).

Green Jobs Forecast

- For its Green Jobs Forecast, the report assumes the following:
 - by 2038, 40% of the electricity generated in the U.S. will come from alternative fuels (30% from wind; 20% from solar; 10% from incremental hydropower; 10% from geothermal; and 30% from biomass);
 - residential and commercial retrofitting will occur at a level that results in a 35% reduction in electricity use in existing buildings over the next three decades; and
 - by 2038, 30% of gasoline and diesel demand for passenger cars and light trucks is satisfied by alternative fuels.
- Under these scenarios, the Green Jobs Index forecasts that by 2038, the economy will generate 4.2 million new Green Jobs, five times today's total count.
- The report projects that these green jobs could provide as much as 10% of new job growth in the economy over the next 30 years.
- Within this forecast, Renewable Power Generation would reach 407,200 jobs over the next decade, 802,000 jobs in the second decade, and account for 1,236,800 jobs by 2038.
- The 30-year project to retrofit the existing residential and commercial building stock would generate 81,000 jobs. These jobs would retrofit a small percentage of the existing stock of buildings each year and dramatically reduce their energy requirements over the forecast period.
- The push to greatly increase use of alternative transportation fuels would generate nearly 1.5 million jobs by 2038. The trajectory of growth for these jobs follows a similar path to the expansion of renewable fuel production, with faster growth in the early forecast period to reach the federal mandate and slower growth thereafter.
- Associated growth in engineering, legal, research and consulting positions would be more than 1.4 million new jobs (846,900 by 2018 and 1,160,300 by 2028).

[OVER]

Green Job Potential Growth

Renewable Power Generation

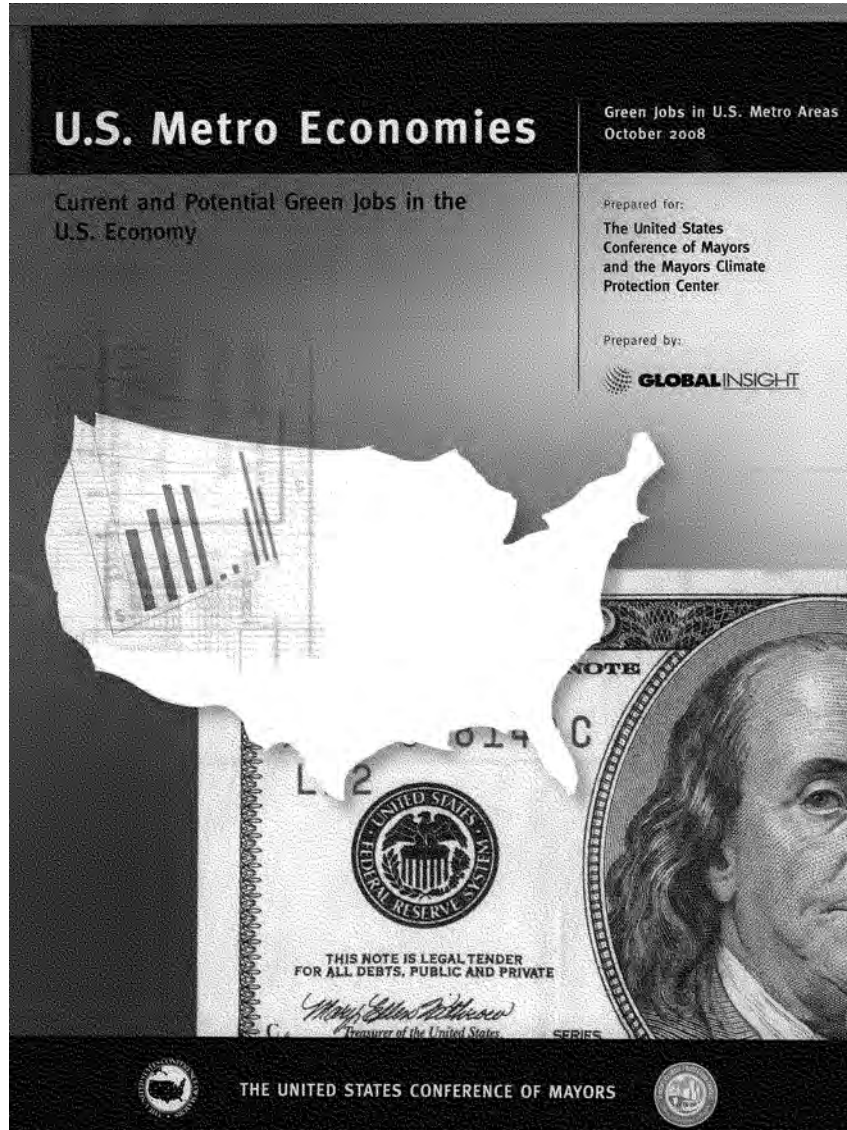
- EPA estimates that in 2006 electricity generation was responsible for 41% of carbon dioxide emissions in the U.S. The Energy Information Administration estimates the electric power sector generated 4,006 billion kilowatt hours of electricity in 2007.
- Of that total, just 319 billion kilowatt hours (8.0%) were generated from renewable sources. Nuclear power made a significant contribution of non-fossil fuel power, generating 806 billion kilowatt hours. Of the renewable fuels, hydroelectric power was by far the largest contributor. Wind energy, though small in magnitude, was the fastest growing from the previous year.
- For wind, the net generation in 2007 was 32.1 billion kilowatt hours, a 21% increase from one year earlier, enough to power 2.9 million homes.
- Wind capacity is expected to increase 45% in 2008, leading to 10% of renewable energy generation in 2008. Still, of total electricity generation for the U.S., wind accounted for just 0.8% of the total for 2007.
- The American Wind Energy Association estimates that total potential generation at 10,777 billion kilowatt hours from wind annually, more than 2.5 times the total U.S. electricity net generation in 2007. North Dakota, Texas, Kansas, South Dakota, and Montana all have the potential to generate more than 1 billion kilowatt hours from wind annually. Opportunities also occur further east, with Maine, New York, and Michigan each in the list of top-twenty states.
- Solar power represents an opportunity for massive job growth. In 2006 approximately 606 million kilowatt hours were generated from photovoltaic and solar thermal devices, representing a 23% growth since 2000. In 2007, investment in solar power capacity jumped 21% in just one year. Solar remains an extremely small part of the overall generation infrastructure, generating just 0.2 percent of alternative-based electricity in 2007.
- Solar manufacturing has surged over the past 10 years. In 1997, domestic producers shipped photovoltaic devices totaling 46,354 peak kilowatts of capacity, employing 1,700 in the industry. By 2006, production had reached 337,268 peak kilowatts of capacity, a more than seven-fold increase, and employment had risen to 4,000 direct jobs.
- In 2007, hydroelectric sources generated 246 billion kilowatt hours of electricity, enough to power more than 22 million homes. Net generation in 2007 accounted for 77% of alternative net electricity generation and 6.1% of U.S. net electricity generation.
- The greatest future growth potential is in "Small Hydro" projects, with capacities ranging from 1 megawatt to 30 megawatts, with locations for projects spread across the country.
- In 2007 geothermal sources yielded net generation of 14.9 billion kilowatt hours, enough to power 1.3 million homes and equaling 4.7% of all renewable generation. The U.S. Geological Survey concluded that total geothermal potential might be ten times higher than current installed capacity.
- In 2007 net generation from biomass sources totaled more than 55 billion kilowatt hours, equivalent of electricity for more than 5 million homes.

Energy Efficiency

- Residential and commercial buildings account for a significant portion of total energy consumption in the U.S. Efforts to increase their efficiency have great potential to generate new employment opportunities.
- One of the key differences between green and conventional energy efficiency renovations is generally the materials used in the process. One problem that currently exists in the industry, however, is a knowledge gap across many contracting firms. Some firms are not fully aware of some green construction techniques or the wide variety of modern materials that can be used in a given renovation project.

Renewable Transportation Fuels

- EPA estimates the transportation sector generated 33% of total carbon dioxide emissions in 2007. Total CO₂ emissions in the sector have increased 16% since 1995, and 25% since 1990.
- In 1997, ethanol made up just 1.09% of the total gasoline pool. By 2007, that had increased to 5.09% with significant growth potential based on legislation at both the Federal and state levels to increase alternative fuels.





**The United States
Conference of Mayors**

Manuel A. Diaz
Mayor of Miami, FL
President

Greg Nickels
Mayor of Seattle, WA
Vice President

Elizabeth B. Kautz
Mayor of Burnsville
Second Vice President

Tom Cochran
Executive Director and CEO



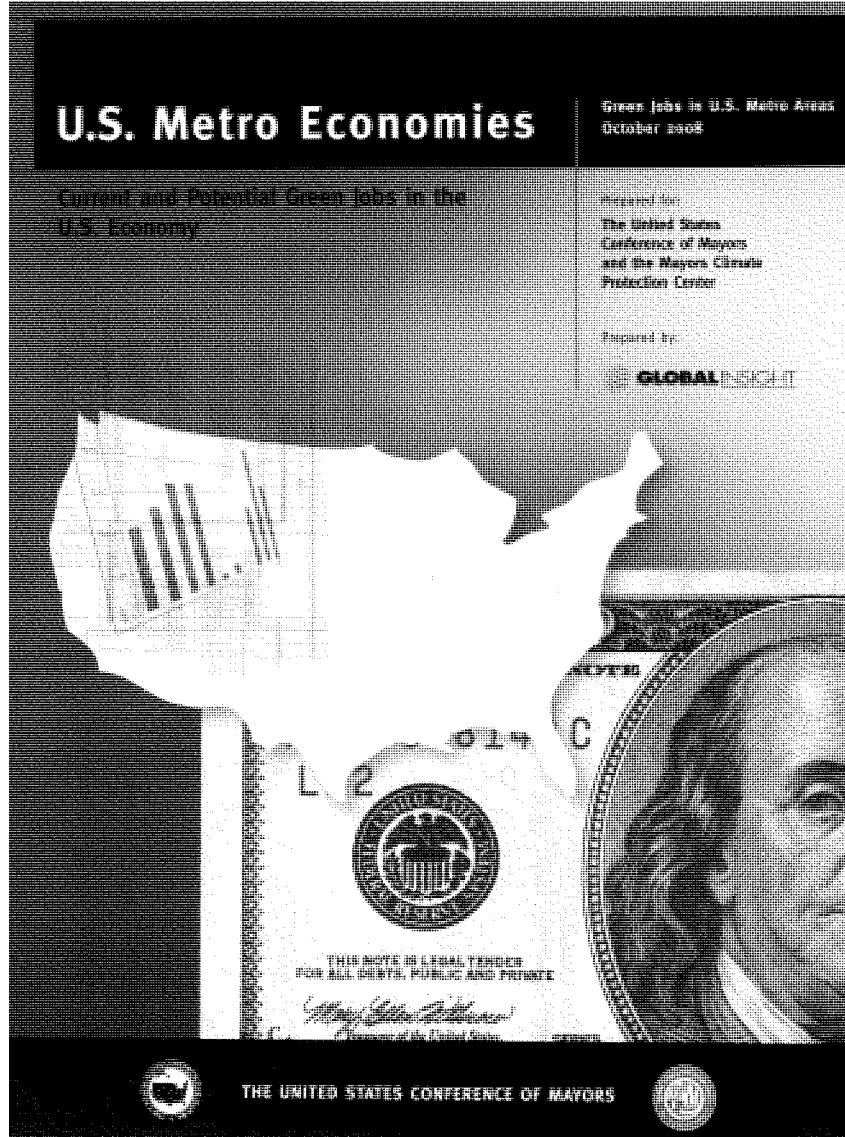


TABLE OF CONTENTS

INTRODUCTION2

 OIL AND GAS CONSUMPTION2

 ELECTRICITY DEMAND3

 A GREENER ECONOMY3

CURRENT GREEN JOBS5

 U.S. CONFERENCE OF MAYORS – GLOBAL INSIGHT GREEN JOBS INDEX5

GREEN JOB POTENTIAL GROWTH6

 RENEWABLE POWER GENERATION - STATUS AND POTENTIAL6

Wind Power6

Solar Power7

Hydropower8

Geothermal Power8

Biomass Power9

 ENERGY EFFICIENCY – STATUS AND POTENTIAL9

Energy Efficiency Standards9

Energy Efficiency Implementation10

 RENEWABLE TRANSPORTATION FUELS11

Transportation Sector Emissions11

Renewable Fuels11

GREEN JOBS FORECAST12

 RENEWABLE POWER GENERATION12

Scenario12

Green Jobs Created13

 RESIDENTIAL AND COMMERCIAL RETROFITTING14

Scenario14

Green Jobs Created14

 RENEWABLE TRANSPORTATION FUELS15

Scenario16

Green Jobs Created16

 INDIRECT JOBS16

 FORECAST RESULTS17

CONCLUSION18

APPENDIX19



INTRODUCTION

Dwindling natural resources, growing global demand for energy, climate change – these issues are irrevocably altering our global economy. In this report, the U.S. Conference of Mayors and Global Insight have examined the economic benefits of the 'Green Economy' – that part of economic activity which is devoted to the reduction of fossil fuels, the increase of energy efficiency, and the curtailment of greenhouse gas emissions. The greening of the U.S. economy, of the global economy, is not a dismantling of the past, but a new step forward – the next step in a continuous process of economic growth and transformation that began with industrialization and led us through the high-tech revolution.

The economic advantages of the Green Economy include the macroeconomic benefits of investment in new technologies, greater productivity, improvements in the US balance of trade, and increased real disposable income across the nation. They also include the micro-economic benefits of lower costs of doing business and reduced household energy expenditures. These advantages are manifested in job growth, income growth, and of course, a cleaner environment.

The remainder of the Introduction presents the background for our research of Green Jobs. In the second section we establish a current count of Green Jobs in the U.S. economy as well as their distribution across metropolitan areas. The third section outlines areas of potential future growth. In the fourth section we forecast potential growth under a set of specific scenarios. The fifth section concludes.

OIL AND GAS CONSUMPTION

As is well known, the United States has a thirst for oil that well exceeds its production. In 1970, when domestic oil production peaked, net imports of foreign oil supplied 21% of total consumption in the United States. By 2007, that figure had risen to 59%, and Global Insight forecasts the import share of consumption to rise to 65% by 2030, unless measures are taken to decrease America's dependence on foreign sources of oil.

The primary driver behind our ever-increasing demand for foreign oil is the transportation sector, namely cars and trucks. According to the Energy Information Administration (EIA) the transportation sector consumed 69% of total petroleum products in 2007.¹ Global Insight estimates that the transportation sector consumed a combined 179 billion gallons of petroleum-based fuels in 2007, and demand for all petroleum products is forecast to grow 7.7% by 2030. That increased demand, combined with lower domestic production, is expected to result in a 27% increase in daily petroleum imports by 2030 over 2007 levels. The transportation sector also accounted for 33% of CO₂ emissions in 2007.

Our increased reliance on foreign oil has led to significant debate on topics such as energy security, foreign policy, and financial stability related to the widening trade deficit. Combining Global Insight's oil import forecast with our expectations for crude oil prices, we are currently forecasting an average outflow of \$240 billion per year, measured in 2006 dollars, to

¹ Annual Energy Review. Energy Information Administration. U.S. Department of Energy. 2007.

pay for imported oil through the year 2030.² That \$240 billion dollars, or 2.3% of Gross Domestic Product, acts very much as a tax on the U.S. economy. Indeed, it is worse than a tax - for the money flows out of the country, not to be re-invested in areas such as health care, education, or infrastructure.

ELECTRICITY DEMAND

Energy demand outside of the transportation sector is also growing, as the population increases and energy-dependent appliances continue to be ever more integrated into homes and businesses. The residential and commercial construction sectors, which use energy for heating and cooling buildings and homes, and electricity for lighting and appliances, are major sources of consumption.

Global Insight projects that by 2030, more than 36 million new homes and 20 billion square feet of commercial building space will be constructed to accommodate new demand and replace older structures. This new construction will generate net additional demand of 790 billion kilowatt hours of electricity by 2030, equivalent to 465 million barrels of oil. Electricity expenditures in 2030 for those net additions are expected to be \$120 billion.

Electricity generation can also have a negative effect on health conditions. Pollution caused by "dirty" power plants (namely, coal-generated utilities), car and truck congestion, and energy-intensive manufacturing plants, all have adverse health effects on the population.

A GREENER ECONOMY

Scientists have almost universally accepted that global climate change is a reality. As a result, many nations are making concerted efforts to reduce the buildup of carbon dioxide (CO₂) and other GHG emissions either by reducing the use of fossil fuels or by finding ways to prevent emissions from entering the atmosphere. While the United States accounts for only 5% of the world's population, it accounts for 20% of worldwide energy usage and 20% of global CO₂ emissions. Becoming a greener economy will enable the U.S. to transition to a lower carbon economy, a step in the direction of preventing the adverse effects of global warming as well as improving public health and stabilizing energy expenditures. It will also create a significant number of new jobs.³

Global Insight has calculated the current total number of Green Jobs in the U.S. across several broad industries. These are industries that have high growth potential as the U.S. becomes a greener economy. We have also calculated potential growth under assumptions for the future of renewable electricity generation, increased energy efficiency for residential and commercial buildings, and increased usage of renewable fuels by the transportation sector.

This data has been broken out at both the national and the metro level. Metropolitan economies are the engines of U.S. economic growth; if investment in green industries is to successfully transform the U.S. economy, it must happen at the metropolitan and local level.

² The average outflow estimate is highly sensitive to expected future oil prices and would be higher if measured in nominal dollars.

³ In this report we project potential job growth of moving toward a lower carbon economy but do not provide a calculation of greenhouse gas reduction.

This investment is critical to our competitiveness in the global economy, to our living standards, indeed, to our future. These investments carry macroeconomic benefits as well – they create jobs, increase productivity, and generate income that creates further jobs. It is a virtuous cycle, an investment that has real returns for both the short and the long term.

CURRENT GREEN JOBS

To construct a count of Green Jobs in the United States we have identified to the finest precision possible the number of workers employed in green activities. We define these as: any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuel, manufacturing jobs producing goods used in renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy-efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields. A full list of the chosen sectors is included in the Appendix.

| Green Jobs by Major Category - U.S. Total | |
|--|----------------|
| Renewable Power Generation | 127,246 |
| Agriculture and Forestry | 57,546 |
| Construction & Systems Installation | 8,741 |
| Manufacturing | 60,699 |
| Equipment Dealers & Wholesalers | 6,205 |
| Engineering, Legal, Research & Consulting | 418,715 |
| Government Administration | 71,900 |
| Total | 751,051 |

U.S. CONFERENCE OF MAYORS – GLOBAL INSIGHT GREEN JOBS INDEX

We estimate that as of 2006 there were just more than 750,000 Green Jobs in the U.S. economy.⁴ More than half of existing jobs were in Engineering, Legal, Research and Consulting, revealing the importance of these indirect jobs to the Green Economy. The second largest category was Renewable Power Generation, with more than 127,000 jobs. Agriculture and Forestry provided a significant contribution of 57,500 jobs.⁵

Green Jobs in 2006 were distributed across the country. Approximately 85% were located in metropolitan areas while the remaining 15% were in non-metropolitan counties. The table to the right reveals the metropolitan areas with the highest numbers of Green Jobs. It is not surprising that the highest ranking areas are some of the largest metropolitan economies in the country, especially considering that over half of the country's Green Jobs are in the engineering, legal, research, and consulting category. These top-ten areas account for 23% of total Green Jobs in the United States.

| Top Ten Metropolitan Areas | |
|-----------------------------------|-----------------|
| MSA | Green Jobs 2006 |
| New York | 25,021 |
| Wash DC | 24,287 |
| Houston | 21,250 |
| Los Angeles | 20,136 |
| Boston | 19,799 |
| Chicago | 16,120 |
| Philadelphia | 14,379 |
| San Francisco | 13,848 |
| San Diego | 11,663 |
| Pittsburgh | 9,627 |

⁴ Data is from the National Establishment Time Series (NETS) database by Walls & Associates. Renewable Power Generation Jobs are not available in NETS. Green Jobs 2006 totals for Metropolitan areas include all categories except Renewable Power Generation.

⁵ We did not include all Corn and Soy Farming jobs in the United States. Approximately 23% of U.S. grown corn is used for ethanol and 16% of soy for biodiesel. We used those shares to scale down the contribution of those sectors.

GREEN JOB POTENTIAL GROWTH

In this section, we examine the fundamental changes to the U.S. economy that are likely to drive future growth in Green Jobs. For renewable resources, the two key areas are in electricity generation and transportation fuels. These two sectors currently use vast amounts of fossil fuels and accordingly are responsible for the bulk of greenhouse gas generation. In addition to using cleaner fuels, there are significant gains to be made in our existing infrastructure by making it more energy efficient. Jobs engaged in developing new technologies to increase energy efficiency and usage of renewable resources, and jobs that install existing technologies, are considered Green Jobs.

RENEWABLE POWER GENERATION - STATUS AND POTENTIAL

Increasing concerns about global warming have brought significant attention to the electric power generation sector. The Environmental Protection Agency estimates that in 2006 electricity generation was responsible for 41% of carbon dioxide emissions in the United States. The sector is a heavy consumer of fossil fuels, using coal to generate approximately half of all electricity in the country. Fortunately, there are a range of alternatives to fossil fuel-based electricity, whose technologies have already made them economically competitive, or are expected to be competitive in the near future. The EIA estimates the electric power sector generated 4,006 billion kilowatt hours of electricity in 2007. Of that total, just 319 billion (8.0%) was generated from renewable sources. The nuclear power industry also created a significant amount of non-fossil fuel power, generating 806 billion kilowatt hours. Of the renewable resources, hydroelectric power was by far the largest contributor. Wind energy, though small in magnitude, was the fastest growing from the previous year.

Wind Power

Wind energy is currently the fastest growing alternative energy source in the country. The EIA of the U.S. Department of Energy estimates that net generation in 2007 was 32.1 billion kilowatt-hours (kWh), a 21% increase from one-year earlier and a near five-fold increase since the start of the decade. Wind generation in 2007 was enough to power more than 2.9 million homes. According to estimates from the American Wind Energy Association (AWEA), 2008 will be another record year. The rapid pace of investment has continued, leading to a 45% increase in capacity, and net generation from wind energy is expected to increase significantly in 2008. This rapid investment has led to an increased share of electricity generation, and it now accounts for 10% of renews-

| U.S. Wind Energy Potential - Top 20 States | | | |
|--|-------|------------|-----|
| Billions of Kilowatt Hours Annually | | | |
| North Dakota | 1,210 | Colorado | 481 |
| Texas | 1,190 | New Mexico | 435 |
| Kansas | 1,070 | Idaho | 73 |
| South Dakota | 1,030 | Michigan | 65 |
| Montana | 1,020 | New York | 62 |
| Nebraska | 868 | Illinois | 61 |
| Wyoming | 747 | California | 59 |
| Oklahoma | 725 | Wisconsin | 58 |
| Minnesota | 657 | Maine | 56 |
| Iowa | 551 | Missouri | 52 |

Source: American Wind Energy Assn.

ble electricity generation. In terms of total energy generation for the U.S., though, it maintains an extremely low share, generating just 0.8% of the total in 2007.

Wind energy is growing quickly, but in the U.S. the industry has tapped less than one-half of a percent of wind's potential generation. The AWEA estimates total potential generation at 10,777 billion kWh annually, more than 2.5 times the net amount of electricity generated in the U.S. in 2007. Regionally, the highest potential lies in the northern and western parts of the country. North Dakota is ranked highest with 1,210 billion kWh of potential. The four highest ranked states (North Dakota, Texas, Kansas, and South Dakota) are estimated to have a total potential of 4,500 billion kWh, enough to power the entire country. Although the preponderance of wind power potential is in northern and western states, there are some opportunities further east. Maine, New York, and Michigan are also on the list of top-twenty states.

Solar Power

Solar power is an alternative energy source providing opportunity for massive job growth and significantly decreased reliance on fossil fuels, especially in electricity generation. The basic technology has existed for decades, but widespread adoption has not occurred mostly because of high generation costs relative to fossil fuel-based power. Recent advances, however, combined with rising fossil fuel prices have dramatically reduced the average cost per kilowatt hour of generating solar electricity, making it more competitive. Federal and state tax incentives along with regulatory changes have also prompted increased investment.

Solar power can be harnessed in several ways. The two most popular are photovoltaic devices that convert the sun's energy directly to electricity, and solar thermal devices, which concentrate the sun's rays to produce heat, usually for living space or water. In 2007, approximately 606 million kWh were generated from photovoltaic and thermal devices, enough to power nearly 55,000 homes. That is 23% higher than in the year 2000. Investment in new solar capacity surged 21% in 2007, according to estimates from the EIA. Despite the rapid investment in solar technology, it remains an extremely small part of the overall generation infrastructure, generating just 0.2% of alternative-based electricity in 2007.

There is tremendous potential for solar power across the country. Implementation options vary from large centralized generation fields to smaller scale units for neighborhoods or individual homes. The most intense and reliable solar energy is in the southwest, but most areas receive enough sunlight for solar power to be economically

**Annual Shipments of Photovoltaic Cells and Modules
(Peak Kilowatts)**

| Year | U.S. Production | Domestic | Exports | Imports |
|------|--------------------|----------|---------|---------|
| 1997 | 46,354 | 12,561 | 33,793 | 1,853 |
| 1998 | 50,562 | 15,069 | 35,493 | 1,931 |
| 1999 | 76,787 | 21,225 | 55,562 | 4,784 |
| 2000 | 88,221 | 19,838 | 68,382 | 8,821 |
| 2001 | 97,666 | 36,310 | 61,356 | 10,204 |
| 2002 | 112,090 | 45,313 | 66,778 | 7,297 |
| 2003 | 109,357 | 48,664 | 60,693 | 9,731 |
| 2004 | 181,116 | 78,346 | 102,770 | 47,703 |
| 2005 | 226,916 | 134,465 | 92,451 | 90,981 |
| 2006 | 337,268 | 206,511 | 130,757 | 173,977 |

Source: EIA Annual Photovoltaic Module/Cell Manufacturers Survey

viable. As with other technologies, potential job growth is available to any city that is able to attract manufacturing firms in the industry. Production within the United States has surged over the past 10 years; in 1997, domestic producers shipped photovoltaic devices totaling 46,354 peak kilowatts of capacity. That year there were more than 1,700 direct employees in the industry. By 2006, production had reached 337,268 peak kilowatts of capacity, a more than seven-fold increase, and employment had risen to 4,000 jobs. The industry actually supports many additional manufacturing jobs, as the end-product producers purchase raw materials and intermediate goods from suppliers. In order for solar energy to attain a more prominent role in domestic energy production, both employment and production would need to increase dramatically.

Hydropower

Hydropower is the largest, most established alternative energy source in the United States, and there is potential for further growth. In 2007, hydroelectric sources generated 246 billion kWh of electricity, enough to power more than 22 million homes. Net generation in 2007 accounted for 77% of alternative net electricity generation and 6.1% of U.S. net electricity generation.

Despite the already large contribution of hydropower to the national electricity infrastructure, there is significant room for it to expand. In a 2006 study, the U.S. Department of Energy identified feasible available potential hydropower projects that would double net generation by this highly efficient and clean source. The best known hydropower projects are massive dams that can power hundreds of thousands of homes; these 'Large Hydro' installations account for just 8% of plants but 80% of hydro power. The greatest future potential, though, is in 'Small Hydro' projects, with capacities ranging from 1 MW to 30 MW. Locations for potential hydropower projects are spread across the country. The DOE indicates that if all potential projects were built, 33 states would more than double their hydropower generation and 41 states would see increases of more than 50%.

Geothermal Power

Geothermal energy is another energy source that is poised to grow and create jobs as our alternative energy infrastructure is further developed. This technology taps into heat and steam in the earth's crust and either uses them directly or to produce electricity. The industry began contributing to the national energy infrastructure in the 1960s and showed rapid gains over the next two decades. From 1970 to 1980, net generation of geothermal electricity increased by a factor of ten. Over the next ten years, net generation tripled. After 1990 though, the industry hit a plateau and then declined as existing plants either lost well pressure or shut down and investment dollars for new projects were diverted to other technologies. In 2007, geothermal sources yielded net generation of 14.9 billion kWh, enough to power 1.3 million homes. That equaled about 4.7% of all renewable generation. There is ample room for expansion of geothermal energy. An assessment by the U.S. Geological survey concluded that total geothermal potential might as much as ten times higher than current installed capacity.⁶

⁶ USGS Circular 790. Assessment of Geothermal Resources of the United States. 1979.

Biomass Power

Biomass is another group of technologies where additional investment and jobs will help to develop the nation's alternative energy infrastructure. Biomass includes perhaps the oldest form of human energy production, the burning of wood products, which is considered a renewable form of energy because of the short time needed to re-grow the energy source relative to fossil fuels. The modern biomass industry has moved far beyond merely burning logs taken from felled trees; it uses wood waste and other byproducts, including agricultural byproducts, ethanol, paper pellets, used railroad ties, sludge wood, solid byproducts, and old utility poles. Several waste products are also used in biomass, including landfill gas, digester gas, municipal solid waste, and methane.

Much of the biomass used in our economy is used to generate electricity. In 2007, net generation by the biomass electric power sector was 25 billion kWh, enough to power 2.3 million homes. But that figure accounts for less than half of electricity generation from this power source, because it only includes the power sector. Firms in the industrial sector recognize the benefits of capturing the power of waste products and have developed an extensive biomass infrastructure to generate power for their own use. Combining the electric power and industrial sectors (and a small contribution from the commercial sector), net generation from biomass sources totaled more than 55 billion kWh, or the equivalent of electricity for more than 5 million homes.

ENERGY EFFICIENCY – STATUS AND POTENTIAL*Energy Efficiency Standards*

Efforts to increase energy efficiency in residential and commercial buildings have great potential to generate new employment opportunities in the rapidly expanding Green Economy. These structures account for a significant portion of total energy consumption in the United States, and dedicated initiatives to improve energy efficiency could significantly impact total electricity consumption.

One of the most comprehensive sets of guidelines, among others, for green building construction and renovation is the United States Green Building Council's LEED® (Leadership in Energy and Environmental Design) rating system. Since its initial launch in early 2000, LEED® has quickly emerged as one of the most widely-recognized green building standards in the United States.⁷ The U.S. Green Building Council (USGBC) has also expanded its oversight into the residential sector with a January 2008 release of LEED® for Homes™. The two rating systems feature several overlapping categories that address site selection, material selection, interior environmental quality, and several others. For our analysis, applications of LEED® construction will refer to the category entitled "energy and atmosphere", which focuses directly on energy efficiency in buildings.

⁷ "The Costs and Financial Benefits of Green Building," Report to California's Sustainable Building Task Force, October 2003, pp. 4-6.

| Energy Star Program Key Indicators, 2000 and 2006 ⁸ | | | |
|--|---------------------------------|-------------|--------------|
| | Indicator | 2000 | 2006 |
| Qualified Products | Products Sold ⁹ | 600 million | 2 billion+ |
| | Product Categories | 40 | 50+ |
| | Product Models | 11,000 | 40,000 |
| | Public Awareness | 40% | 68% |
| | Retailers (partners) | 25 | 900 |
| New Homes | New Homes Built ¹⁰ | 25,000 | 725,000 |
| | Home Builders (partners) | 1,600 | 3,500 |
| Commercial Buildings | Buildings Rated | 4,200 | 30,000 |
| | Buildings Labeled ¹¹ | 545 | 3,200 |
| Annual Results | Energy Saved (kWh) | 62 billion | 170 billion |
| | Net Savings (USD) | \$5 billion | \$14 billion |

⁸ Cumulative Results Since 1992 Program Inception

Within the LEED® energy and atmosphere certification category, many of the criteria are based on guidelines established by the Environmental Protection Agency's Energy Star® program. The primary goal of Energy Star® is to promote the use of energy-efficient products and building practices by providing good information for consumers and business owners about the available energy efficiency strategies.⁹ Energy Star® also provides funding to get new green technologies off the ground.

Energy Efficiency Implementation

Research has shown that both green and conventional construction projects are being bid and worked on by similar contractors, implying that green construction work does not require specialized workers.¹⁰ Instead, one of the key differences between green and conventional renovations is generally the materials used in the process. One problem that currently exists in the industry, however, is a knowledge gap across many contracting firms. Some firms are not fully aware of some green construction techniques or the wide variety of modern materials that can be used in a given renovation project. This makes them unable to effectively educate customers about the energy efficient building options that are available.¹¹ Despite these current limitations, we should not expect to see a new industry populated by a new breed of "green construction workers." As green building technology becomes increasingly popular—due to advocacy programs like Energy Star® — traditional contractors will develop their skill sets and expand their knowledge bases in ways that will allow them to transform large numbers of ordinary buildings into some of the most energy efficient in the world. The existing stock of energy inefficient buildings offers an opportunity to reduce total electricity demand and create jobs for these workers.

⁸ "Energy Star and Other Climate Protection Partnerships, 2006 Annual Report," Environmental Protection Agency (EPA), September 2007, Table 9.

⁹ "Energy Star®—The Power To Protect the Environment Through Energy Efficiency," Environmental Protection Agency (EPA), August 2003, pp. 1-2.

¹⁰ "Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investments," Political Economy Research Institute, June 2008.

¹¹ Sigalle Rosner, "Job Implications in Los Angeles' Green Building Sector", University of California at Los Angeles, May 2006.

RENEWABLE TRANSPORTATION FUELS*Transportation Sector Emissions*

The U.S. transportation sector has garnered a significant amount of attention recently for several reasons. Like the electricity generation sector, it uses a significant amount of fossil fuels, resulting in greenhouse gas emissions. In fact, the EPA estimates the transportation sector generated 33% of total carbon dioxide emissions in 2007. Total CO₂ emissions in the sector have increased 16% since 1995, and 25% since 1990. Another concern is the source of the energy. The vast majority of transportation fuels are derived from petroleum, a commodity that is increasingly imported from abroad.

Renewable Fuels

| Year | U.S. Motor Fuels Production | | |
|------|-----------------------------|----------------------------|-------------------------|
| | Ethanol (Million Gals) | Gasoline (Million Gals) | Ethanol Share (%) |
| 1997 | 30,674 | 2,826,051 | 1.09 |
| 1998 | 33,453 | 2,880,521 | 1.16 |
| 1999 | 34,881 | 2,895,989 | 1.20 |
| 2000 | 38,627 | 2,910,056 | 1.33 |
| 2001 | 42,028 | 2,928,050 | 1.44 |
| 2002 | 50,956 | 2,986,747 | 1.71 |
| 2003 | 66,772 | 2,990,949 | 2.23 |
| 2004 | 81,009 | 3,025,128 | 2.68 |
| 2005 | 92,961 | 3,035,889 | 3.06 |
| 2006 | 116,294 | 3,052,754 | 3.81 |
| 2007 | 155,263 | 3,050,614 | 5.09 |

Source: EIA

The private market and legislators at all levels are increasingly turning to alternative fuels for the transportation sector, specifically to ethanol and biodiesel. National and state energy policies have encouraged increased usage of ethanol blended with gasoline in recent years. That, combined with rising petroleum prices making biofuels more economically palatable, has led

to dramatic growth in their usage. In 1997, ethanol made up just 1.09% of the total gasoline pool. By 2007, that had increased to 5.09%. Ethanol can be produced from any feedstock that has plentiful natural sugars or starch that can be easily converted into sugars. In the United States most ethanol is produced from corn, but other feedstocks are used internationally in rapidly expanding ethanol markets such as Brazil (sugar cane) and Europe (sugar beets). Biodiesel is similar in nature to ethanol, in that it is a fuel substitute derived from crops. Current production and usage is on a much smaller scale in the United States. In the U.S., the predominant feedstock for biodiesel is soybean oil, but in Europe the primary feedstock is rapeseed and sunflower oil, while in Malaysia biodiesel is produced from palm oil. Both ethanol and biodiesel production are growing rapidly in the United States, with heavy investment in both types of facilities in recent years.¹²

Our estimates of potential Green Jobs in the transportation sector are derived from increased production of renewable fuels. There are potentially many more Green Jobs that would result from research, development, and production of new vehicle engine types, reengineered transportation systems, and other changes as policies and investments seek to reduce dependency on imported oil and fossil fuels. These and other changes are not addressed in this report.

¹² We acknowledge there is debate over whether corn-based ethanol and soy-based biodiesel should be considered Green Jobs due to high energy and water usage in the production of crops. We consider them as alternative fuels here because of their ability to reduce reliance on fossil fuels.

GREEN JOBS FORECAST

In order to forecast potential Green Jobs, we've created three separate categories (Renewable Power Generation, Residential and Commercial Retrofitting, and Renewable Transportation Fuels) and performed three forecasts of direct jobs under various scenarios. We then projected indirect jobs in the support categories and combined the results. This overall U.S.-level forecast is then distributed to metropolitan areas according to existing shares of Green Jobs. The MSA-level forecast, then, should not be viewed as our projection of what *will* happen. It shows the growth of new Green Jobs that would occur in metropolitan areas if the current distribution were to remain proportionally unchanged. We fully expect, however, that as with high-technology jobs, metropolitan areas will compete with each other in order to draw the maximum number of Green Jobs to their economies.

RENEWABLE POWER GENERATION

There are efforts at both the federal and state levels to increase the use of renewable resources in electricity generation, and those efforts are the motivation for our scenario here. There are 24 states plus the District of Columbia that have enacted Renewable Portfolio Standards (RPS) mandating a specific share of electricity that must be generated from renewable resources by a certain date. Additionally, there are four states with nonbinding goals for the adoption of renewable energy sources. No two states are quite the same, though, and federal legislators have attempted to pass legislation that would provide a nationwide mandate. Our scenario construction here is similar in nature to federal legislation proposed in 2007 and 2008, but with higher RPS standards and a longer time frame.

| Total Power Generation and Renewable Share (Million Kilowatt Hours) | | | | |
|--|-----------|-----------|-----------|-----------|
| | 2008 | 2018 | 2028 | 2038 |
| Total Net Generation | 4,147,850 | 4,650,350 | 5,094,400 | 5,437,350 |
| Total Renewable | 124,350 | 668,550 | 1,385,050 | 2,175,000 |
| Wind | 38,850 | 225,200 | 441,050 | 652,500 |
| Solar | 700 | 41,300 | 181,250 | 435,000 |
| Hydropower* | 13,650 | 67,950 | 139,650 | 217,500 |
| Geothermal | 15,100 | 74,150 | 146,050 | 217,500 |
| Biomass | 56,050 | 259,950 | 477,050 | 652,500 |
| Renewable Share | 3% | 14% | 27% | 40% |

*Incremental Hydropower added since January 1, 2001

Scenario

The forecast for total net generation comes from the Global Insight Energy Group. Over the 30-year forecast period, total net generation is expected to increase approximately 30% over the 2008 level. In our scenario, we assume 40% of electricity generated in the United States must come from alternative resources. Qualifying alternative resources are wind, solar, geothermal, biomass, and incremental hydropower.¹³ That last resource is defined as hydropower generation capacity added since January 1, 2001, via increased efficiency at

¹³ Nuclear power generation jobs are included in the count of current Green Jobs but are not included in our projection scenario.

existing infrastructure or by investing in new infrastructure. We also assume a distribution among resources within renewable generation. The table above shows our assumed distribution and the total generation from each resource under our assumptions. The distribution by resource is: Wind 30%, Solar 20%, Incremental Hydropower 10%, Geothermal 10%, and Biomass 30%. The trajectory to achieve 40% by the year 2038 is linear, and in the early years closely resembles the paths proposed in federal legislation in 2007 and 2008.

To achieve this increased generation from alternative resources there is clearly a need for increased infrastructure, which in turn will create Green Jobs. The manufacture of necessary materials, construction of facilities, and ongoing operations and management of the infrastructure will all require workers. For each resource, we use two coefficients (manufacturing and construction) that are in terms of "jobs per megawatt hour of newly installed capacity" and a third coefficient (operations) that is in terms of "jobs per megawatt hour of total installed capacity". Green Jobs are created by additions to the infrastructure and by the operation of that infrastructure.¹⁴

Green Jobs Created

For each alternative resource type, there are jobs created in manufacturing the necessary materials, construction of new facilities, and operation and maintenance (O&M) of those facilities. As discussed above, some areas of the country have an advantage for a specific resource type due to more intense sunlight, wind, flowing water, or access to geothermal heat. So construction and O&M jobs will depend on the site of installation. But Green Jobs in the manufacture of materials can be created in any location that is able to draw firms and investment.

The bulk of jobs related to *wind* infrastructure will come in the manufacturing of equipment. The technology of wind electricity is relatively new, but the manufacturing base for its production is very similar to past products. Every state in the country has firms and a labor force with experience making products similar to the blades, gearboxes, brakes, hubs, cooling fans, couplings, drives, cases, bearings, generators, towers and sensors that make up a wind tower. These jobs fall into the familiar durable manufacturing sectors of plastics and rubber, primary metals, fabricated metal products, machinery, computer and electronic products, and electrical equipment. Cities across the country have the capacity to attract job growth in these important manufacturing sectors along the nation's path to a new energy infrastructure.

Many potential manufacturing jobs in the *solar* industry are high tech jobs in the Semiconductor and Related Devices subsector. Nearly one-quarter of existing jobs in this sector are in California, but many other states have a significant presence too. But solar infrastructure also requires components from more traditional sectors such plastics and rubber, fabricated metal products, and electrical equipment. In a national move to develop a larger solar ener-

¹⁴ Coefficients are derived from:

"The Work That Goes Into Renewable Energy". Renewable Energy Project (REPP). November 2001. No. 13.

"Geothermal Industry Employment: Survey Results and Analysis". Geothermal Energy Assn. September 2005.

"California Renewable Technology Market and Benefits Assessment". Electric Power Research Institute (EPRI).

November 2001. Report 1001193.

"Solar Manufacturing Activities". Energy Information Administration (EIA). October 2007. Tables 2.17-2.29

gy infrastructure many cities would have the opportunity for job growth across several sectors.

As with other technologies, increased investment in *hydropower* will generate jobs not just in locations where new infrastructure is installed, but also in cities and towns that are best able to attract manufacturing firms to build the necessary generators, turbines, rotors, blades, and other associated parts.

The vast majority of potential *geothermal* sites are in the western part of the country, and most of the potential associated jobs would be created on-site and are similar to existing fossil fuel industry jobs. These include contractors, construction, drilling equipment operators, excavators, and surveyors. But associated manufacturing jobs making mechanical equipment, drilling equipment, and primary metal suppliers could be located anywhere in the country. Also, an expansion of geothermal infrastructure would create jobs for architects, designers, structural engineers, and environmental services consultants that do not need to be located on-site.

Many of the new jobs created by growth in the *biomass* sector would be in waste management, to recover usable wood and waste products as well as in the harvesting and manufacture of raw fuels such as agriculture byproducts as fuels. Additionally there would be manufacturing and construction jobs for new generating facilities and the retrofitting of existing generation facilities for biomass use. Landfills, discarded wood products, and industrial waste are not limited to any particular region, and the generators to burn the fuel can be built anywhere. Biomass thus has the potential to bring Green Jobs to any city in the country.

RESIDENTIAL AND COMMERCIAL RETROFITTING

The next component of our study addresses the potential job growth associated with energy efficiency improvements for residential and commercial buildings. We assume that these efficiency gains will be implemented through a series of building renovations during the forecast period that will incorporate new energy efficient features into existing structures. We do not include the potential job implications of energy efficiency efforts in construction of new green buildings.

Scenario

We assume a reduction of energy consumption by the current stock of residential and commercial structures by 35% over the next three decades. Other research has established that such a reduction is technically feasible. In the forecast, this reduction is distributed in identical increments for each year. This works out to incremental reductions in total annual energy consumption for residential and commercial buildings of approximately 1.2% per year.

Green Jobs Created

In order to translate the implied energy savings into a forecast for job creation, we use coefficients that establish a quantitative relationship between the amount of electricity

saved (in millions of kilowatt-hours) and the resulting number of jobs that would be created in the process.¹⁵ We use these coefficients in conjunction with the energy savings levels dictated by our 35% reduction assumption to project the number of jobs created when the energy efficiency guidelines are implemented. These jobs include the manufacture of necessary products as well as their installation. Retrofitting jobs can encompass a wide variety of different tasks, ranging from the relatively minor to the most complex. Forecasts driven by energy savings are able to incorporate the diversity of renovation jobs that can be done, even accounting for the possibility that efficiency gains could be achieved through a series of varying incremental improvements made over time on individual houses.

In our scenario, reducing current annual energy consumption levels of residential and commercial buildings by 35% over the next 30 years will result in incremental energy savings of more than 32,000 million kilowatt-hours each year. These savings will be divided almost equally across the residential and commercial sectors, with 51% allocated to the former and 49% allocated to the latter. Meanwhile, achieving these annual energy efficiency goals will require nearly 81,000 Green Jobs, approximately 36,000 in the residential sector and 45,000 in commercial.

| Power Usage by Current Residential and Commercial Sectors (Million Kilowatt-Hours) | | | | |
|---|-----------|-----------|-----------|---------|
| | 2008 | 2012 | 2028 | 2038 |
| Power Usage by Sector | | | | |
| Residential | 1,397,250 | 1,245,450 | 1,076,650 | 908,200 |
| Commercial | 1,348,150 | 1,201,700 | 1,038,000 | 876,300 |
| Reduction | | | | |
| Residential | | -11% | -23% | -35% |
| Commercial | | -11% | -23% | -35% |

Given the nature of building retrofitting work, we believe that the specialty trade contractor component of the construction sector will ultimately benefit the most from these new employment opportunities. Many of the workers required to complete the renovation work and installations of efficiency upgrades fall under the classifications of the traditional construction trades that comprise this category. Ultimately, increasing demand for green building work can be expected to generate new employment opportunities for electricians, HVAC technicians, carpenters, plumbers, roofers, laborers, and insulation workers, among others. Increased demand for green retrofitting work will simultaneously stimulate demand for green building materials, providing additional sources of job gains in associated manufacturing industries.

RENEWABLE TRANSPORTATION FUELS

In an effort to use cleaner fuels and to reduce reliance on foreign petroleum, both the private market and legislators are attempting to increase usage of plant based products such as ethanol and biodiesel. Our forecast is motivated by the expectation that the private market and legislators will continue to push the U.S. transportation sector toward higher usage of non-petroleum fuels.

¹⁵ Coefficients are derived from:
"The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture," American Council for an Energy-Efficient Economy, May 2008, Appendix A.

| New Renewable Transportation Fuel Production Cars & Light Trucks (Billion Gallons) | | | |
|--|---------|---------|---------|
| | 2016 | 2028 | 2038 |
| Total Fuels | 149,500 | 143,500 | 142,000 |
| Alternative Fuels | 34,500 | 41,000 | 42,500 |
| Alternative Fuel Share | 23% | 29% | 30% |

Scenario

In our scenario we assume that ethanol and biodiesel increase their contribution to transportation fuels during the forecast period. Specifically, we assume that 30% of gasoline and diesel demand for passenger cars and light trucks is satisfied by an alternative by the year 2038. The table above shows total production of both fuels under this assumption in that year.¹⁶ The trajectory of implementation includes consideration of current federal legislation which mandates usage of 36 billion gallons of alternative fuel by the year 2022. Our scenario includes a rapid expansion of production in the early portion of the forecast period and slower growth thereafter to reach the 30% mark by the year 2038.

Green Jobs Created

To achieve this significant increase in the production of alternative fuels, the United States would need to invest heavily in new infrastructure and also greatly expand production of the crops that serve as feedstocks for the fuels. Both, of course, would create new Green Jobs. To estimate the total number of Green Jobs, we apply two coefficients; the first coefficient is an estimate of the number of manufacturing and construction jobs required to build each marginal addition to the ethanol and biodiesel infrastructure. The second coefficient is an estimate of the number of jobs required to grow the feedstocks and operate the facilities for the increased production of the fuels.¹⁷

INDIRECT JOBS

It is clear that the engineering, legal, research, and consulting positions play a major role in the Green Economy, as they account for 56% of current Green Jobs. They have also grown faster than direct Green Jobs since 1990, expanding 52%, compared with 38% growth in direct jobs.

In projecting potential future Green Jobs, though, we remain conservative. Although these indirect jobs have historically grown faster, we do not project them to do the same under our scenarios. This is because we do not expect that each marginal electricity generation job will require another environmental lawyer, for example, and not every retrofitting position will require commensurate growth in research or consulting. Thus, we conservatively project

¹⁶ Our expected total transportation fuel demand comes from a separate Global Insight Inc. forecast

¹⁷ Coefficients are derived from:

"Contribution of the Ethanol Industry to the Economy of the United States". Renewable Fuels Assn. (RFA). February 2008.

a single indirect job added for every two direct jobs in the future, well below the historical pattern.¹⁸

FORECAST RESULTS

Our projections reveal that there is great potential for Green Job growth in the U.S. economy. Under our chosen scenarios, renewable power generation would lead to the generation of more than 1.2 million jobs. The trajectory of job growth is similar to the assumed path of electricity generation. There is relatively smooth growth as the manufacturing sector expands in response to demand for generation equipment, the construction sector expands to install the new equipment, and more jobs are created to operate and maintain the new infrastructure. The 30-year project to retrofit our existing residential and commercial building stock would generate nearly 81,000 jobs. These jobs would retrofit a small percentage of the existing residential and commercial stock of buildings each year and dramatically reduce their energy requirements over the 30-year forecast period.

The push to greatly increase use of alternative transportation fuels would generate nearly 1.5 million new Green Jobs in the U.S. economy. The trajectory of growth for these jobs follows a similar path to the expansion of renewable fuel production, with faster growth in the early forecast period to reach the federal mandate and slower growth thereafter. And the associated growth in engineering, legal, research and consulting positions would be more than 1.4 million new jobs. Overall, we estimate there is the potential for 4.2 million new Green Jobs to be added to the U.S. economy.

| Potential New Green Jobs 2038 - U.S. Total | | | |
|--|------------------|------------------|------------------|
| | 2018 | 2028 | 2038 |
| Renewable Power Generation | 407,200 | 802,000 | 1,236,800 |
| Residential & Commercial Retrofitting | 81,000 | 81,000 | 81,000 |
| Renewable Transportation Fuels | 1,205,700 | 1,437,700 | 1,492,000 |
| Engineering, Legal, Research & Consulting | 846,900 | 1,160,300 | 1,404,900 |
| Total | 2,540,800 | 3,481,000 | 4,214,700 |

The potential growth in Green Jobs is significant in that it could be the fastest growing segment of the United States economy over the next several decades and dramatically increase its share of total employment. The current count of 750,000 jobs amounts to less than one-half of a percent of total current jobs. The generation of 4.2 million new Green Jobs would more than quintuple the total count and could provide as much as 10% of new job growth over the next 30 years.

It is important to recognize these forecast results depend heavily on our chosen scenarios. Altering any of the assumptions regarding the share of electricity to be generated from alternative resources, the extent of retrofitting, or the share of transportation fuels from renewable sources would obviously change the results.

At the metropolitan level, our analysis shows that there is great potential for Green Job growth in regional economies. The Appendix Tables show the number of new Green Jobs

¹⁸ Government Administration jobs are included in the current count of Green Jobs but are not a source of growth in our projections.

that would be attributed to each metropolitan area assuming that all growth occurs in metro areas and that the current distribution remains unchanged. This should not be interpreted as a forecast for each individual metro; one of the promising aspects of Green Jobs is that the vast majority of them are not restricted to any specific location, so cities and their metro areas across the country can and are expected to compete to attract this job growth.

CONCLUSION

The United States is clearly heading toward a new era in terms of its energy policy, energy infrastructure, and energy-based economy. Elected officials at all levels of government and private markets are both gearing up for massive investments in new alternative fuel technologies and in increased energy efficiency. There are many Green Jobs in our economy already, but that figure stands to grow tremendously over the coming years due to market forces, legislation, and local initiatives, or some combination thereof. The vast majority of Green Jobs are not location dependent, so future Green Jobs will be located in cities and metropolitan areas that are currently the most attractive for investment, or in areas that actively increase their attractiveness relative to competing areas. The good news is that traditional industries continue to be replaced by new opportunities, and we have only just begun to tap into many of them.

APPENDIX

Standard Industrial Classification 8-Digit Codes Used

| Renewable Power Generation | Manufacturing |
|--|--|
| Hydroelectric | Wet corn milling |
| Nuclear | Corn milling by-products |
| Other Renewable | Gluten feed and meal |
| Agriculture and Forestry | Soybean and Vegetable oil mills |
| Corn Farming | Lecithin, soybean |
| Soybean Farming | Soybean flour, grits, oil, cake, meal, or powder |
| Forestry and Reforestation services | Soybean protein concentrates and isolates |
| Forest management services | Hydrogen |
| Forest management plans, preparation of | Ethyl alcohol, ethanol |
| Timber cruising, estimating, and valuation services | Solar heaters and collectors |
| Engineering, Legal, Research & Consulting | Turbines and turbine generator set units, complete |
| Environmental law | Gas turbine generator set units, complete |
| Environmental protection organization | Hydraulic turbine generator set units, complete |
| Pollution control engineering | Steam turbine generator set units, complete |
| Building construction consultant | Turbines and turbine generator sets and parts |
| Heating and ventilation engineering | Gas turbines, mechanical drive |
| Electrical or electronic engineering | Hydraulic turbines |
| Energy conservation engineering | Steam engines and turbines |
| Agricultural and Biological research | Turbo-generators |
| Biotechnical research, commercial | Wheels, water |
| Natural resource research | Windmills for pumping water, agricultural |
| Energy research | Windmills, electric generating |
| Environmental research | Light emitting diodes |
| Materials mgmt. consultant | Solar Cells and Photovoltaic devices, solid state |
| Productivity improvement consultant | Fuel cells, solid state |
| Environmental remediation | Hydrogen ion equipment, colorimetric |
| Energy conservation consultant | Environmental controls and testing equipment |
| Environmental consultant | Solarimeters |
| Earth science services | Construction & Systems Installation |
| Geological and Geophysical consultant | Solar energy contractor |
| Recycling, waste materials | Energy management controls |
| Environmental cleanup services | Environmental system control installation |
| Natural resource preservation service | Pollution control equipment installation |
| Government Administration | Equipment Dealers & Wholesalers |
| Environmental health program administration | Heating equipment and panels, solar |
| Environmental agencies | Air pollution control equipment and supplies |
| Air pollution control agency | Pollution control equipment, air (environmental) |
| Environmental protection agency | Pollution control equipment, water (environmental) |
| Environmental quality and control agency | Solar heating equipment |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|---------------------------------------|------------------|------------------------|
| Alaska | | |
| Anchorage, AK | 1,271 | 10,058 |
| Fairbanks, AK | 270 | 2,138 |
| Alabama | | |
| Anniston-Oxford, AL | 119 | 944 |
| Auburn-Opelika, AL | 246 | 1,949 |
| Birmingham-Hoover, AL | 1,970 | 15,589 |
| Columbus, GA-AL | 377 | 2,986 |
| Decatur, AL | 171 | 1,350 |
| Dothan, AL | 65 | 511 |
| Florence-Muscle Shoals, AL | 720 | 5,695 |
| Gadsden, AL | 57 | 455 |
| Huntsville, AL | 2,358 | 18,654 |
| Mobile, AL | 453 | 3,584 |
| Montgomery, AL | 1,341 | 10,609 |
| Tuscaloosa, AL | 214 | 1,694 |
| Arkansas | | |
| Fayetteville-Springdale-Rogers, AR-MO | 247 | 1,956 |
| Fort Smith, AR-OK | 183 | 1,450 |
| Hot Springs, AR | 263 | 2,085 |
| Jonesboro, AR | 54 | 424 |
| Little Rock-North Little Rock, AR | 1,319 | 10,438 |
| Memphis, TN-MS-AR | 1,075 | 8,507 |
| Pine Bluff, AR | 37 | 291 |
| Texarkana, TX-Texarkana, AR | 560 | 4,430 |
| Arizona | | |
| Flagstaff, AZ | 337 | 2,668 |
| Lake Havasu, AZ | 74 | 587 |
| Phoenix-Mesa-Scottsdale, AZ | 3,887 | 30,753 |

¹⁹ The New Through 2038 column should not be viewed as our projection of where new Green Jobs *will* be located. It shows the locations of new Green Jobs that would occur if the current distribution were to remain proportionally unchanged. We fully expect that local areas will compete with each other in order to draw the maximum number of Green Jobs to their economies.

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Prescott, AZ | 181 | 1,430 |
| Tucson, AZ | 1,310 | 10,365 |
| Yuma, AZ | 52 | 414 |
| California | | |
| Bakersfield, CA | 913 | 7,222 |
| Chico, CA | 237 | 1,872 |
| El Centro, CA | 44 | 347 |
| Fresno, CA | 1,053 | 8,332 |
| Hanford-Corcoran, CA | 14 | 113 |
| Los Angeles-Long Beach-Santa Ana, CA | 20,136 | 159,321 |
| Madera, CA | 58 | 461 |
| Merced, CA | 40 | 314 |
| Modesto, CA | 417 | 3,303 |
| Napa, CA | 239 | 1,891 |
| Oxnard-Thousand Oaks-Ventura, CA | 2,477 | 19,596 |
| Redding, CA | 434 | 3,434 |
| Riverside-San Bernardino-Ontario, CA | 4,224 | 33,425 |
| Santa Barbara-Santa Maria, CA | 777 | 6,145 |
| Sacramento-Arden-Arcade--Roseville, CA | 8,236 | 65,162 |
| Santa Cruz-Watsonville, CA | 813 | 6,434 |
| San Diego-Carlsbad-San Marcos, CA | 11,663 | 92,285 |
| San Jose-Sunnyvale-Santa Clara, CA | 3,810 | 30,147 |
| Salinas, CA | 441 | 3,493 |
| San Luis Obispo-Paso Robles, CA | 446 | 3,528 |
| Santa Rosa-Petaluma, CA | 619 | 4,897 |
| San Francisco-Oakland-Fremont, CA | 13,848 | 109,570 |
| Stockton, CA | 461 | 3,649 |
| Vallejo-Fairfield, CA | 533 | 4,218 |
| Visalia-Porterville, CA | 522 | 4,128 |
| Yuba City, CA | 132 | 1,044 |
| Colorado | | |
| Boulder, CO | 2,402 | 19,003 |
| Colorado Springs, CO | 570 | 4,511 |
| Denver-Aurora, CO | 6,644 | 52,568 |
| Fort Collins-Loveland, CO | 617 | 4,882 |
| Greeley, CO | 272 | 2,149 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Grand Junction, CO | 185 | 1,462 |
| Pueblo, CO | 99 | 780 |
| Connecticut | | |
| Bridgeport-Stamford-Norwalk, CT | 803 | 6,354 |
| Hartford-West Hartford-East Hartford, CT | 8,019 | 63,448 |
| New Haven-Milford, CT | 1,348 | 10,668 |
| Norwich-New London, CT | 485 | 3,841 |
| District of Columbia | | |
| Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) | 24,287 | 192,165 |
| Delaware | | |
| Dover, DE | 753 | 5,957 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA) | 14,379 | 113,772 |
| Florida | | |
| Cape Coral-Fort Myers, FL | 677 | 5,359 |
| Deltona-Daytona Beach-Ormond Beach, FL | 512 | 4,051 |
| Fort Walton Beach-Crestview-Destin, FL | 91 | 718 |
| Gainesville, FL | 632 | 4,999 |
| Jacksonville, FL | 2,091 | 16,547 |
| Lakeland, FL | 429 | 3,397 |
| Miami-Fort Lauderdale-Miami Beach, FL | 6,717 | 53,145 |
| Naples-Marco Island, FL | 280 | 2,214 |
| Ocala, FL | 269 | 2,132 |
| Orlando-Kissimmee, FL | 2,855 | 22,588 |
| Palm Coast, FL | 131 | 1,037 |
| Palm Bay-Melbourne-Titusville, FL | 581 | 4,600 |
| Panama City-Lynn Haven, FL | 212 | 1,677 |
| Pensacola-Ferry Pass-Brent, FL | 936 | 7,410 |
| Port St. Lucie-Fort Pierce, FL | 536 | 4,239 |
| Punta Gorda, FL | 156 | 1,231 |
| Sarasota-Bradenton-Venice, FL | 670 | 5,303 |
| Tallahassee, FL | 568 | 4,491 |
| Tampa-St. Petersburg-Clearwater, FL | 2,935 | 23,225 |
| Vero Beach, FL | 91 | 719 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|-------------------------------------|------------------|------------------------|
| Georgia | | |
| Albany, GA | 178 | 1,406 |
| Athens-Clarke County, GA | 557 | 4,411 |
| Atlanta-Sandy Springs-Marietta, GA | 7,354 | 58,186 |
| Augusta-Richmond County, GA-SC | 4,461 | 35,295 |
| Brunswick, GA | 90 | 714 |
| Chattanooga, TN-GA | 672 | 5,313 |
| Columbus, GA-AL | 377 | 2,986 |
| Dalton, GA | 137 | 1,084 |
| Gainesville, GA | 139 | 1,102 |
| Hinesville-Fort Stewart, GA | 21 | 166 |
| Macon, GA | 257 | 2,033 |
| Rome, GA | 108 | 852 |
| Savannah, GA | 479 | 3,793 |
| Valdosta, GA | 251 | 1,988 |
| Warner Robins, GA | 90 | 714 |
| Hawaii | | |
| Honolulu, HI | 2,022 | 15,997 |
| Iowa | | |
| Ames, IA | 264 | 2,089 |
| Cedar Rapids, IA | 654 | 5,176 |
| Davenport-Moline-Rock Island, IA-IL | 586 | 4,638 |
| Des Moines, IA | 1,489 | 11,784 |
| Dubuque, IA | 148 | 1,173 |
| Iowa City, IA | 402 | 3,179 |
| Omaha-Council Bluffs, NE-IA | 1,337 | 10,582 |
| Sioux City, IA-NE-SD | 331 | 2,619 |
| Waterloo-Cedar Falls, IA | 405 | 3,202 |
| Idaho | | |
| Boise City-Nampa, ID | 1,962 | 15,521 |
| Coeur d'Alene, ID | 251 | 1,984 |
| Idaho Falls, ID | 417 | 3,300 |
| Lewiston, ID-WA | 70 | 556 |
| Logan, UT-ID | 369 | 2,919 |
| Pocatello, ID | 117 | 928 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|---|------------------|------------------------|
| Illinois | | |
| Bloomington-Normal, IL | 265 | 2,094 |
| Champaign-Urbana, IL | 965 | 7,637 |
| Chicago-Naperville-Joliet, IL-IN-WI (MSA) | 16,120 | 127,545 |
| Danville, IL | 99 | 787 |
| Davenport-Moline-Rock Island, IA-IL | 586 | 4,638 |
| Decatur, IL | 1,902 | 15,048 |
| Kankakee-Bradley, IL | 441 | 3,492 |
| Peoria, IL | 2,221 | 17,573 |
| Rockford, IL | 280 | 2,213 |
| Springfield, IL | 1,880 | 14,874 |
| St. Louis, MO-IL | 3,436 | 27,190 |
| Indiana | | |
| Anderson, IN | 138 | 1,091 |
| Bloomington, IN | 313 | 2,475 |
| Chicago-Naperville-Joliet, IL-IN-WI (MSA) | 16,120 | 127,545 |
| Cincinnati-Middletown, OH-KY-IN | 4,221 | 33,398 |
| Columbus, IN | 55 | 432 |
| Elkhart-Goshen, IN | 214 | 1,696 |
| Evansville, IN-KY | 574 | 4,540 |
| Fort Wayne, IN | 437 | 3,461 |
| Indianapolis, IN | 8,909 | 70,491 |
| Kokomo, IN | 381 | 3,012 |
| Lafayette, IN | 931 | 7,365 |
| Louisville, KY-IN | 1,827 | 14,456 |
| Michigan City-La Porte, IN | 143 | 1,131 |
| Muncie, IN | 62 | 494 |
| South Bend-Mishawaka, IN-MI | 405 | 3,205 |
| Terre Haute, IN | 197 | 1,562 |
| Kansas | | |
| Kansas City, MO-KS | 2,522 | 19,953 |
| Lawrence, KS | 176 | 1,395 |
| St. Joseph, MO-KS | 388 | 3,073 |
| Topeka, KS | 213 | 1,683 |
| Wichita, KS | 669 | 5,295 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Kentucky | | |
| Bowling Green, KY | 135 | 1,064 |
| Cincinnati-Middletown, OH-KY-IN | 4,221 | 33,398 |
| Clarksville, TN-KY | 259 | 2,051 |
| Elizabethtown, KY | 113 | 897 |
| Evansville, IN-KY | 574 | 4,540 |
| Huntington-Ashland, WV-KY-OH | 314 | 2,487 |
| Lexington-Fayette, KY | 643 | 5,088 |
| Louisville, KY-IN | 1,827 | 14,456 |
| Owensboro, KY | 424 | 3,355 |
| Louisiana | | |
| Alexandria, LA | 150 | 1,191 |
| Baton Rouge, LA | 3,470 | 27,458 |
| Houma-Bayou Cane-Thibodaux, LA | 156 | 1,233 |
| Lake Charles, LA | 250 | 1,975 |
| Lafayette, LA | 589 | 4,659 |
| Monroe, LA | 126 | 994 |
| New Orleans-Metairie-Kenner, LA | 1,514 | 11,981 |
| Shreveport-Bossier City, LA | 396 | 3,136 |
| Massachusetts | | |
| Barnstable Town, MA | 1,680 | 13,293 |
| Boston-Cambridge-Quincy, MA-NH (MSA) | 19,799 | 156,660 |
| Pittsfield, MA | 405 | 3,208 |
| Providence-New Bedford-Fall River, RI-MA | 1,961 | 15,517 |
| Springfield, MA | 901 | 7,129 |
| Worcester, MA | 2,090 | 16,537 |
| Maryland | | |
| Baltimore-Towson, MD | 5,910 | 46,763 |
| Cumberland, MD-WV | 24 | 186 |
| Hagerstown-Martinsburg, MD-WV | 116 | 920 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA) | 14,379 | 113,772 |
| Salisbury, MD | 83 | 653 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) | 24,287 | 192,165 |
| <i>Sum of Metro Area</i> | | |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|---|------------------|------------------------|
| Maine | | |
| Bangor, ME | 458 | 3,623 |
| Lewiston-Auburn, ME | 157 | 1,246 |
| Portland-South Portland-Biddeford, ME | 954 | 7,545 |
| Michigan | | |
| Ann Arbor, MI | 1,288 | 10,193 |
| Battle Creek, MI | 66 | 525 |
| Bay City, MI | 137 | 1,086 |
| Detroit-Warren-Livonia, MI | 4,884 | 38,642 |
| Flint, MI | 345 | 2,731 |
| Grand Rapids-Wyoming, MI | 655 | 5,184 |
| Holland-Grand Haven, MI | 1,189 | 9,408 |
| Jackson, MI | 172 | 1,364 |
| Kalamazoo-Portage, MI | 431 | 3,410 |
| Lansing-East Lansing, MI | 1,835 | 14,522 |
| Monroe, MI | 102 | 807 |
| Muskegon-Norton Shores, MI | 64 | 509 |
| Niles-Benton Harbor, MI | 884 | 6,992 |
| Saginaw-Saginaw Township North, MI | 157 | 1,241 |
| South Bend-Mishawaka, IN-MI | 405 | 3,205 |
| Minnesota | | |
| Duluth, MN-WI | 472 | 3,734 |
| Fargo, ND-MN | 251 | 1,989 |
| Grand Forks, ND-MN | 573 | 4,531 |
| La Crosse, WI-MN | 291 | 2,301 |
| Minneapolis-St. Paul-Bloomington, MN-WI | 4,811 | 38,063 |
| Rochester, MN | 309 | 2,445 |
| St. Cloud, MN | 318 | 2,519 |
| Missouri | | |
| Columbia, MO | 190 | 1,505 |
| Fayetteville-Springdale-Rogers, AR-MO | 247 | 1,956 |
| Jefferson City, MO | 2,080 | 16,458 |
| Joplin, MO | 154 | 1,215 |
| Kansas City, MO-KS | 2,522 | 19,953 |
| Springfield, MO | 300 | 2,371 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| St. Joseph, MO-KS | 388 | 3,073 |
| St. Louis, MO-IL | 3,436 | 27,190 |
| Mississippi | | |
| Gulfport-Biloxi, MS | 268 | 2,122 |
| Hattiesburg, MS | 158 | 1,252 |
| Jackson, MS | 803 | 6,355 |
| Memphis, TN-MS-AR | 1,075 | 8,507 |
| Pascagoula, MS | 92 | 727 |
| Montana | | |
| Billings, MT | 262 | 2,073 |
| Great Falls, MT | 148 | 1,171 |
| Missoula, MT | 572 | 4,526 |
| North Carolina | | |
| Asheville, NC | 452 | 3,574 |
| Burlington, NC | 82 | 649 |
| Charlotte-Gastonia-Concord, NC-SC | 1,932 | 15,285 |
| Durham, NC | 5,645 | 44,663 |
| Fayetteville, NC | 157 | 1,245 |
| Goldensboro, NC | 105 | 828 |
| Greensboro-High Point, NC | 764 | 6,044 |
| Greenville, NC | 158 | 1,246 |
| Hickory-Lenoir-Morganton, NC | 206 | 1,630 |
| Jacksonville, NC | 28 | 219 |
| Raleigh-Cary, NC | 3,315 | 26,226 |
| Rocky Mount, NC | 166 | 1,315 |
| Virginia Beach-Norfolk-Newport News, VA-NC | 2,164 | 17,126 |
| Wilmington, NC | 297 | 2,353 |
| Winston-Salem, NC | 867 | 6,857 |
| North Dakota | | |
| Bismarck, ND | 237 | 1,878 |
| Fargo, ND-MN | 251 | 1,989 |
| Grand Forks, ND-MN | 573 | 4,531 |
| Nebraska | | |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Lincoln, NE | 926 | 7,325 |
| Omaha-Council Bluffs, NE-IA | 1,337 | 10,582 |
| Sioux City, IA-NE-SD | 331 | 2,619 |
| New Hampshire | | |
| Boston-Cambridge-Quincy, MA-NH (MSA) | 19,799 | 156,660 |
| Manchester-Nashua, NH | 486 | 3,843 |
| New Jersey | | |
| Allentown-Bethlehem-Easton, PA-NJ | 1,110 | 8,781 |
| Atlantic City, NJ | 281 | 2,227 |
| New York-Nrthrn New Jersey-Lng Islnd, NY-NJ-PA (MSA) | 25,021 | 197,971 |
| Ocean City, NJ | 76 | 601 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA) | 14,379 | 113,772 |
| Trenton-Ewing, NJ | 8,788 | 69,535 |
| Vineland-Millville-Bridgeton, NJ | 127 | 1,008 |
| New Mexico | | |
| Albuquerque, NM | 2,297 | 18,177 |
| Farmington, NM | 92 | 726 |
| Las Cruces, NM | 354 | 2,802 |
| Santa Fe, NM | 1,269 | 10,044 |
| Nevada | | |
| Carson City, NV | 187 | 1,480 |
| Las Vegas-Paradise, NV | 2,126 | 16,821 |
| Reno-Sparks, NV | 679 | 5,372 |
| New York | | |
| Albany-Schenectady-Troy, NY | 9,567 | 75,694 |
| Binghamton, NY | 330 | 2,607 |
| Buffalo-Niagara Falls, NY | 2,017 | 15,959 |
| Elmira, NY | 52 | 411 |
| Glens Falls, NY | 224 | 1,774 |
| Ithaca, NY | 454 | 3,589 |
| Kingston, NY | 271 | 2,145 |
| New York-Nrthrn New Jersey-Lng Islnd, NY-NJ-PA (MSA) | 25,021 | 197,971 |
| Poughkeepsie-Newburgh-Middletown, NY | 1,001 | 7,918 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|-------------------------------------|------------------|------------------------|
| Rochester, NY | 1,909 | 15,108 |
| Syracuse, NY | 1,344 | 10,634 |
| Utica-Rome, NY | 220 | 1,738 |
| Ohio | | |
| Akron, OH | 947 | 7,496 |
| Canton-Massillon, OH | 634 | 5,019 |
| Cincinnati-Middletown, OH-KY-IN | 4,221 | 33,398 |
| Cleveland-Elyria-Mentor, OH | 2,952 | 23,357 |
| Columbus, OH | 3,938 | 31,163 |
| Dayton, OH | 1,180 | 9,334 |
| Huntington-Ashland, WV-KY-OH | 314 | 2,487 |
| Lima, OH | 225 | 1,777 |
| Mansfield, OH | 146 | 1,156 |
| Parkersburg-Marietta-Vienna, WV-OH | 113 | 896 |
| Sandusky, OH | 52 | 410 |
| Springfield, OH | 84 | 662 |
| Toledo, OH | 1,298 | 10,272 |
| Weirton-Steubenville, WV-OH | 47 | 369 |
| Wheeling, WV-OH | 277 | 2,194 |
| Youngstown-Warren-Boardman, OH-PA | 456 | 3,604 |
| Oklahoma | | |
| Fort Smith, AR-OK | 183 | 1,450 |
| Lawton, OK | 28 | 222 |
| Oklahoma City, OK | 2,016 | 15,951 |
| Tulsa, OK | 1,190 | 9,416 |
| Oregon | | |
| Bend, OR | 642 | 5,080 |
| Corvallis, OR | 783 | 6,198 |
| Eugene-Springfield, OR | 993 | 7,853 |
| Medford, OR | 1,109 | 8,775 |
| Portland-Vancouver-Beaverton, OR-WA | 6,714 | 53,122 |
| Salem, OR | 1,815 | 14,360 |
| Pennsylvania | | |
| Allentown-Bethlehem-Easton, PA-NJ | 1,110 | 8,781 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Altoona, PA | 63 | 500 |
| Erie, PA | 360 | 2,850 |
| Harrisburg-Carlisle, PA | 1,898 | 15,021 |
| Johnstown, PA | 100 | 792 |
| Lancaster, PA | 433 | 3,429 |
| Lebanon, PA | 130 | 1,031 |
| New York-Nrthrn New Jersey-Lng Islnd, NY-NJ-PA (MSA) | 25,021 | 197,971 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA) | 14,379 | 113,772 |
| Pittsburgh, PA | 9,627 | 76,174 |
| Reading, PA | 473 | 3,741 |
| Scranton-Wilkes-Barre, PA | 400 | 3,162 |
| State College, PA | 167 | 1,324 |
| Williamsport, PA | 79 | 626 |
| York-Hanover, PA | 899 | 7,111 |
| Youngstown-Warren-Boardman, OH-PA | 456 | 3,604 |
| Rhode Island | | |
| Providence-New Bedford-Fall River, RI-MA | 1,961 | 15,517 |
| South Carolina | | |
| Anderson, SC | 154 | 1,216 |
| Augusta-Richmond County, GA-SC | 4,461 | 35,295 |
| Charleston-North Charleston, SC | 1,775 | 14,044 |
| Charlotte-Gastonia-Concord, NC-SC | 1,932 | 15,285 |
| Columbia, SC | 2,155 | 17,049 |
| Florence, SC | 278 | 2,198 |
| Greenville, SC | 3,954 | 31,287 |
| Myrtle Beach-Conway-North Myrtle Beach, SC | 230 | 1,819 |
| Spartanburg, SC | 144 | 1,138 |
| Sumter, SC | 169 | 1,335 |
| South Dakota | | |
| Rapid City, SD | 185 | 1,463 |
| Sioux City, IA-NE-SD | 331 | 2,619 |
| Sioux Falls, SD | 354 | 2,800 |
| Tennessee | | |
| Chattanooga, TN-GA | 672 | 5,313 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|---|------------------|------------------------|
| Clarksville, TN-KY | 259 | 2,051 |
| Cleveland, TN | 40 | 319 |
| Jackson, TN | 25 | 197 |
| Johnson City, TN | 444 | 3,515 |
| Kingsport-Bristol-Bristol, TN-VA | 214 | 1,691 |
| Knoxville, TN | 6,755 | 53,450 |
| Memphis, TN-MS-AR | 1,075 | 8,507 |
| Morristown, TN | 318 | 2,515 |
| Nashville-Davidson--Murfreesboro, TN-AR | 3,250 | 25,712 |
| Texas | | |
| Abilene, TX | 116 | 920 |
| Amarillo, TX | 405 | 3,201 |
| Austin-Round Rock, TX | 6,059 | 47,937 |
| Beaumont-Port Arthur, TX | 747 | 5,912 |
| Brownsville-Harlingen, TX | 238 | 1,885 |
| College Station-Bryan, TX | 2,520 | 19,941 |
| Corpus Christi, TX | 654 | 5,178 |
| Dallas-Fort Worth-Arlington, TX | 8,851 | 70,029 |
| El Paso, TX | 707 | 5,597 |
| Houston-Sugar Land-Baytown, TX | 21,250 | 168,136 |
| Killeen-Temple-Fort Hood, TX | 139 | 1,102 |
| Laredo, TX | 184 | 1,456 |
| Longview, TX | 537 | 4,249 |
| Lubbock, TX | 305 | 2,410 |
| McAllen-Edinburg-Mission, TX | 470 | 3,716 |
| Midland, TX | 284 | 2,247 |
| Odessa, TX | 227 | 1,796 |
| San Angelo, TX | 135 | 1,068 |
| San Antonio, TX | 2,220 | 17,565 |
| Sherman-Denison, TX | 54 | 426 |
| Texarkana, TX-Texarkana, AR | 560 | 4,430 |
| Tyler, TX | 306 | 2,421 |
| Victoria, TX | 38 | 304 |
| Waco, TX | 164 | 1,299 |
| Wichita Falls, TX | 74 | 586 |
| Utah | | |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Logan, UT-ID | 369 | 2,919 |
| Ogden-Clearfield, UT | 603 | 4,774 |
| Provo-Orem, UT | 354 | 2,799 |
| Salt Lake City, UT | 3,040 | 24,053 |
| St. George, UT | 26 | 208 |
| Virginia | | |
| Blacksburg-Christiansburg-Radford, VA | 313 | 2,477 |
| Charlottesville, VA | 263 | 2,083 |
| Danville, VA | 25 | 201 |
| Harrisonburg, VA | 178 | 1,411 |
| Kingsport-Bristol-Bristol, TN-VA | 214 | 1,691 |
| Lynchburg, VA | 1,600 | 12,659 |
| Richmond, VA | 1,952 | 15,443 |
| Roanoke, VA | 465 | 3,679 |
| Virginia Beach-Norfolk-Newport News, VA-NC | 2,164 | 17,126 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) | 24,287 | 192,165 |
| Winchester, VA-WV | 55 | 439 |
| Vermont | | |
| Burlington-South Burlington, VT | 586 | 4,637 |
| Washington | | |
| Bellingham, WA | 317 | 2,506 |
| Bremerton-Silverdale, WA | 272 | 2,154 |
| Kennewick-Richland-Pasco, WA | 979 | 7,750 |
| Lewiston, ID-WA | 70 | 556 |
| Longview, WA | 521 | 4,122 |
| Mount Vernon-Anacortes, WA | 229 | 1,813 |
| Olympia, WA | 630 | 4,988 |
| Portland-Vancouver-Beaverton, OR-WA | 6,714 | 53,122 |
| Seattle-Tacoma-Bellevue, WA | 6,257 | 49,510 |
| Spokane, WA | 648 | 5,128 |
| Wenatchee, WA | 131 | 1,037 |
| Yakima, WA | 470 | 3,718 |
| Wisconsin | | |
| Appleton, WI | 299 | 2,369 |

Current and Potential Green Jobs by Metropolitan Area¹⁹

| | Existing 2006 | New Through 2038 |
|--|------------------|------------------------|
| Chicago-Naperville-Joliet, IL-IN-WI (MSA) | 16,120 | 127,545 |
| Duluth, MN-WI | 472 | 3,734 |
| Eau Claire, WI | 224 | 1,772 |
| Fond du Lac, WI | 89 | 706 |
| Green Bay, WI | 637 | 5,041 |
| Janesville, WI | 146 | 1,153 |
| La Crosse, WI-MN | 291 | 2,301 |
| Madison, WI | 3,016 | 23,861 |
| Milwaukee-Waukesha-West Allis, WI | 1,979 | 15,662 |
| Minneapolis-St. Paul-Bloomington, MN-WI | 4,811 | 38,063 |
| Oshkosh-Neenah, WI | 213 | 1,682 |
| Racine, WI | 99 | 785 |
| Sheboygan, WI | 160 | 1,267 |
| Wausau, WI | 155 | 1,223 |
| West Virginia | | |
| Charleston, WV | 548 | 4,333 |
| Cumberland, MD-WV | 24 | 186 |
| Hagerstown-Martinsburg, MD-WV | 116 | 920 |
| Huntington-Ashland, WV-KY-OH | 314 | 2,487 |
| Morgantown, WV | 240 | 1,903 |
| Parkersburg-Marietta-Vienna, WV-OH | 113 | 896 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) | 24,287 | 192,165 |
| Weirton-Steubenville, WV-OH | 47 | 369 |
| Wheeling, WV-OH | 277 | 2,194 |
| Winchester, VA-WV | 55 | 439 |
| Wyoming | | |
| Casper, WY | 196 | 1,551 |
| Cheyenne, WY | 198 | 1,564 |

Top 100 Current and Potential Green Jobs Ranked by Metropolitan Area

| | | Existing 2006 | New Through 2038 |
|----|--|------------------|---------------------|
| 1 | New York-Nrthrn New Jersey-Lng Islnd, NY-NJ-PA (MSA) | 25,021 | 197,971 |
| 2 | Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA) | 24,287 | 192,165 |
| 3 | Houston-Sugar Land-Baytown, TX | 21,250 | 168,136 |
| 4 | Los Angeles-Long Beach-Santa Ana, CA | 20,136 | 159,321 |
| 5 | Boston-Cambridge-Quincy, MA-NH (MSA) | 19,799 | 156,660 |
| 6 | Chicago-Naperville-Joliet, IL-IN-WI (MSA) | 16,120 | 127,545 |
| 7 | Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA) | 14,379 | 113,772 |
| 8 | San Francisco-Oakland-Fremont, CA | 13,848 | 109,570 |
| 9 | San Diego-Carlsbad-San Marcos, CA | 11,663 | 92,285 |
| 10 | Pittsburgh, PA | 9,627 | 76,174 |
| 11 | Albany-Schenectady-Troy, NY | 9,567 | 75,694 |
| 12 | Indianapolis, IN | 8,909 | 70,491 |
| 13 | Dallas-Fort Worth-Arlington, TX | 8,851 | 70,029 |
| 14 | Trenton-Ewing, NJ | 8,788 | 69,535 |
| 15 | Sacramento--Arden-Arcade--Roseville, CA | 8,236 | 65,162 |
| 16 | Hartford-West Hartford-East Hartford, CT | 8,019 | 63,448 |
| 17 | Atlanta-Sandy Springs-Marietta, GA | 7,354 | 58,186 |
| 18 | Knoxville, TN | 6,755 | 53,450 |
| 19 | Miami-Fort Lauderdale-Miami Beach, FL | 6,717 | 53,145 |
| 20 | Portland-Vancouver-Beaverton, OR-WA | 6,714 | 53,122 |
| 21 | Denver-Aurora, CO | 6,644 | 52,568 |
| 22 | Seattle-Tacoma-Bellevue, WA | 6,257 | 49,510 |
| 23 | Austin-Round Rock, TX | 6,059 | 47,937 |
| 24 | Baltimore-Towson, MD | 5,910 | 46,763 |
| 25 | Durham, NC | 5,645 | 44,663 |
| 26 | Detroit-Warren-Livonia, MI | 4,884 | 38,642 |
| 27 | Minneapolis-St. Paul-Bloomington, MN-WI | 4,811 | 38,063 |
| 28 | Augusta-Richmond County, GA-SC | 4,461 | 35,295 |
| 29 | Riverside-San Bernardino-Ontario, CA | 4,224 | 33,425 |
| 30 | Cincinnati-Middletown, OH-KY-IN | 4,221 | 33,398 |
| 31 | Greenville, SC | 3,954 | 31,287 |
| 32 | Columbus, OH | 3,938 | 31,163 |
| 33 | Phoenix-Mesa-Scottsdale, AZ | 3,887 | 30,753 |
| 34 | San Jose-Sunnyvale-Santa Clara, CA | 3,810 | 30,147 |
| 35 | Baton Rouge, LA | 3,470 | 27,458 |
| 36 | St. Louis, MO-IL | 3,436 | 27,190 |
| 37 | Raleigh-Cary, NC | 3,315 | 26,226 |
| 38 | Nashville-Davidson--Murfreesboro, TN-AR | 3,250 | 25,712 |
| 39 | Salt Lake City, UT | 3,040 | 24,053 |
| 40 | Madison, WI | 3,016 | 23,861 |

Top 100 Current and Potential Green Jobs Ranked by Metropolitan Area

| | | Existing 2006 | New Through 2038 |
|----|--|------------------|---------------------|
| 41 | Cleveland-Elyria-Mentor, OH | 2,952 | 23,357 |
| 42 | Tampa-St. Petersburg-Clearwater, FL | 2,935 | 23,225 |
| 43 | Orlando-Kissimmee, FL | 2,855 | 22,588 |
| 44 | Kansas City, MO-KS | 2,522 | 19,953 |
| 45 | College Station-Bryan, TX | 2,520 | 19,941 |
| 46 | Oxnard-Thousand Oaks-Ventura, CA | 2,477 | 19,596 |
| 47 | Boulder, CO | 2,402 | 19,003 |
| 48 | Huntsville, AL | 2,358 | 18,654 |
| 49 | Albuquerque, NM | 2,297 | 18,177 |
| 50 | Peoria, IL | 2,221 | 17,573 |
| 51 | San Antonio, TX | 2,220 | 17,565 |
| 52 | Virginia Beach-Norfolk-Newport News, VA-NC | 2,164 | 17,126 |
| 53 | Columbia, SC | 2,155 | 17,049 |
| 54 | Las Vegas-Paradise, NV | 2,126 | 16,821 |
| 55 | Jacksonville, FL | 2,091 | 16,547 |
| 56 | Worcester, MA | 2,090 | 16,537 |
| 57 | Jefferson City, MO | 2,080 | 16,458 |
| 58 | Honolulu, HI | 2,022 | 15,997 |
| 59 | Buffalo-Niagara Falls, NY | 2,017 | 15,959 |
| 60 | Oklahoma City, OK | 2,016 | 15,951 |
| 61 | Milwaukee-Waukesha-West Allis, WI | 1,979 | 15,662 |
| 62 | Birmingham-Hoover, AL | 1,970 | 15,589 |
| 63 | Boise City-Nampa, ID | 1,962 | 15,521 |
| 64 | Providence-New Bedford-Fall River, RI-MA | 1,961 | 15,517 |
| 65 | Richmond, VA | 1,952 | 15,443 |
| 66 | Charlotte-Gastonia-Concord, NC-SC | 1,932 | 15,285 |
| 67 | Rochester, NY | 1,909 | 15,108 |
| 68 | Decatur, IL | 1,902 | 15,048 |
| 69 | Harrisburg-Carlisle, PA | 1,898 | 15,021 |
| 70 | Springfield, IL | 1,880 | 14,874 |
| 71 | Lansing-East Lansing, MI | 1,835 | 14,522 |
| 72 | Louisville, KY-IN | 1,827 | 14,456 |
| 73 | Salem, OR | 1,815 | 14,360 |
| 74 | Charleston-North Charleston, SC | 1,775 | 14,044 |
| 75 | Barnstable Town, MA | 1,680 | 13,293 |
| 76 | Lynchburg, VA | 1,600 | 12,659 |
| 77 | New Orleans-Metairie-Kenner, LA | 1,514 | 11,981 |
| 78 | Des Moines, IA | 1,489 | 11,784 |
| 79 | New Haven-Milford, CT | 1,348 | 10,668 |
| 80 | Syracuse, NY | 1,344 | 10,634 |

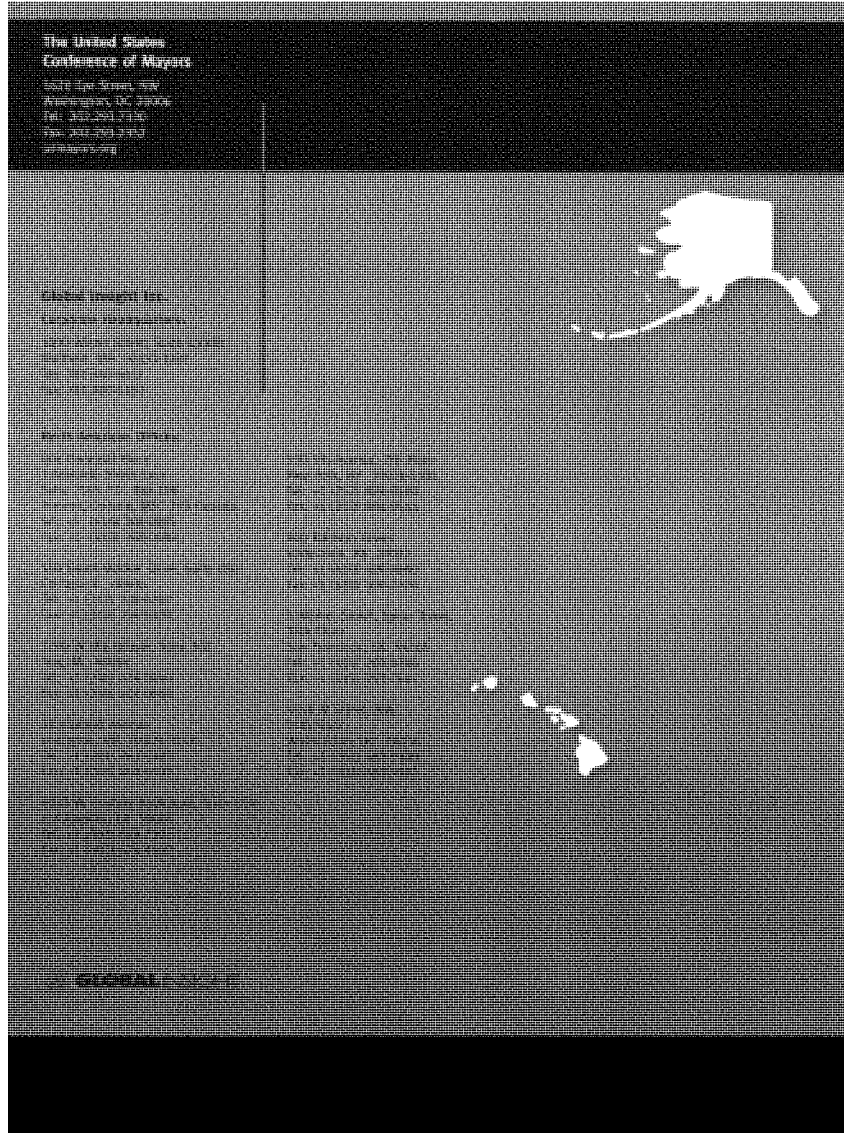
Top 100 Current and Potential Green Jobs Ranked by Metropolitan Area

| | | Existing 2006 | New Through 2038 |
|-----|---------------------------------------|------------------|---------------------|
| 81 | Montgomery, AL | 1,341 | 10,609 |
| 82 | Omaha-Council Bluffs, NE-IA | 1,337 | 10,582 |
| 83 | Little Rock-North Little Rock, AR | 1,319 | 10,438 |
| 84 | Tucson, AZ | 1,310 | 10,365 |
| 85 | Toledo, OH | 1,298 | 10,272 |
| 86 | Ann Arbor, MI | 1,288 | 10,193 |
| 87 | Anchorage, AK | 1,271 | 10,058 |
| 88 | Santa Fe, NM | 1,269 | 10,044 |
| 89 | Tulsa, OK | 1,190 | 9,416 |
| 90 | Holland-Grand Haven, MI | 1,189 | 9,408 |
| 91 | Dayton, OH | 1,180 | 9,334 |
| 92 | Allentown-Bethlehem-Easton, PA-NJ | 1,110 | 8,781 |
| 93 | Medford, OR | 1,109 | 8,775 |
| 94 | Memphis, TN-MS-AR | 1,075 | 8,507 |
| 95 | Fresno, CA | 1,053 | 8,332 |
| 96 | Poughkeepsie-Newburgh-Middletown, NY | 1,001 | 7,918 |
| 97 | Eugene-Springfield, OR | 993 | 7,853 |
| 98 | Kennewick-Richland-Pasco, WA | 979 | 7,750 |
| 99 | Champaign-Urbana, IL | 965 | 7,637 |
| 100 | Portland-South Portland-Biddeford, ME | 954 | 7,545 |



Printed on Recycled Paper. 100% Recycled, 30% Post-Consumer Waste, Processed Chlorine Free. FSC-certified.

DO YOUR PART! PLEASE RECYCLE!



Environment and Public Works Committee Hearing
July 21, 2009
Follow-Up Questions for Written Submission
 Questions for: Mayor Doug Palmer
 Questions from: Senator Barbara Boxer

1. Mayor Palmer, your testimony on the success of the US Conference of Mayor's pledge to reduce greenhouse gas emissions states: "[M]ore than one quarter of our population - more than 83 million people - resides in cities where a mayor has pledged action to curb their city's greenhouse gas emissions."

What is the geographic composition of the mayors who have signed this pledge? Also, do those mayors only come from the largest cities or are they also from other areas?

Since 2005, more than 970 mayors across the country have signed on to the U.S. Mayors Climate Protection Agreement pledging local actions to reduce greenhouse gas emissions by seven percent below 1990 levels below 2012. These mayors represent over 83 million people – more than a quarter of the U.S. population – in all 50 states, plus the District of Columbia and Puerto Rico. This diverse group of mayors is comprised of Democrats, Republicans, and Independents on Non-partisan officeholders. They are mayors of some of our most populous cities such as New York City, NY and Dallas, TX to others such as Juneau, AK and Tulsa, OK. There are cities represented by Republican mayors from cities such as San Diego, CA; Tucson, AZ ; and Arlington, TX who have joined with Democratic mayors and others in this effort.

2. Mayor Palmer, the U. S. Conference of Mayors' green jobs report found that metropolitan and non-metropolitan areas have an opportunity to increase their relative share of a green economy. Could you please describe some of the ways that urban and rural communities could benefit from green jobs?

The Conference's report, *U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy*, which was prepared by Global Insight and submitted to the Committee's record of this hearing, finds that green jobs will account for the largest, single source of new jobs over the next thirty years and that both urban and rural communities will have the opportunity to capture their share of new green jobs. Specifically, the report found that "[t]here are many Green Jobs in our economy already, but that figure stands to grow tremendously over the coming years due to market forces, legislation, and local initiatives, and some combination thereof. The vast majority of Green Jobs are not location dependent, so future Green Jobs will be located in cities and metropolitan areas that are currently the most attractive for investment, or in areas that increase their attractiveness relative to competing areas.

We know that cities and their adjoining communities have always been the strength of our national economy. As the nation shifts to a greener economy, much of the work that needs to be done to "green" local economies and "green" communities will create green jobs, by reinvesting in both urban and rural communities. In making our communities more efficient will reduce both per capita energy use and energy expenditures for families, businesses and the broader community, which in effect will free up resources for other investment and business activity in our cities and other communities. And, increased energy efficiency and more localized energy production from renewable and other sources means that a bigger share of each energy dollar will be used to

generate local jobs and stimulate local businesses. Certainly, the broader national economy benefits as well as these local efforts reduce our dependence on foreign oil.

Creating green jobs in local communities has the potential of providing its residents jobs that offer a living wage and upward mobility. It also has the potential to provide valuable opportunities to unemployed and displaced workers that reside in cities. Through the creation of green jobs and job training programs, the nation will have the opportunity to create a new workforce – a green collar, domestic workforce – where new green jobs are created in America's cities and other local communities.

3. Mayor Palmer, could you please describe how people in your City of Trenton have benefited from your energy efficiency initiatives?

In 2007, the City of Trenton launched the Trenton Green Initiative, an energy efficiency initiative whereby the City joined together with state agencies, local nonprofits and utility companies to creatively plan how to become more energy efficient while simultaneously creating a number of new, local green jobs. While the goals of the Trenton Green Initiative are aggressive, we believe they can be met through the objectives set forth in the plan. Thus far, energy efficiency initiatives that have been implemented have provided city-wide benefits, including initial reductions in the city's energy costs. These reductions are a result of replacing all traffic signals with light-emitting diode or LED fixtures and also replacing light and lighting controls in all city buildings. In addition, the city's work with the New Jersey Department of Environmental Protection in planting more than 4,000 trees in Trenton will benefit Trentonians by reducing air pollution, lowering temperatures in the summer, and absorbing carbon from the atmosphere. Finally, the city is now updating its Zoning Ordinance and is in the process of expanding the use of the Sustainable Design Rating System that the New Jersey Department of Housing and Economic Development now applies to all projects in its redevelopment areas.

Senator SANDERS [presiding]. My apologies for having to go down. I am going to get my bearings here, and I am going to let Senator Inhofe begin the questioning.

Senator INHOFE. Thank you, Mr. Chairman.

I enjoyed your remarks, Mayor Palmer. I used to have a hard job. I was the Mayor of a city.

Mr. PALMER. You have the hardest job as Mayor.

Senator INHOFE. There is no hiding place. If they do not like the trash system, they put it in your front yard. And I know, because they did.

[Laughter.]

Senator INHOFE. I would only say this. I would hope that since, and you are right on in terms of what is important to real people, they are out there, they want their jobs, and I hope that you will read the testimony of our witness that we had last week, Harry Alford, who is the president of the National Black Chamber of Commerce. It is not a matter of just losing jobs if we are to pass this bill, but it is regressive.

In other words, the percentage of income that a person has who is very poor that goes toward heating his home is much higher than it is for a wealthy person. And that is what I would like to have you look at for sure.

Representative Lowery, I appreciate that you are here, and I want your beautiful wife to hold her hand up so that we know that support is there.

I was following along with you, and I did not see that in the written testimony, but I understand that you said \$180 million a year on the refinery in El Dorado?

Mr. LOWERY. Yes, sir.

Senator INHOFE. What is the name of that refinery?

Mr. LOWERY. It is Lion Oil Refinery. It is owned by a group of independent businessmen. It is not Exxon or ARCO level whatsoever. It is a small independent.

Senator INHOFE. OK, because we have the same thing in my State of Oklahoma. Now, you said right now in El Dorado the unemployment rate is at 10 percent?

Mr. LOWERY. It is 10.2 percent.

Senator INHOFE. Is that due to the poultry plant? Tell us what happened in that poultry incident.

Mr. LOWERY. Well, all areas of our economy, unfortunately, as diversified as we are, are suffering as are most parts of the country. But with the plant closing, the poultry plant, not only did that eliminate 1,800 jobs, it also affected the family farms, the poultry people who are mortgaged to the hilt for their poultry houses, and their farms and they are not even included in there.

Senator INHOFE. So, prior to that exodus, what was the unemployment rate before it became 10 percent?

Mr. LOWERY. We started out, before the economic downturn, at 5 percent.

Senator INHOFE. At 5 percent. And then you say that, in the event that this would happen if they passed the Waxman-Markey bill which would effectively shut down your refinery, is there an analysis saying what it would be up to then?

Mr. LOWERY. No, sir. I have a resolution here included for the record from the Mayor and the City Council of the impact, but I got my information from Mayor Dumas last week and asked him to calculate and have his staff calculate it.

Senator INHOFE. OK, well let me ask you this. Two weeks ago, we had Lisa Jackson. She is Obama's appointee as Director of the Environmental Protection Agency. I asked her the question. I said, if we were to pass Waxman-Markey what would it do in terms of reducing the overall CO₂ going into the air? She thought for a while, and I applaud her, and I have applauded her since then for her honesty, she said, nothing. It will not affect it.

What she is saying is this: the problem we have is not here. The problem is in China, in India. In China right now they are cranking out two new coal-fired power plants ever week. They are looking at us right now hoping and praying that we will pass this bill so they can get our manufacturing jobs over there. And that would be a place where there are no emission requirements, no restrictions, and the end result would be an increase in the amount of carbon into the air. Does that make sense to you?

Mr. LOWERY. Yes, sir. Unfortunately, India, presently, is building a large refinery, I think a 400- to 600-barrel capacity, with no restrictions on it. They are designing that thing to make gasoline for America and to meet American standards.

Senator INHOFE. Oh, and I have got the quotes that you probably were going to read there. They are, under no circumstances, going to put any kind of restrictions on themselves. When they go to Copenhagen, there is a, not us you guys.

Mr. LOWERY. So, unfortunately, this represents, as we see if, if we shut local refineries down, independents, large or small, these job transfer are going to go to India. It is another large transfer of wealth that is already going to the Middle East that we are all opposed to and concerned about. This is going to add insult to injury, if you will, if we lose these domestic jobs.

Senator INHOFE. Well, I would only ask you, or anyone there, in this bill there is an unemployment provision. There is a section that guarantees 70 percent of the wages for 3 years and up to \$1,500 relocation assistance. It would seem to me that it is logical that the drafters of this bill know it is going to cost jobs because they have unemployment benefits in there. Do you agree with that?

Mr. LOWERY. I agree. Absolutely.

Senator SANDERS. Let me start off with Mayor Kiss. In our city of Burlington, we have a large wood chip burning plant, and I know you have been talking about the potential benefits of the concept of district energy. Can you say a few words about what you would like to see in Burlington in terms of district energy?

Mr. KISS. Sure. With the McNeil, what a wood chip plant does is have extra heat which is not used in the process of creating electricity. That heat would be coming in the form of hot water which could be piped to as many as 8,000 homes in the city and businesses, and, essentially provide the heating and cooling opportunities for all of those homes and businesses if we could put the infrastructure in place to make that work.

District heating is something that is used, for example, in Copenhagen. Ninety-seven percent of the heating method in Copenhagen,

Denmark, is a district heating method. Jamestown, New York, a much smaller example, already uses it. So, the examples exist in both the United States and Europe. But—

Senator SANDERS. And not only would you be creating an inexpensive source of heating for the local residents, but you would be creating jobs in the area as well.

Mr. KISS. Absolutely. I think the one thing that is true, the Copenhagen experience, we had people come from Denmark to talk to us about their experience. They tend to run their programs on a 50-year investment, paid off in 25 years, that allows them then have 25 years of heat that is essentially with the infrastructure paid. The benefit of that, if we could put it into place, is significant in terms of Burlington's future.

Senator SANDERS. Mayor Palmer, thank you very much for all of the work you have done as the Mayor of Trenton and as the past president of the U.S. Conference of Mayors in understanding the importance of addressing global warming and the potential for job creation in the process. We appreciate having worked with you on the Block Grant Program that Senator Menendez and I introduced.

In terms of the Energy Efficiency Block Grant Program, how is it working in your city in terms of job creation right now and addressing some of the energy problems of the city?

Mr. PALMER. Well, what we are doing right now, we put together our plan. Like I said, we certainly are looking to do the retrofits in homes and also in buildings. And our police station. We are taking care of retrofitting those kinds of things as well. But we are also looking at that money to help us leverage other moneys with our housing authority, with our school system, in order to use more of that to do more retrofits and those kinds of things.

Senator SANDERS. And in the process you are creating jobs, I presume?

Mr. PALMER. Yes. But the big thing I would say, Senator, is what the Mayors of the Nation are talking about. We definitely want this included in the bill and at least for 40 years. We need to know every year that money is there so that we can do the proper planning, so that we can use the money even more efficiently to leverage that, not just say it is a one shot deal.

Senator SANDERS. In other words, we did well in the stimulus package, but you want to see a regular source of funding—

Mr. PALMER. We want to see—

Senator SANDERS. And the Conference of Mayors feels that strongly?

Mr. PALMER. Very strongly about that. And like I said, Senator, this is sort of our baby together, what we have done, and I can tell you that it is creating, it is beginning to create, tremendous results in terms of jobs. Getting money directly to Mayors, getting money directly to cities, we will get that money out and create the jobs.

Senator SANDERS. OK. Thank you very much.

Mayor Euille, I apologize for not hearing your testimony. But in your written testimony, you talked about the T.C. Williams High School, which is now a LEED gold facility. What impact is that having on the kids in the school and on their response to education in general? Can you say a few words on that?

Mr. EUILLE. Yes, thank you, and I must say that the new high school is my former high school, the T.C. Williams High School. I graduated in 1968, and of course, while I hopefully will remember the successful 1976 movie about the T.C. Williams championship team, Remember the Titans, but the new building itself is a crown jewel. That is how I refer to it.

It is a \$100 million LEED gold certified building. Water is collected and retained on the roof and it circulates into a 500,000 gallon tank which is then recycled back in the building to flush the toilets, recycled for heating the building, and drinking water and everything else. There is a garden, an environmental garden, on the rooftop that the students use for biology and science classes.

The bottom line here is that it has been not just a building to educate students, but in terms of the core courses, it has actually enhanced and inspired them to fully appreciate and understand the importance of climate change and energy efficiency.

Senator SANDERS. Do the kids feel proud of the building?

Mr. EUILLE. Very much so. As a matter of fact, not only are they proud of the building, but when I did the grand opening ribbon cutting, I encouraged them to protect this building because this a unique opportunity, one of its kind, and so I am up there usually at least a couple of times a week, and the building looks like it did the day it opened, almost spanking brand new, a few years later.

Senator SANDERS. Thank you.

Senator BARRASSO.

Senator BARRASSO. Thank you very much, Mr. Chairman.

Representative Lowery, if I could. I was reading in your testimony that the Waxman-Markey bill will really change our way of life, you said in terms of at home in Arkansas, in regards to your community in lost jobs and higher energy prices. We have the same concerns in Wyoming. Our Governor, who is a Democrat, is opposed to the proposal.

I am just curious. I think you touched on it a little bit in your testimony that it seems to be what is happening in mid-America, bi-partisan opposition, as opposed to maybe on the coasts, which is bi-partisan support. Any thoughts on that?

Mr. LOWERY. Well, Congressman Mike Ross voted against it in the House, Marion Berry, Democrats, so it is non-partisan, if you will. What its effect is, and how, before I vote on any legislation at the State level, obviously not of this magnitude, I like to step back and say, what is going to be said to me back in the coffee shop in El Dorado before I cast my vote on this issue? Because I am going to go there, and I am going to hear those responses.

And what I am hearing here from the people who have lost jobs is that the potential of this legislation already has stopped maintenance and a major expansion of Lion Oil. That is just the potential of this. Also, at Murphy Oil in our community, they are in a non-hiring mode.

So it is non-partisan. It is not politics. It is about the people that we represent, real people in real jobs, not theoretical jobs. And we are not opposed to the increases and what other parts of the country want to do. But no, this is not a partisan issue at all.

It is about the American people, the way they choose to live in the South in rural areas. They choose that. Let us help protect

that. And let us also give jobs and opportunities and retain jobs in those areas as well as other parts of the country, but not at the expense of the other one.

One principle, well, many principles, but one principle instilled in me by my parents, you never benefit yourself at the expense of others. Always watch that principle.

And I know the Mayors here, I already just met Mr. Palmer, and I know he is a likeable personable guy, and he is already my friend, I think. And so I am not opposed to what these Mayors are saying here at all. I would not want my region of the country to do anything at the expense of them.

Basically what we are talking here, we are talking about taxing some regions of the country, and I know that he is not proposing that, to fund other areas and other potential jobs. That is really what we are talking about and how we see it in South Arkansas. Thank you.

Senator BARRASSO. And to follow up on that, because that is what I hear in Wyoming when I am at home on the weekend, and I was just home this past weekend, on the same issues. I think in your testimony you said not only would this bill destroy our economy, our communities, our way of life, but it is also going to make us pay more, pay more, due to it. Can you talk a little bit about that?

Mr. LOWERY. I do not know what the price tag will be. I do not think anybody knows. But I think it is unrealistic to say \$175 a year, whatever, per person. It is going to escalate costs tremendously.

So, I do not have the scientific data, if you will, with me, not the benefit of a staff that maybe others have. But, I mean just reason tells you that this is going to be very expensive. For instance here \$180 million for one refinery, if they can stay in business. And I do not think they can. This is company that their net profit for the last 23 years only averaged \$12 million a year. You do the math. So, I would say that is a very expensive proposition.

Senator BARRASSO. So, in terms of employment and the employment picture in your community say 5 years from now, if this goes through, is devastating?

Mr. LOWERY. Yes, sir. The Mayor before I came up here, I asked him to run some figures based on the most recent unemployment, 10.2 percent currently, what this would do to direct jobs and indirect jobs that support Lionel and Murphy Oil in our community. And he projects from 18 to 20 percent unemployment immediately.

Senator BARRASSO. So, if you were able to get Congress down to your coffee shop or everybody from the coffee shop up here sitting at the table, what message would they send to Washington about this Waxman-Markey bill?

Mr. LOWERY. Well, they would say that this is, in our opinion, bad legislation. The theoretical part of climate change and addressing that, we are not opposed to that. New innovation, new technology, we are not opposed to that. But we are looking at real jobs, real people that are going to lose their jobs and have nowhere else to go in this economy.

I think they would say take a second look and be very sure, very, very sure before you move forward this dramatically in taxing em-

ployers such as ours in our area there. Move very, very cautiously and be very, very sure before you do this.

Senator BARRASSO. Thanks, Mr. Lowery.

Thank you very much, Mr. Chairman.

Senator SANDERS. Let me start off with Representative Lowery. I apologize for not having heard your testimony.

Let me ask you the same question that I asked Governor Hoeven, and that is, seated exactly where you are seated now, over the past several years, we have been hearing testimony from some of the leading climatologists in the world. What they have told us is that if our country and the rest of the world do not get our act together, global warming is going to cause horrendous problems for the United States and the entire planet in terms of flooding, in terms of drought, in terms of extreme weather disturbances, in terms of disease, in terms of national security issues.

Do you agree with them, that if we do not get our act together our planet is going to suffer irreparable harm?

Mr. LOWERY. Well, I believe there is, we need to address and look at climate change. I do. I know the scientific community argues about how much is manmade and how much is natural. But certainly either way we need to address it. And the human element, yes, we need to address it. But not as dramatic as is in this piece of legislation.

Senator SANDERS. So, you do not agree with what the leading scientists of the world are saying, that if we do not move aggressively, this planet will suffer irreparable harm which we may never recover from in the years to come?

Mr. LOWERY. I do not disagree. I just think we have a difference of opinion as to how aggressive and what the term—

Senator SANDERS. Oh, no, they are saying, and if you do disagree, that is OK, they are saying that if we do not act aggressively irreparable harm will occur.

Mr. LOWERY. I cannot disagree with that.

Senator SANDERS. You cannot disagree with that?

Mr. LOWERY. No, sir, I cannot disagree with that. I think, again, it is the means.

Senator SANDERS. OK.

Mayor Kiss, you said something that I thought was very significant. I think we are proud of living in Burlington, Vermont, and the State is proud of it, and that is, since 1989, with normal economic growth, Burlington is, we have our problems with the recession but we are doing reasonably well, everything considered, Burlington today is consuming 1 percent more electricity than was the case 20 years ago.

What would be the implications for the United States, do you think, if the rest of the country was as aggressive as Burlington has been in terms of energy efficiency and, in fact, the State of Vermont has in recent years as well?

Mr. KISS. Vermont has an energy efficiency utility, VEIC. What they have been saying for quite a while now is that they could reduce Burlington's and Vermont's energy use by one-third through energy conservation and energy efficiency measures. So, one of the real opportunities that is still out there for us is not to build new capacity, but actually to reduce the use of energy by weatherizing

homes and taking that kind of action. If we invest in that, it is a much cheaper fix than building new capacity.

Senator SANDERS. You know, I have been hearing, over the last several years, how dire the economy would be if we were aggressive in terms of dealing with global warming. And yet Burlington has been one of the leaders in the country. Has that had dire economic impacts?

Mr. KISS. I do not think so. I think positive affects have been the result. On the contrary, I think Burlington has been actually creating more jobs with higher wages than the rest of the State. I think people look to Burlington and the greater metropolitan area as the economic engine of Vermont. And the investment in green infrastructure, as I said earlier, I think greens all of the jobs in Burlington and at the same time it creates new green collar jobs that are clearly responding to change.

Senator SANDERS. OK.

Mayor Palmer, I was excited to read your report stating that we could create, this is from the U.S. Conference of Mayors, 4.2 million green jobs by 2038 by increasing efficiency and alternative energy production. That would be a significant expansion over where we are today. Do you want to elaborate on that?

Mr. PALMER. Yes, this is our 2008 Metro Green Jobs Report that we put out. I figured that you were going to ask me that, Senator, and that is why I wanted to be sure. Forty percent of it would come from electricity from alternative sources, another 35 percent reduction in energy use, and that is both residential and commercial buildings, and 30 percent of gas-diesel demand replaced by ethanol and biodiesel. And my good friend here, I can give you this, too.

[Laughter.]

Mr. PALMER. So that is what we are looking at. Let us face it, Senator, this is a tremendous debate, especially to have 40 years when we are looking at the first man landing on the Moon. We have got to do this.

The cost of inaction is going to hurt future generations. If we do not do something now, you know, I love Florida, and parts of Florida may be underwater. Parts of Trenton, New Jersey, may be underwater. And then economic tsunami that would create would overshadow any kind of discussion that we are having as it relates to a gloom and doom forecast. We cannot afford not to do something.

Senator SANDERS. Well, I think Mayor Palmer, on that note, on that profound note, we are going to end the hearing. Just let me just say this, because I think you raise an issue that has not been focused on enough.

Some of our friends say that the legislation that is coming forward is not perfect. Well you know what? It is not perfect. I think we have got to improve it, and so forth.

But what you are saying is that the cost of doing nothing would, in fact, be catastrophic, not just for New Jersey or Florida or Vermont, but in fact for billions of people on this planet. And we do not hear that enough.

It would be catastrophic in terms of human suffering and disease, and areas in this world that are often inhabited by some of the poorest people literally being underwater, and it would be a

disaster in terms of what we would leave our kids and our grandchildren.

And it would be a disaster economically. People are saying, oh, you want to spend a whole lot of money dealing with global warming. Yes, that is true. What would be the economic costs in terms of trillions of dollars of loss if we do not go forward aggressively?

So, I think on that very profound note, which I happen to agree with very much, we will end the hearing.

I just want to conclude again, as a former Mayor, by thanking all of you and you, Mr. Lowery, as well, I know you are in the legislature there, for the important work, the grassroots work that you are doing. Keep up the excellent work.

Thank you all very much. The hearing is ended.

[Whereupon, at 12:58 p.m., the committee was adjourned.]

[An additional statement submitted for the record follows:]

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

Madam Chairman, as a former mayor and Governor, I have a unique appreciation for the perspectives of State and local officials as we contemplate national policy. Those perspectives are particularly important as we debate national climate and energy policy. Over the past few years we have seen various iterations of cap and trade programs and renewable electricity standards make their way through the legislative process. While many of the underlying details vary in these proposals, what's clear is that these policies will have vastly different impacts from one region of the country to the next. And while various "winners" and "losers" are created under these bills depending on how carbon credits are divided or how "renewable" is defined, the bills are consistently shown to be losers for consumers in States that rely on coal for electricity generation, have a large manufacturing base, and that have limited access to renewable forms of electricity generation.

Indeed, cap and trade is a policy mechanism that results in wealth redistribution among the various regions of the country, where consumers in regions with higher emissions pay consumers in regions with lower emissions for the right to emit. Thus it is no surprise that you see Senators from the Northeast and Pacific Northwest advocating for aggressive carbon caps. The same is true of proposals to implement a national renewable electricity standard: generators that cannot meet the standard will have to buy "green" energy credits from those that can. Not surprisingly, Senators representing States with large resources of renewable energy are the most vocal advocates for aggressive RES requirements.

The Waxman bill compounds this problem in a number of ways: First, the bill combines an RES with a cap and trade program. The result is a system of overlapping and redundant requirements that will impede cost effective emissions reductions and increase the overall costs of the policy and the flow of resources from one region of the country to another. Indeed, if national emissions are being controlled by the cap, there is no need for an RES.

Second, the bill's allocation scheme under the cap is punitive to coal dependent regions. This is most clearly seen when looking at the allocation formula for the electric generating sector. Under this formula, 50 percent of the credits are given to utilities based on historic emissions, and 50 percent are given based on electricity sales. However, awarding allowances based on electricity sales gives credits to companies that do not need them for compliance purposes. That is, generators utilizing nuclear power or renewables to make electricity have no compliance obligations for those sources. Quite simply, giving allowances to entities that do not emit greenhouse gases increases compliance costs for those that have emissions reductions obligations. The result will be a "windfall" for States in the Northeast and Pacific Northwest, while States in the Midwest and Southeast run carbon deficits.

For example, under the electricity allocation structure, Ohio will have only 70 percent of its utility emissions covered by free allocations. California, on the other hand, will receive 140 percent of its utility emissions in free allocations. Assuming a modest CO₂ price of \$15 per ton, the result is a net loss to Ohio's electricity customers of \$643 million in 2012 and a net gain to California's customers of \$385 million in 2012. Such an allocation scheme is unfair and unnecessary.

Separately, the bill provides for Federal preemption in areas where it should not and fails to preempt States where it should. For example, the bill gives the Federal Government power over local building codes. The new established national building codes would be federally enforceable, giving the Federal Government the ability to dock Federal funding or carbon allowances from States that don't meet the national efficiency targets. This represents an unprecedented level of Government intrusion into State and local affairs that has little to do with the bill's goals. As with the RES, if emissions are being controlled by the cap, these provisions are unnecessary.

Alternatively, the bill does not preempt State cap and trade programs. Unlike localized reductions in other air pollutants (e.g., sulfur dioxide, particulate matter), when an emissions source reduces its carbon dioxide emissions, it does not generate a corresponding local climate change benefit. From a practical standpoint, the actions of one or a group of States cannot by themselves reduce the global accumulation of GHG emissions in the atmosphere. At the same time, a patchwork of standards and regulations across the Nation may hinder a company's efficiency and create additional economic burdens for firms that operate in multiple States.

Of significant concern, the bill appears to cede expansive authority to States to adopt measures that would directly impact the nature and scope of the Federal cap-and-trade program, including the availability of allowances and their cost in the new carbon marketplace. Section 334 expressly permits a State to require the surrender of Federal emissions allowances as a means of demonstrating compliance with a State program. Thus, a State, or group of States, would have the ability to adjust the level of available emission allowances within the Federal program. And because allowance value will be determined by scarcity, the national economy could be seriously impacted by individual State policy choices on emissions targets.

Madam Chairman, I am certainly glad that the committee has decided to delay marking up this legislation. The more we dig into it, the more problems we find. The national interest is best accomplished through a transparent, coherent policy that clearly defines the rules of the game, allows for a cost effective system for emissions reductions, provides for regulatory certainty and that takes each State's capabilities and energy needs into account. This is no easy task, and much work will have to be done to craft a bill that meets those requirements.

Thank you.

[Additional material submitted for the record follows:]



*Scott Baxter
Director of Manufacturing*

**Great Lakes Chemical
A Chemtura Company**
P. O. Box 7020
El Dorado, AR 71730
870-864-1549 ph

July 20, 2009

The Honorable State Representative John Lowery, Jr.
200 North Jefferson, Suite 620
El Dorado, AR 71730

Dear Representative Lowery:

Thank you for your attention to the pending legislation known as the Cap and Trade bill; the American Clean Energy and Security Act of 2009.

As you know, our company has been a manufacturer of specialty chemicals in this community for over 40 years and we currently employ over 400 direct employees, with a significant indirect impact on this community through other services, suppliers, payroll, taxes, capital investment, and royalty payments. You are also aware that manufacturing in today's climate has become increasingly difficult to remain competitive in a global environment, and our industry is no different.

While our industry supports policies to reduce greenhouse gas emissions, we believe further discussion and changes are required on the Cap and Trade legislation to ensure a level playing field for American manufacturers who compete in a global economy. A good example is the emission allowance provisions for energy-intensive industries like ours; they are inadequate to maintain competitiveness and protect high-paying manufacturing jobs in the U.S.

Representative Lowery, we thank you for your commitment to South Arkansas and for your support of industries like ours working to produce products that make people's lives better, healthier, and safer. We thank you for carrying our message with you to Washington.

Sincerely,

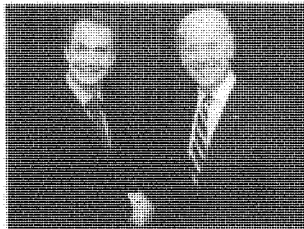
Scott Baxter
Director of Manufacturing

THE WALL STREET JOURNAL

MARCH 30, 2009, 11:24 AM ET

Green Jobs, Ole: Is the Spanish Clean-Energy Push a Cautionary Tale?

Now that Spain's renewable-energy leadership has become a template for the Obama administration and its clean-energy push, news that Spain's green-energy drive has actually been destroying jobs has made quite a splash. Should it have?



Pais, again (AP)

A new study by an economics professor at Juan Carlos University in Madrid says Spanish government spending on green energy to boost job creation kills on average 2.2 jobs for every green-collar job it creates. The carnage could be even worse, the study says, if job destruction from companies fleeing Spain's higher energy prices were included.

That got conservative commentators excited. National Review's Planet Gore, for instance, notes that following that math, the U.S. could stand to lose at least 6 million jobs if the Obama green-jobs push is successful.

Now, Spain's job-creation record is far from stellar—the country has had double-digit unemployment since the restoration of democracy thirty years ago, and today has a 14% jobless rate. Renewable-energy leadership has not been a panacea, as much as the current premier hopes it will pull Spain out of the current crisis.

But the study doesn't actually identify those jobs allegedly destroyed by renewable-energy spending. What the study actually says is that government spending on renewable energy is less than half as efficient at job creation as private-sector spending. Specifically, each green job required on average 571,000 euros, compared with 259,000 euros in "average capital per worker" in the rest of the economy.

So how does that translate into outright job destruction? It's simply a question of opportunity cost, the paper says: "The money spent by the government cannot, once committed to "green jobs", be consumed or invested by private parties and therefore the jobs that would depend on such consumption and investment will disappear or not be created."

On paper, that makes sense. But Spain's support for renewable energy came out of existing tax revenues—there were no special levies on corporate activity designed to underwrite clean energy.

The money the government has spent on clean energy may have edged out other government spending, but it's hard to see how it could have edged out private-sector spending, especially when the Socialist government there has reduced corporate income-tax rates, most recently this past January.

And just where did that study come from? Professor Gabriel Calzada is the founder and president of the Fundacion Juan de Mariana, a libertarian think tank founded in 2005. He's also a fellow of the Center for New Europe, a Brussels-based libertarian think tank that in recent years apparently accepted funding from Exxon Mobil.



111TH CONGRESS
1ST SESSION

H. R. 2454

AN ACT

To create clean energy jobs, achieve energy independence, reduce global warming pollution and transition to a clean energy economy.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

1 “(v) FINAL ACTION.—The Adminis-
2 trator shall take final action on such peti-
3 tion no later than 6 months after the peti-
4 tion is received by the Administrator.

5 **“SEC. 764. DISTRIBUTION OF EMISSION ALLOWANCE RE-**
6 **BATES.**

7 “(a) DISTRIBUTION SCHEDULE.—

8 “(1) IN GENERAL.—For each vintage year, the
9 Administrator shall distribute pursuant to this sec-
10 tion emission allowances made available under sec-
11 tion 782(e), no later than October 31 of the pre-
12 ceding calendar year. The Administrator shall make
13 such annual distributions to the owners and opera-
14 tors of each entity in an eligible industrial sector in
15 the amount of emission allowances calculated under
16 subsection (b), except that—

17 “(A) for vintage years 2012 and 2013, the
18 distribution for a covered entity shall be pursu-
19 ant to the entity’s indirect carbon factor as cal-
20 culated under subsection (b)(3);

21 “(B) for vintage year 2026 and thereafter,
22 the distribution shall be pursuant to the
23 amount calculated under subsection (b) multi-
24 plied by, except as modified by the President
25 pursuant to section 767(d)(1)(C) for a sector—

1 number of allowances allocated pursuant to section 782(e),
2 the Administrator shall reduce each entity's distribution
3 on a pro rata basis so that the total distribution under
4 this section equals the number of allowances allocated
5 under section 782(e).

6 “(d) IRON AND STEEL SECTOR.—For purposes of
7 this section, the Administrator shall consider as in dif-
8 ferent industrial sectors—

9 “(1) entities using integrated iron and
10 steelmaking technologies (including coke ovens, blast
11 furnaces, and other iron-making technologies); and

12 “(2) entities using electric arc furnace tech-
13 nologies.

14 “(e) METAL, SODA ASH, OR PHOSPHATE PRODUC-
15 TION CLASSIFIED UNDER MORE THAN ONE NAICS
16 CODE.—For purposes of this section, the Administrator
17 shall not aggregate data for the beneficiation or other
18 processing (including agglomeration) of metal ores, soda
19 ash, or phosphate with subsequent steps in the process
20 of metal, soda ash, or phosphate manufacturing. The Ad-
21 ministrator shall consider the beneficiation or other proc-
22 essing (including agglomeration) of metal ores, soda ash,
23 or phosphate to be in separate industrial sectors from the
24 metal, soda ash, or phosphate manufacturing sectors. In-
25 dustrial sectors that beneficiate or otherwise process (in-