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BUSINESS OPPORTUNITIES AND CLIMATE POLICY

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

MAY 19, 2009

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ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

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BUSINESS OPPORTUNITIES AND CLIMATE POLICY

TUESDAY, MAY 19, 2009

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

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

Present: Senators Udall, Inhofe, Voinovich, Bond, Lautenberg, Carper, Klobuchar, and Merkley.

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

Senator BOXER. The hearing will come to order. Welcome, everybody. We are very happy you are here. Our schedule is such that we expect to vote shortly. So my intention is to have us each make a 2-minute opening statement at maximum and then put the rest of our statement into the record so that we can get right to our witnesses.

So, I would ask unanimous consent that all statements be placed in the record and I will start with mine.

Today we will hear testimony on just a sampling of the business opportunities that we can expect when we act to cut the carbon pollution that causes global warming and we do it in the right way.

Our witnesses today will provide on-the-ground examples of the way the American people will benefit from the clean energy policy that drives an economic recovery, creates jobs and helps to break our dangerous dependence on foreign oil.

So when you hear my colleagues on the other side say this is the worst time to ever do this, it is going to cost a lot, it is going to be terrible, I have a real opposing view because I have lived a long time and I have seen all of this.

When we passed the Clean Air Act, they said the same thing. Every time California stepped forward to clean up our environment, and even this recent move where they said we are going to take the lead on cutting global warming pollution—and at noon we are going to find out at the White House that they have followed California's leadership—we have always been told oh, the sky is falling and everything is going to be terrible.

The truth is that when you clean up the environment, you create good, clean, green jobs. We are seeing it in California today where we have a horrible recession. With our housing problems, we are about No. 2 in the Country in terms of our foreclosures. We have got all of these issues that have hit us in the financial sector, but

yet we see 400 new solar companies springing up and venture capitalists just waiting for the Congress to act.

I am a very upbeat, optimistic person. I think the fact that you have got this economic recession converging onto this need to do something about global warming, I think that will equal American leadership and American Jobs.

In closing, I would say to all of you who have not read Thomas Friedman's book Hot, Flat, and Crowded, I highly recommend it because, in the most beautiful prose, he says what I just said but in a much better way. The country that leads on this will be the economic leader in this century.

With that, I would turn to the Ranking Member, Senator Bond.

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

Senator BOND. Thank you very much, Madam Chair. My sympathies to you and the Californians with the $42 billion deficit that you have incurred.

We want to hear today from the experts who believe that global warming legislation can be profitable. In some instances, the problem is that the profit will come from the suffering of others, from the pain of energy taxes and the lost jobs through global warming legislation. There are some who want us to feel the pain of higher prices to produce carbon savings. And from the pain of many will come the profit of some.

When energy prices are so high, high costs will finally become competitive. What some try to forget is that consumers, families, farmers and workers and will suffer under higher energy prices. All will face the pain at the pump, the light switch, the checkout counter and the unemployment line.

I am very proud to have a Missouri witness, Mr. Tim Healey. Tim's family founded and ran fertilizer distributor Lange-Stegmann in St. Louis. He will tell us how high natural gas prices the last few years led to record fertilizer prices for farmers. Many fertilizer producers could not pass on enough high prices and closed down. I have a chart that shows that more than a dozen fertilizer plants have closed in the last 10 years to move their operations and their jobs to lower cost countries like China and the Persian Gulf. Global warming legislation can impose the same costs. Higher farm prices, food prices and jobs lost to China.

Some would say that the savior to this suffering is green jobs. I support helping to create green jobs when it makes economic sense. We can, and should, do more to encourage renewable power, biofuels, clean energy technology, algae conversion. But we will create far too few green jobs to make up for crushing higher energy prices.

Phil Angelides of the Apollo Alliance wrote in Roll Call yesterday that Michigan produced more than 3,000 new clean energy jobs. That is a nice number but that is less than 1 percent of the 400,000 manufacturing jobs Michigan lost.

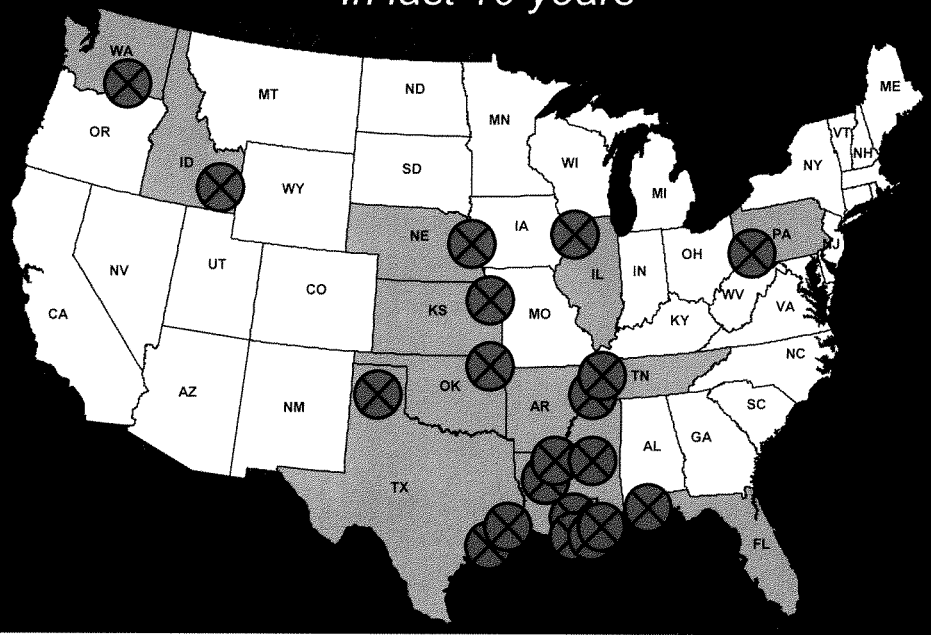
I have laid all this out in a report I did called Yellow Light on Green Jobs that I will submit for the record.

Senator BOXER. Without objection, Senator Bond.

[The referenced chart follows:]

HIGH ENERGY PRICES CLOSED FERTILIZER PLANTS, KILLED JOBS

In last 10 years



Senator BOND. Expected taxpayer subsidies are very expensive and Federal subsidies of $100,000 per green job plus the costs of the taxpayer subsidies for some of the energy generated by solar and wind are too high.

Thank you, Madam Chair.

Senator BOXER. Thank you very much. I will see our Republican Governor today and I will send your best wishes and he would tell you that our budget problems date way back. It has nothing to do with global warming legislation which is creating jobs in our State. But, once again, the party of no puts forward its arguments and we will hear a lot more of that.

We are going to go to Senator Udall.

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

Senator UDALL. Thank you very much, Madam Chair.

Let me just say welcome to all of our witnesses and a special welcome to Cynthia Warner, the President of Sapphire Energy. I would also like to thank the Chair for inviting Sapphire to testify.

I know that Sapphire is based in California but I think you do much of your work in New Mexico. This is an area that I will say we are very interested in in New Mexico in terms of renewable energy and using some of the lands that we have in New Mexico that have the ability to produce renewable energy. You talk about desert land and you talk about a hot climate and salty and brackish water. We have it all and we have it in a pretty significant quantity in certain parts of our State.

We really look forward to working closely with you and developing this resource because it is something that I think is not only important for New Mexico, it is important for the Nation.

So, welcome here and I would yield back any time so that we can get directly to our witnesses.

Thank you, Madam Chair.

Senator BOXER. Thanks so much, Senator.

Senator Voinovich.

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

Senator VOINOVICH. Thank you, Madam Chairman.

Climate change is a complex issue that requires examination from a variety of perspectives. In this regard I would note that, while hearings on green jobs and climate science are helpful, they do not provide numbers with an adequate forum to examine the various policy options available to address climate change.

Reports of an aggressive Senate agenda for the consideration of mark up legislation now in the House has caused me great concern. And I am glad, Madam Chairman, that we talked about this prior to the hearing, that you intend to have robust hearings here in this Committee of any bill that comes over from the House.

Senator BOXER. Yes. Many, many workshops.

Senator VOINOVICH. I would hope that beyond the workshops we have more than one mark up as we did last time and that we do get a lot more information about the impact that this legislation will have on the entire economy.

Given our knowledge of the previous bills, we would expect that the potential costs to consumers to be high for Congressman Waxman's proposal. Many people now engaged in this debate downplay the impacts that climate change will have on our economy. Although the green jobs movement advanced by the environment establishment is trying to convince us that rationing energy resources will save the world and our economy, there is no credible analysis that support these claims.

One of the things that people fail to realize is that eight-tenths of 1 percent comes from solar. One point 4 percent comes from wind power. The rest of it comes from other sources of energy in this Country.

The other thing that has been failed to be mentioned is that the "green industry," in terms of kilowatt hours, is a subsidy of about $24 per kilowatt as compared to a lot lower costs for other sources of energy.

We understand that the industry has to get started and once they get going, maybe the price is going to come down. But to give us this impression that all of a sudden the green jobs are going to make up for the ones that we are going to lose from cap-and-trade legislation, which I am sure is going to happen, does not make sense.

A lot of people tell me, George, do not worry about it. It is all going to be taken care of. It is going to work out. Well, if I am somebody that has been put out of work, or I am a person in Cleveland who is on fixed income, and I see my energy costs increase like they did for natural gas, I have some real concern about this legislation and its impact on me and the economy and on jobs.

Senator BOXER. Thanks, Senator.

Senator Lautenberg.

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

Senator LAUTENBERG. Thanks, Madam Chairman.

People are appropriately concerned about how we work our way out of this recession that we are in. I and many around here believe that there are job opportunities in what we are calling the green environment. I think the title mystifies people to the tune of disbelief. They just do not see it. We have to make sure that we show the examples very clearly of what the benefits can be to our health and what we can do in terms of sharing with the public at large a look at how a green opportunity is a valuable one.

I recently visited a company is West Hampton, New Jersey called Lighting Sciences. It employs 48 New Jerseyans and 110 people across the Country. It makes a high efficiency LED bulb. These lights consume much less energy than standard bulbs, do not contain mercury, lead or other toxins, and LEDs pay for themselves in a short amount of time, saving money on energy bills for businesses.

Having built and run a pretty good sized company, I can tell you savings like that do add up and will allow business to invest and expand and hire more workers. And in this economy, helping businesses expand and hire more workers should be our primary mission.

I have great respect for our colleague from Ohio. He is always bringing to our attention the fact that higher costs are not something that would like they would help us out of a recession. But there are opportunities. I say to my friend, there are opportunities out there and we have to work very hard and I am pleased that our witnesses here are prepared to talk about business opportunities and the environment.

Madam Chairman, I ask that my full statement be included in the record.

Senator BOXER. Absolutely. Will do.

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

Senator BOXER. Now we will turn to our panel. I have been told that the votes have been pushed back a bit so we should be able to get through this panel. We are very, very proud that you have all agreed to be here. We really are. We thank you so much for taking your time.

Charles Holliday, Jr., Chairman and Chief Executive Officer of DuPont. Welcome, sir.

STATEMENT OF CHARLES O. HOLLIDAY, JR., CHAIRMAN AND CHIEF EXECUTIVE OFFICER OF E.I. DUPONT DE NEMOURS AND COMPANY, INC.

Mr. HOLLIDAY. Thank you, Chairman Boxer and distinguished Committee members.

I am here as Chairman of DuPont, a $30 billion revenue, 207-year-old American-grown company; but also as a member of the U.S. Climate Action Partnership. I appreciate the fact that you are holding these hearings focusing on the important need to address climate change and seize the opportunity for American companies to grow in the U.S.

I believe that addressing climate change may be the single, greatest opportunity to reinvent American industry and put us on a more sustainable path than we face today. Yes, leadership has the potential to create real economic growth by providing the certainty companies need to increase their investment and accelerate the development and deployment of low carbon solutions, creating good jobs for American workers.

That leadership can help the nations of the world all come together to adopt low carbon energy technologies that will create these massive new markets for large companies like DuPont and smaller companies. We need to be sure that American companies are leaders in this.

I think it is very useful to think about this subject as two buckets. In bucket No. 1 are more energy efficient and effective solutions. In bucket No. 2 are expanded and new sources of low carbon energy.

Turning first to efficiency, as you drive through almost any subdivision here in the U.S. you will see DuPont Tyvek wrapped around a home. That is a very efficient, cost effective way to conserve energy. A typical two-story house in the Midwest that uses Tyvek can reduce their energy use by 20 percent from this one step alone. What we see is that there are clear opportunities on technologies that are here today. We must break down the barriers to

deploy them and develop them more completely and we need to create those jobs here in the U.S. to do that.

In the second bucket I described, there are new sources of energy. There are two examples from DuPont, both from the biofuels area. We are working on ethanol that can be made from corn cobs and switch grass. We are building a $40 million power plant in the State of Tennessee that will be operating by year end.

Our second biofuel is biobutanol, which has some advantages over ethanol because it can be mixed freely with gasoline and has higher energy content per unit weight. We need to be sure that we provide the environment so that those projects can be developed here in the U.S.

I have one last perspective that I would like to share with the Committee that is based on my 35 years of doing business in DuPont. This climate change issue is very complex. We believe the science is clear and you need to take action. But exactly what is going to happen and exactly when it is going to happen no one knows for sure. Therefore, we believe there will be very legitimate debate, very important work for your Committee, to debate how much you limit the impacts of climate change versus how much you adapt to it. That should be done with great vigor and you should work on that carefully as a Committee and I think that is very good use of your time.

What I do not think you should debate is the need to create those jobs here in the U.S. for American companies and what it takes to be sure that not only the development is done here, but the jobs are created and the activities deployed here.

Now let me be extremely blunt and say it is a lot easier to go to Singapore, Hong Kong or China today and get immediate government support for a clean energy project than it is in my own Country. Let me give you three specific examples.

If I wanted to bring a new clean energy technology project out, I could get approval in the three countries I described in less than 100 days. At the same time, I could also go to those governments and find support for our action that would take down the amount of up front cash we have which would allow us to go faster and bigger. And third, what we will find is fast track approval for the permitting process, by no means relaxing the standards, but speeding things through.

I urge your Committee to look at ways we can be just as competitive as the three entities I described, to make sure those new jobs come here, not just for American companies, but you can attract Japanese and German and Brazilian companies to do the same thing. I urge you to focus on that opportunity. I think it is the greatest opportunity we face as a Country.

Thank you very much.

[The prepared statement of Mr. Holliday follows:]

Statement of Chad Holliday

Chairman

E.I. DuPont de Nemours and Company, Inc

before the Senate Environment and Public Works Committee

May 19, 2009

Thank you, Chairman Boxer and Ranking Member Inhofe, for convening a hearing today on this important topic. I am pleased to be here as Chairman of DuPont. I appreciate your holding this hearing about the opportunities that arise from addressing climate change. It is easy to identify the challenges, and not enough attention has been paid to the very real opportunities. It is these opportunities that will help American companies grow, invest and add jobs. They will drive innovation in large established companies like DuPont and in startups across the US. And these innovations can form the basis for a green export flow to other countries

In fact, I believe that addressing climate change may be the single greatest opportunity to reinvent American industry, putting us on a more sustainable path forward. A federal climate program has the potential to create real economic growth by providing the certainty companies need to increase their investment and accelerate the development and deployment of low carbon solutions. And to do so in a profitable manner that provides good jobs for American workers.

At DuPont our goal is sustainable growth, which we define as the creation of shareholder and societal value while reducing our environmental footprint along the value chains in which we operate. Our sustainable approach to climate change is informed, in part, by our experience with chlorofluorocarbons in the 1980s. When atmospheric research on ozone depletion led to the realization of the role of CFCs, we actively engaged in the development of the Montreal Protocol and an international agreement to phase out the use of CFCs. Our experience with the Montreal Protocol showed us the vital role for policy in creating a predictable pathway for change. With the Protocol in place we knew where we were headed and we put our science to work to phase out CFCs and develop better replacement materials. Those efforts not only had benefits for stratospheric ozone but also produced almost six times the greenhouse gas emissions reductions that the Kyoto Protocol would have achieved if it had been fully implemented. I am proud that DuPont and the US could be leaders in that effort.

That experience helps inform our efforts today. DuPont believes that the science on climate is sufficient to compel action. As you know, we are a founding member of the

US Climate Action Partnership, and with our USCAP partners are actively engaged to push forward on responsible climate legislation.

Over the last twenty years, as DuPont has become more aware of the potential business and environmental implications of climate change, we have looked for ways to contribute to solutions. In 1994 we publicly committed to voluntary global greenhouse gas reduction goals. Between 1990 and 2004 we reduced our own greenhouse gas emissions by 72% globally through a variety of efforts. By 2015, we will further reduce our greenhouse gas emissions by 15% from a base year of 2004. We have also committed to help our customers reduce their greenhouse gas emissions by providing products that help them do so, such as with our new automobile air conditioning refrigerant. This new product has one quarter of one percent the global warming potential of the current product in use. That is a 350 times improvement. And so the path we began many years ago with the Montreal Protocol of using science to deliver better solutions continues. It also demonstrates the opportunities that lie ahead.

DuPont will continue to do its part, working not only to further reduce our own footprint, but also by using our science to bring new products to market that help others reduce their emissions. In doing this we will create revenues and growth for our employees and our shareholders, and benefits for our communities and customers. Let me provide a few examples of opportunities from the DuPont portfolio. I think this will give you a sense for the range of markets that DuPont serves where we could anticipate greater demand in a low-carbon economy.

We provide many of the advanced materials that make up photovoltaic solar cells. We are also actively engaged in research to enhance the efficiency of PV. This is a strong business, with good growth in recent years, such that even in the current economic conditions we are looking at expanding production in some materials. Globally, DuPont's photovoltaics businesses sell about $400 million of materials today, and we expect to nearly triple these sales to more than $1 billion by 2012, under current market conditions. This market is particularly strong in places where governments have made sustained commitments, like Germany, Japan and California. Imagine the opportunities when cap and trade creates a broad demand for effective renewable energy technologies like photovoltaics. I'd also like to note that elements of the American Recovery and Reinvestment Act make the U.S. a great candidate for additional renewable energy manufacturing investments.

Another alternative energy technology where we expect to see expanding demand is wind. We manufacture a number of materials for wind turbine construction, such as Nomex® insulation for the generators and transformers which improve their reliability, and specialty coatings for the blades that make them "slipperier' and more efficient. This market is another tremendous growth opportunity.

A federal climate program would also expand markets for next-generation low global warming potential (GWP) refrigerants, where we are a leader. A cap would expand demand for products such as the HFO-1234yf I mentioned earlier, which has a 350 times

lower global warming potential than current refrigerants. Currently we see growing market demand in places like the EU, where limits are being placed on greenhouse gas emissions. Use of this product will have significant climate benefits, providing. We are developing other very low-GWP materials for applications such as air conditioning, refrigeration and the production of energy efficient insulating foams for residential & commercial construction and home appliances.

DuPont is also actively engaged in developing technologies to produce valuable products from biomass, rather than hydrocarbons. We are nearing market readiness for our two next generation biofuels. We are developing cellulosic ethanol from switchgrass and corn cobs through our joint venture with Danisco. This is a biofuel with an extremely low life cycle greenhouse gas profile produced from on non-food feedstocks. Our high performance fuel biobutanol, under development with BP, is designed specifically to expand the performance of biofuels.

But it is not just fuels. We create other value-adding materials from biomass feedstocks, like Bio-PDO™.. Bio-PDO™ has spawned an array of products that are displacing hydrocarbon based materials in the market, including our DuPont™ Sorona® polymers and fibers, which you can find in Mohawk's SmartStrand carpet; renewably sourced airplane de-icing fluids and bio-based ingredients for cosmetics and household cleaners. . Making Bio-PDO™ from renewable, farm-grown sources results in 60% fewer greenhouse gas emissions than comparable products made from hydrocarbons. Delivering high quality products that are environmentally responsible makes great business sense. Customer demand for these products has nearly doubled since the opening of the first bio-based production lines in 2006 and this portfolio represents a $14 billion market opportunity.

Our seed company Pioneer Hi-Bred provides farmers with seeds that are increasingly resistant to adverse weather conditions, pest resistant, fertilizer efficient and high yielding, allowing farmers to continually produce more food and fuel per acre with fewer inputs. Under cap and trade we expect to see an increase in demand for agricultural practices like no-till that can help sequester enormous amounts of carbon across hundreds of millions of acres. This in turn will expand demand for seeds and related agricultural products that can expand yield while enabling low-carbon growing practices, and Pioneer provides those products. Additionally, Pioneer seeds can help farmers adapt to agricultural challenges related to climate change.

Of course, one of the smartest and most cost effective means to reduce greenhouse gas emissions is through more efficient use of energy. We make products that enable greater energy efficiency, such as refrigerants that reduce energy use in refrigeration and air conditioning and the DuPont™ Tyvek® HomeWrap® you see when you drive past building construction and renovation. For example, in a typical 2-story house in the Midwest, the use of Tyvek® can reduce the CO2 footprint of the house by 32,000 tons per year, a 20% improvement in energy efficiency. Considering the long lifespan of a home, investing in materials that enable greater energy efficiency can add up to impressive numbers in avoided greenhouse gas emissions over time. A federal climate

change program will focus a great deal of attention on improving the energy efficiency of our built infrastructure. DuPont believes we can provide many of the products and technologies to fill this need.

We also produce the materials that make fuel cells and advanced batteries work, and anticipate that these will be increasingly important technologies as the U.S. is likely to use more electricity in transportation and have a greater need for renewable energy storage as we make reductions in greenhouse gas emissions. Hybrid automobiles that rely on hydrogen fuel cells and advanced batteries are just one example of innovations that rely on work that scientists and engineers at DuPont are advancing.

There is a growing global demand for electronic goods, and a growing recognition of their energy consumption. For example, display screens are used in a wide range of applications - mobile phones, personal computers, and televisions to name a few. Under cap and trade there will be increasing demand for energy efficient electronics and communications technologies. DuPont's Organic Light Emitting Diode (OLED) technology offers significant energy savings in both displays and in lighting. DuPont has developed a unique low-cost technology for manufacturing OLEDs. Our initial target for OLED technology is in mobile displays. We are also planning to introduce OLED technology for flat-panel televisions and for general lighting, both markets where adoption of our technology would result in significant power savings.

I've mentioned the low-carbon biofuels that we are bringing to market. The use of low-carbon fuels, coupled with improved vehicle efficiency has the potential to provide significant reductions in the greenhouse gas emissions from automobile travel. Reducing vehicle weight and enhancing engine efficiency help us get there, and DuPont provides a range of specialty plastics that contribute to lightweighting and reducing friction in moving parts, all while maintaining safety. Again, in a cap and trade scenario these markets should expand.

While that may seem like a long list, these are all products and markets in our current portfolio. Reducing greenhouse gas emissions will also create new markets that demand new technologies, and we will be there to serve those markets with our innovations. In the first quarter of this year we introduced 500 new products, twice the number of new products we introduced in the first quarter of the previous year, despite current economic conditions. Think what new markets will unleash.

I started by noting that there are both economic challenges and opportunities associated with taking action. I think we are realistic about both. We also believe that it is possible to develop legislation that is, as USCAP has called for, environmentally effective and economically sustainable. The USCAP Blueprint provides a roadmap for such legislation. Effective climate legislation will encourage markets to turn increasingly to greater energy efficiency, low carbon energy forms and bio-based products. This will provide companies like DuPont the certainty we need to increase our investment and accelerate development and deployment of technologies that will be critical to a low-carbon economy. DuPont will thrive and innovate whether there is cap and trade or not.

However, climate change is a very real challenge, with very real solutions, and I think applying DuPont's innovations to those challenges would truly be sustainable growth.

In closing, DuPont has taken these actions and policy positions because they are the right things to do, both for business and the environment. We will continue to work hard to bring new products and technologies to market that will help address the global climate challenge. But business cannot solve the problem alone. Federal legislation will help create the marketplace that will drive innovation, economic growth, and environmental progress. DuPont is proud to be part of the US Climate Action Partnership, which reflects both a growing group of businesses who believe that it is time for the US to take action on climate change and diverse NGOs working hand in hand to address this challenge. I appreciate this opportunity to exchange views with you, and look forward to working with you to enact effective legislation.

Senator BOXER. Thank you so much and I hope that your words resonate far through this U.S. Senate. You say this is a great, great opportunity.

Mr. Stiles, we welcome you, Senior Vice President of Trinity Industries. We look forward to hearing from you.

STATEMENT OF MARK W. STILES, GROUP PRESIDENT AND SENIOR VICE PRESIDENT, TRINITY INDUSTRIES, INC.

Mr. STILES. Thank you, Madam Chairman, and Senators.

It is a pleasure to be here today as we testify about the business opportunities for renewable energy as far as Trinity Industries sees it.

We are a multi-industry company. We operate in 13 States. We have one of our largest barge building facilities in Caruthersville, Missouri. We have a number of our highway products businesses in Illinois and Ohio. We are in 10 other States.

One of the things that I think is extremely important for us today, and to echo Mr. Holliday's remarks, is that the jobs that are created here are real jobs. We have lost jobs in the businesses we are in. We are in the rail car business, the barge business, the concrete and aggregate business. We are so tied to what goes on in this economy and the manufacturing portion of what is going on. We are one of the multi-industry manufacturers that are still left in this Country.

A number of years ago, when we started building wind towers, it was looked at as a "science project." But we participate in this business now. In 2003, we built no wind towers. Now, we are the largest manufacturer of wind towers in the U.S. We provide those wind towers for General Electric, Suzlon, Acciona, Gamesa, Impsa and Mitsubishi. Those companies are operating in the U.S. We do not want to lose jobs to foreign countries as well because it does not take them as much investment or take as much red tape, so to speak, to get their permits and start.

The fact is that our people are productive and efficient. We use almost 100 percent recycled steel to build these products. We can compete as long as we are on level playing fields and these are real jobs that are being created. We have several hundred jobs in these businesses and we have put them in facilities that have previously been shut down from other businesses.

There has been a drastic drop in the production of the rail car industry in the U.S. and one of the things that we have done is be able to take advantage of building these wind towers in these facilities. These towers, you will see, that is 15 feet across, it weighs close to 30 tons, when it is finished it is going to be 200 feet tall, it is going to have 150 tons in it, all of those things are made from flat plate steel. That is American steel, American workers, American facilities that were shut down.

One of the main reasons I think I was asked to be here today, and I am pleased to do it, is because in Newton, Iowa, there was a Maytag facility, and Senator Bond and Senator Voinovich both mentioned this, there were 4,000 jobs in Newton, Iowa working for Maytag. Those jobs are gone. They did not go overseas. They went to another State, as I understand it.

We are not Maytag. We do not provide that many jobs. In fact, there are only about 100 there now. We expect to go to 250. But they are good jobs with good benefits and what the people in Newton, Iowa have said is we did not have anything before you came.

We worked with Governor Culver there in Iowa to get this facility started. Recently President Obama was there for Earth Day. We were very pleased to show him the plant. He asked me what the main problem was. The main problem was that a year ago there were 24 credit facilities that were out operating for wind tower development and there are only four at this time. The money that Congress is trying to put forward needs to get down to the developers. GE, one of our biggest customers, will tell you flat out that they have not had a turbine order since last August. And the opportunities are there.

Transmission must be addressed. I want to say that when you stop and you look at this, these jobs that are created are in steel manufacturing, the people that collect the scrap that makes the steel, the transportation, the railroads that ship the steel, the fitters, the welders, the machinery operators, and the maintenance people. There are schools that are being set up all over this Country now to learn how to maintain wind turbines. There are the transmission jobs. There are hundreds of jobs, thousands of jobs, literally being created. But the money has to get down to the bottom, to the people that are developing these things.

What I will tell you is that we had facilities that have been idled in Oklahoma, Georgia, Texas and in a number of other States. We have taken facilities in Illinois and Iowa and rebuilt them from what they were. These are real jobs and the money needs to get there.

We believe that there is a future for the renewable energy business. There is some subsidy going on, as you said, for the wind and solar business, but the fact is that we are going to have to work ourselves out of the dependence on foreign oil in order to become a competitive Country and stay that way.

Thank you very much.

[The prepared statement of Mr. Stiles follows:]

Testimony of Mark W. Stiles,
Group President and Senior Vice President,
Trinity Industries Inc.

Before the Senate Committee on Environment and Public Works

Hearing on:
Business Opportunities and Climate Policy

May 19, 2009

Chairman Boxer, Ranking Member Inhofe, and Members of the Committee, thank you for inviting me to testify on business opportunities in renewable energy. My name is Mark Stiles. I am Senior Vice President and Group President for Trinity Industries, Inc. Our corporate headquarters is in Dallas, Texas.

Trinity is a multi-industry company that owns a variety of market-leading businesses which provide products and services to the industrial, energy, transportation, and construction sectors. Our Rail Group is the leading freight railcar manufacturer in North America and a leading provider of leased railcars. Our Inland Barge Group is the leading producer of inland barges in the United States. Trinity Highway Products, LLC is a leading manufacturer of guardrails, crash cushions, end terminals, and proprietary products (i.e., cable barrier system) on our nation's highways. Trinity Structural Towers, Inc. is the leading manufacturer of structural wind towers in North America. The Structural Towers business and our involvement in the wind energy sector is the reason I am here today addressing your Committee.

Trinity Industries was incorporated in 1933. Since that time, we have aggressively pursued manufacturing opportunities in several industries. Our quality work force has enabled us to be entrepreneurial in growing businesses and in entering new markets when business opportunities are presented. One such opportunity is wind tower construction for commercial scale wind farms you see across the United States. We

started producing wind towers in the 1990s, when being "green" was not cool and many considered wind energy a "science experiment."

Despite a rather stormy beginning in the wind energy industry, Trinity has shown its true resiliency as a company. From producing zero wind towers in 2003, Trinity Structural Towers has emerged today as the leader in wind tower manufacturing in the United States. Our customers are some of the leading wind turbine manufacturers in the world – General Electric, Suzlon, Acciona, Gamesa, Impsa, and Mitsubishi.

We manufacture the tower structure that supports the wind turbine as well as providing related products and services, including transporting services, for the wind energy industry. Currently, our primary markets are in the central United States. We are presently manufacturing wind towers at facilities in: Fort Worth, Texas; Clinton, Illinois; and Newton, Iowa. We also have an assembly plant in Coleman, Texas. We have other product manufacturing facilities that were recently idled because of the current economic recession's impact on the railcar market. These facilities are located in Oklahoma City, Oklahoma; Tulsa, Oklahoma; and Denton, Texas. As the economic conditions improve, these facilities could build wind towers since they are strategically located in the best wind corridor in the United States. Our laid off workers are eager to return to work. We are hopeful that the easing of credit, the extension of the production tax credit, and the stimulus package's provisions for renewable energy will re-invigorate wind energy development.

Needless to say, we are extremely supportive of the United States developing a complete energy portfolio that includes all forms of renewable energy. With the high cost of fossil fuel that is strongly influenced by foreign countries, Trinity has committed significant resources and capital to manufacture quality wind towers to meet OEM standards and for on-time delivery by our heavy haul trucking division to our customers. We are proud to be a part of the renewable energy industry in America. By investing in the manufacturing arm of clean, renewable energy sources, we are an integral part of the push for an energy independent America.

Our rapid expansion in wind tower manufacturing was made possible by the visionary initiatives provided by Federal and State governments to support renewable energy production. For example, Trinity received a long term agreement to manufacture wind towers for General Electric provided we could find existing manufacturing facilities in the Midwestern United States. Such a facility would be strategically located and would reduce transportation costs of shipping towers from the manufacturing facility to wind farm developers in that region of the country. Our search ultimately led us to Newton, Iowa.

We received tremendous assistance from Governor Chet Culver of Iowa, the Iowa Department of Economic Development, and the city leaders of Newton, Iowa. Their combined efforts made it possible for Trinity to convert a section of the closed Maytag plant in Newton into a state-of-the-art structural tower facility. This was a major endeavor to transform a plant making washing machines into a facility making wind

towers. We started this conversion in May, 2008 and produced the first wind tower in October, 2008. For illustrative purposes, compare a washing machine in your home to a wind tower that, when erected, stands 262 feet in height, with a diameter of almost 15 feet, and that weighs more than 150 tons. This tower structure will support a wind turbine that weighs more than 80 tons and blades that have a longer wing span than a Boeing 737 jet.

In addition to renovating the building, City of Newton leaders closed a road adjacent to the facility and are now in the process of building a new bypass road around the facility. The city of Newton received a Federal grant to renovate a storage yard next to the facility. All of the improvements necessary for our start-up were accomplished in 5 months. The flexibility of Trinity's engineering capabilities and our ability to react quickly to market conditions help differentiate us from other manufacturers. We stand ready to do the same to our reserve facilities when the demand for wind towers increases in the future.

Our Newton plant has the capacity to produce about 300 wind towers per year. When the General Electric turbines they support are in production, these wind towers will be part of an energy production unit that will annually generate approximately 450 MW. Over the next 10 years, the Newton plant will help provide enough electricity to service more than 1.2 million homes and businesses. By developing and promoting renewable energy initiatives, Congress is stimulating the entrepreneurial spirit of the private sector to create jobs and to enhance America's future energy portfolio.

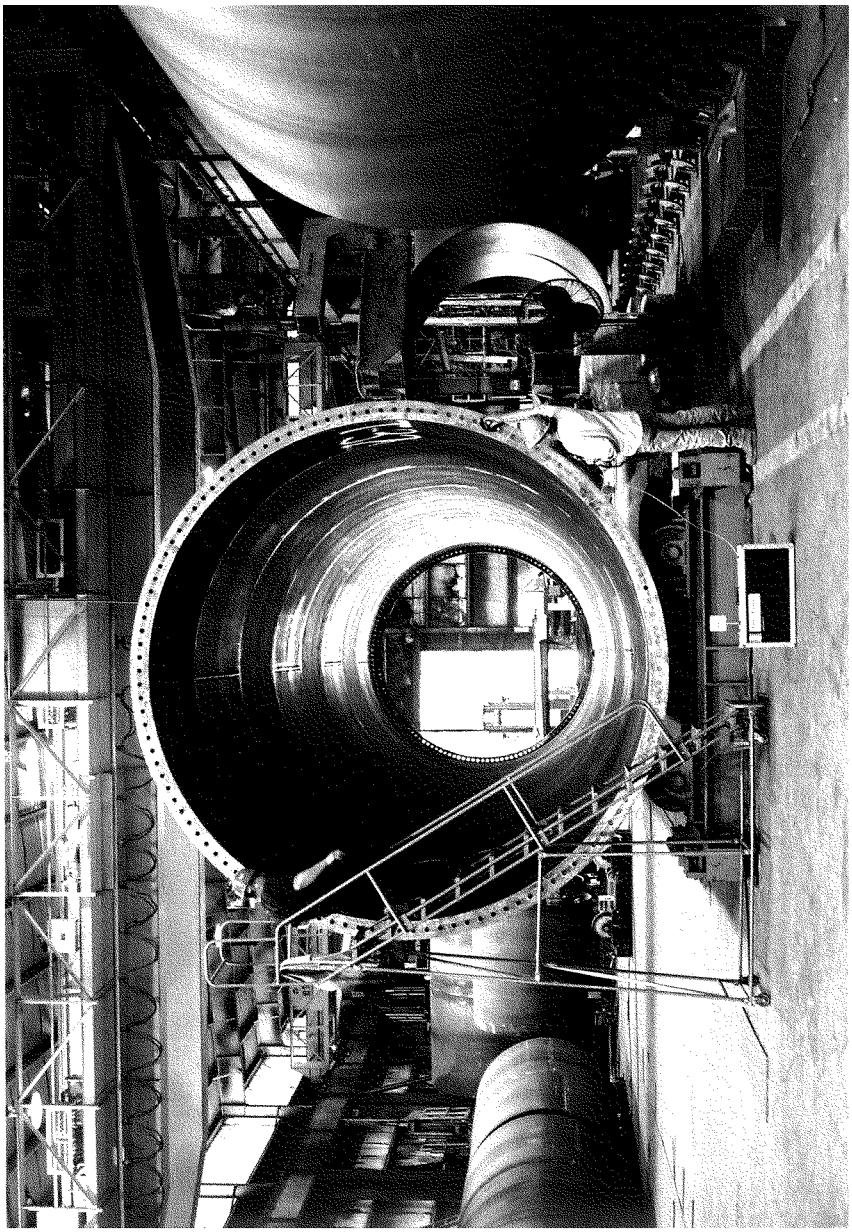
On April 22, our employees at the Newton Plant were honored to host President Obama as he celebrated "Earth Day" by highlighting his energy policies and plans for the energy future of America. What we have done in Newton with the assistance of our customer and the State of Iowa is a model of how flexible and entrepreneurial manufacturers are succeeding in America.

Through the leadership and sustainable programs of Governor Culver, Iowa is now second in wind energy generation behind Texas. We take a great deal of pride in helping these and other states to execute their plans to meet their renewable energy standards.

Trinity has several other businesses that are actively involved in the energy sector. In addition to wind towers, our Energy Equipment Group manufactures steel containers primarily for the liquid propane gas. Our large storage tanks, up to 120,000 water gallons, are used for a wide variety of industrial uses, including ethanol production.

Trinity Specialty Products, Inc. builds OEM dump bodies for heavy hauling equipment for mining oil sands, coal, copper, and iron ore. Transit Mix Concrete & Materials Company, owned by Trinity, is a major producer of concrete foundations for wind and transmission towers. The newest operating division in our portfolio is TRENCOM, which stands for Trinity Renewable Energy Components. TRENCOM produces steel support structures for commercial solar energy plants. In the spirit of what has made Trinity an industry leader, we are continually searching for new business opportunities that are consistent with our core competencies.

The Trinity story is a story of American ingenuity and entrepreneurship meeting the challenge of providing renewable energy to America. The U.S. Congress and state governments have developed initiatives that make it possible for us to create jobs and to produce high quality products. These products serve as an investment in the energy independence for future generations of Americans. For this, my colleagues at Trinity say "thank you."



Senator BOXER. Thank you so much.

Now, I am really very pleased, C.J. Warner, President of Sapphire Energy, headquartered in San Diego, California. Beautiful San Diego, California. Using algae to convert sunlight and carbon dioxide into renewable fuels. Sapphire's jet fuel has been successfully tested in a Boeing 737. We are very happy to see you here.

STATEMENT OF CYNTHIA J. WARNER, PRESIDENT, SAPPHIRE ENERGY

Ms. WARNER. Thank you very much.

I really appreciate the opportunity speak with you about Sapphire Energy. We are a very exciting new company with a great new technology. We were established in 2007. We have 107 employees and we work in California and New Mexico. Our goal is ambitious. It is to become the world's leading producer of renewable fuels.

At Sapphire, we have established four benchmarks to guide our work. First, is to produce "drop in" transportation fuels that are compatible with today's existing energy infrastructure including today's vast network of refineries, pipelines and terminals and the existing fleet of cars, trucks and jets. Second, is to produce fuels that can be grown on marginal desert lands and in brackish or in saltwater. Third, is to produce fuels with a low carbon impact. And fourth, is to produce fuels that are scalable in the near term and cost competitive in the long term.

I am very pleased to say that we are well on our way to meeting these benchmarks. We have developed a product that is renewable. It is produced right here in the U.S. It has a low carbon footprint. It has no adverse environmental side effects. It is price competitive and it fits seamlessly into our existing energy infrastructure. That product is algae-based fuel, which we call green crude. I have a vial of it right here. And if looking at crude samples is something that you are familiar with, it looks a lot like West Texas Intermediate except it has a little bit more of a green tinge to it.

[Laughter.]

Ms. WARNER. Algae is uniquely suited to serve as the foundation for a new generation of transportation fuels. It is one of most nature's most efficient photosynthetic organisms. It has a short growing cycle. It does not require usable farm land or potable water. The environmental benefits are dramatic. The production of algae consumes enormous amounts of CO_2, both from industrial gas and from the atmosphere. The production of one gallon of green crude will consume about 30 pounds of CO_2.

This provides a two for one benefit, by using CO_2 emitted by a facility, such as a coal fire power plant, as a feedstock for production of transportation fuel. In essence, the carbon gets used twice.

When I explain the benefits of algae-based fuel, people sometimes ask jokingly if I have been drinking too much of the green Kool-Aid. It sounds too good to be true. But algae-based fuel is not science fiction fantasy. It is real.

Just last year, Sapphire successfully produced 91 octane gasoline and 5 months ago we participated in a test flight with a Boeing 727 twin-engine aircraft. The flight was an incredible success. The algae-based jet fuel met all requirement standards and it actually

burned 4 percent more efficiently than the petroleum based fuel. The test pilot said that the engines performance was textbook.

This was a great demonstration that our products are not inferior, green compromises. They are premium fuels with desirable qualities, such as high diesel cetane numbers and low levels of undesirable qualities such as sulfur. Our unrefined algae could command a significant price premium over light sweet crude.

In terms of production, we do currently operate an R&D facility in La Jolla, California and a 100-acre development facility in Las Cruces, New Mexico. Soon, we will open an additional 300 acres of processing capacity in New Mexico. Over here you can see depicted our various facilities. We will continue to expand as production expands itself.

We plan to meet very ambitious milestones. It is illustrated in our commercialization time line over here: producing 1 million gallons of fuel per year by 2011, more than 100 million by 2018 and 1 billion gallons by 2025. This is really exciting.

The clear advantages of algae has gone on elsewhere, spawning more than 90 other algae-based companies in the past 2 or 3 years. All told, it is realistic that by 2050, algae-based fuel can replace more than 25 percent of today's conventional petroleum usage.

This will create thousands of green collar jobs all across the Country. In San Diego alone, algae is already responsible for 500 jobs, $25 million in wages and $63 million in economic output. Local analysts' predict that Sapphire's Las Cruces-based facilities will produce nearly 750 direct and indirect jobs in rural New Mexico.

The Algae Industry Trade Association recently estimated that, over the next three or 4 years, the production of algae-based fuel will create almost 12,000 direct jobs and another 30,000 indirect jobs.

Sapphire's commercial success is closely tied to the important work that this Committee has undertaken. Our business model works best if the Country is on a path to energy efficiency, reducing greenhouse gas, and promoting domestic renewable fuel resources. Accordingly, we have been working with this Committee to ensure that cap-and-trade legislation provides a proper carbon accounting for algae-based fuel.

In conclusion, Sapphire Energy believes that the business opportunity presented by climate policy can be transformational. By getting ahead of the curve, we can produce a new generation of transportation fuels for the world that are low carbon, produced right here in the U.S. and that generate renewed economic growth and new green collar jobs.

Thanks and I look forward to answering your questions.

[The prepared statement of Ms. Warner follows:]

STATEMENT OF
CYNTHIA J. WARNER, PRESIDENT, SAPPHIRE ENERGY
BEFORE THE
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
HEARING ON "BUSINESS OPPORTUNITIES AND CLIMATE POLICY"
May 19, 2009

Madam Chairman, Ranking Member Inhofe, and Members of the Committee:

Good morning. Thank you for the opportunity to testify at this important hearing. My name is Cynthia Warner. I am the President of Sapphire Energy, an algae-based energy company established in California in 2007.

Sapphire Energy was founded with one mission in mind: to change the world by developing a domestic, renewable source of energy that benefits the environment and hastens America's energy independence. Thanks to a supportive syndicate of respected investors, including The Wellcome Trust (the world's largest biomedical research charity), Cascade Investment (an investment holding company owned by Bill Gates), Venrock (the venture capital arm of the Rockefeller family), ARCH Venture Partners, and other like-minded investors, Sapphire is well on its way to fulfilling this mission. Using algae as a feedstock, Sapphire has developed a breakthrough technology that produces fungible, drop-in transportation fuels – including 91-octane gasoline, 89 cetane diesel, and jet fuel - out of sunlight and carbon dioxide (CO_2).

Sapphire Energy is headquartered in San Diego, and we have established a growing presence in New Mexico. We currently have 107 employees who carry out our mission in both

states, and, as I will explain in my testimony today, we expect to employ many more in the near future.

The Sapphire Business Model

Sapphire Energy's goal is ambitious. It is to become the world's leading producer of renewable fuels and petrochemical products. To accomplish this we brought together a team of people who, as entrepreneurs, scientists, and concerned citizens, hold several shared beliefs. We believe that climate change is a threat to our environment and that dependence on imported oil is a threat to our national security. We believe that existing alternatives to imported transportation fuels are too slow to commercialize, too expensive to produce, and have their own harmful environmental trade-offs. We believe that, through the application of vision and technology, we have found a better way to achieve energy independence and minimize greenhouse gas emissions.

To focus our efforts, we established four benchmarks to guide our work.

- First, to produce "drop in" transportation fuels that have equivalent or better energy density than the petroleum fuels we currently use and are also compatible with the existing energy infrastructure, including the existing network of refineries, pipelines, and terminals and the existing fleet of cars, trucks, and jets. Americans have spent more than seven trillion dollars developing our transportation fuel infrastructure. The most economically practical renewable fuel, therefore, is a "drop in" transportation fuel that does not require us to recreate this infrastructure.

- Second, to produce fuels that can be grown on marginal desert lands, and in brackish or salt water. We did not want to produce energy crops that compete with food crops for agricultural land; nor did we want to divert precious fresh water resources.

- Third, to produce fuels that have a low carbon impact. We wanted to produce alternative fuels with a life cycle carbon impact that is roughly 2/3 less than that of petroleum-based fuels, and significantly lower than other conventional biofuels.

- Fourth, to produce fuels that are scalable in the near term and cost competitive in the long term. We wanted to be able to produce over one million barrels a day of a renewable crude-oil equivalent, within the next fifteen years. We also recognized the need for this alternative to be competitive with current and future crude oil prices, anticipating that over time, our alternative would become more competitive as crude oil's prices increase, and ours decrease.

I am here today to tell you that we are well on our way to meeting each and every one of these four benchmarks. After two years of dedicated research and development, fueled by the Department of Energy's conclusions regarding algae's suitability as an ideal energy crop, we have developed an algae-based fuel that is renewable, produced in the United States, has a low carbon footprint, has no adverse environmental side effects, is price-competitive, and fits seamlessly into our existing energy infrastructure. Let me be clear. I am not talking about an inferior substitute for gasoline, diesel, and jet fuel. Rather, I am talking about a renewable, domestically produced, and environmentally sustainable fuel that is chemically identical – and in

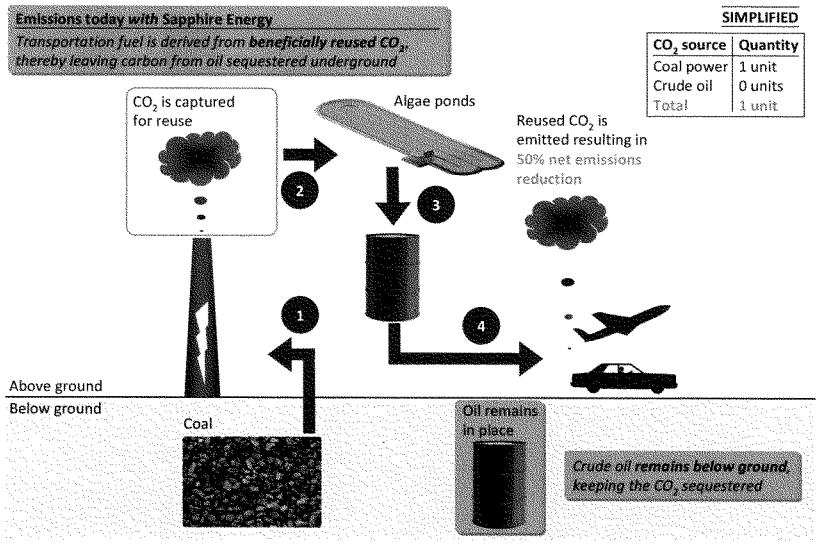
many ways superior – to gasoline, diesel, and jet fuel. That product is our algae-based "Green Crude."

The Technology of Algae-Based Fuel

Algae is uniquely suited to serve as the foundation for a new generation of renewable and low carbon transportation fuels. Algae is one of nature's most prolific and efficient photosynthetic organisms; in fact, it is the source, millions of years ago, of all of the earth's crude oil. Nearly all of algae's biomass is concentrated in the chloroplast—the engine that turns sunlight and CO_2 into organic carbon, so that algae does not "waste" time or energy making stalks, roots, leaves, or fruits. This efficiency leads to very high yields of oil. For example, while palm oil can yield 554 gallons of oil per acre, algae can yield 5,107 gallons per acre—increasing oil output by a factor of ten. Further, algae has a short growing cycle and does not require arable land or potable water—it can be grown quickly in brackish or salt water in the desert.

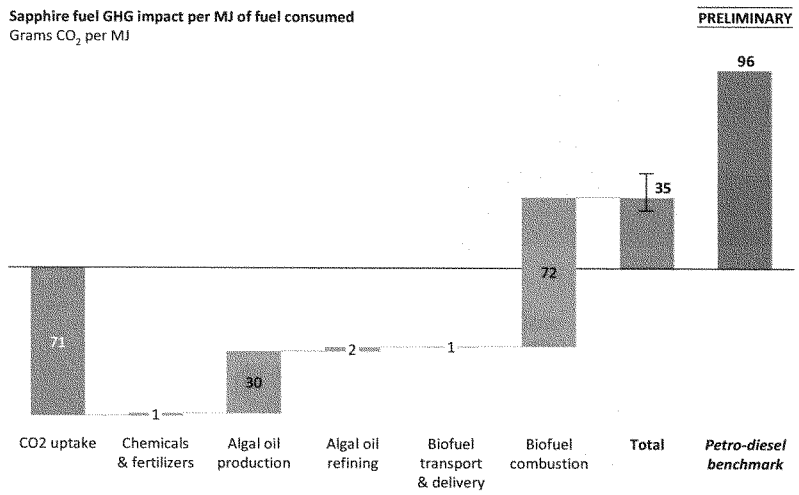
Drawing on years of algae discoveries in the academic and governmental realm, and building on that research with our high throughput biological experimentation with additional tens of thousands of strains, we have successfully developed algal feedstocks that turn sunlight and CO_2 into drop-in transportation fuels that are, in many aspects, superior to petroleum fuels we use today. For example, our green fuels are very low in sulfur, have no benzene, result in superior diesel fuels with high cetane levels, and are higher in energy density than traditional petroleum-based fuels. These elements of superiority will command a higher premium for green crude and make us more cost competitive.

Furthermore, the environmental benefits of our algal fuels are exceptional. Carbon dioxide plays a critical role in the cultivation of algae. In other words, algae consumes enormous amounts of CO_2, drawn from both industrial and atmospheric sources, in its growth process. For example, the amount of algae it takes to extract one gallon of Green Crude consumes between 29 and 33lbs (13-15 kg) of CO_2. The environmental benefits of using algae as a feedstock are thus exceptional; algae-based green crude provides a "two for one" benefit from the use of fossil fuel, by using the CO_2 emitted by a facility (such as a coal-fired electric utility) as a feedstock for the production of green crude. Using algae to beneficially reuse CO_2 results in green electric power and a low carbon, drop-in hydrocarbon fuel.

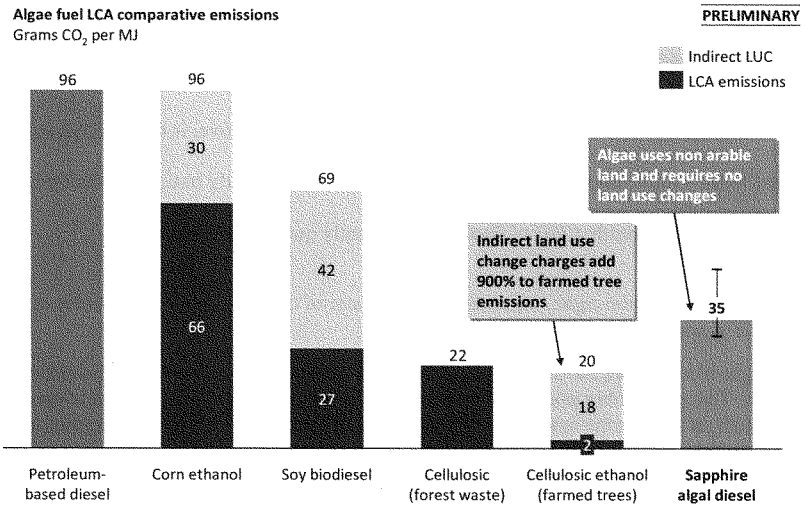


Our green crude's environmental superiority was recently confirmed by the results of a life cycle analysis conducted by Life Cycle Associates, a well-respected company that has

conducted numerous life cycle analyses for the California Air Resources Board. The company determined that Sapphire's algae-based fuels emit approximately two-thirds less CO_2 than petroleum-based fuels at scale. When compared with conventional biofuels, such as corn ethanol and soy biodiesel, our green crude has significantly less than half their carbon impact, while delivering far greater energy density than either alternative.



Source: Draft values from California Air Resources Board; Life Cycle Associates, LLC



Source: Draft values from California Air Resources Board; Life Cycle Associates, LLC

Putting all of this together, we agree with the assessment of a team of scientists from Utah State University, who said, in a report released last week,

> Growing algae, the most productive of all photosynthetic life, and converting it into plastics, fuels, and or secondary feedstocks, could significantly help mitigate greenhouse gas emissions, reduce energy price shocks, reclaim wastewater, conserve fresh water (in some scenarios), lower food prices, reduce the transfer of U.S. wealth to other nations, and spur regional economic development.[1]

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[1] Utah State University, "Algae-Based Carbon Recycling," May, 2008, page 6. This study was released in conjunction with Jeff Muhs' testimony before the Senate Energy and Water Appropriations subcommittee's hearing on the Beneficial Reuse of Carbon Dioxide.

Government officials are excited about algae's promise as well. Just last week, Jonathan Trent, the lead researcher at NASA's Ames Research Center, proclaimed that "[a]lgae are the best source of biofuels on the planet that we know about."[2]

Most exciting, from Sapphire's "the fuel producer's" perspective, is the fact that our future customers – those who consume large amounts of fuel on a daily basis - are thrilled at algae's potential. Fred Smith, CEO of FedEx, was recently quoted as follows:

> "Did you know that algae, which is a prolific eater of carbon dioxide, can double in mass quickly, sometimes in four to six hours? …
>
> "Algae has 30 times the amount of oil inside its molecular structure than cellulose ethanol does. That gives it big potential for the production of jet fuel. In fact, you could produce enough jet fuel for the entire world in a land mass about the size of West Virginia, as compared to other biofuels, which would take a land mass the size of the United States. Amazing what you can do with a little pond scum!
>
> "Over the past year, there have been four successful demonstration flights with biofuels made from jatropha and algae, so this is not pie-in-the-sky thinking."[3]

These are just a few of the many quotes from those in academia, the government, and industry, who are excited about algae's ability to hasten America's energy independence, and improve our environment.

The Practical Prospects for Algae-Based Fuel

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[2] Jonathan Trent, "NASA Bags Algae, Wastewater, in Bid for Aviation Fuel," GreenWire, May 12, 2009.

[3] Fred Smith, "Keeping America Competitive: The View from the Commerce Street," TownHall Los Angeles, Feb. 10, 2009.

As Fred Smith noted, algae-based fuel is not some science fiction fantasy, or a theory that works on a blackboard or in a laboratory but has little practical application. To the contrary, algae-based fuel can have a profound impact on our economy in the near future.

One year ago, Sapphire successfully produced 91-octane gasoline that fully conforms to ASTM certification standards. Five months ago, we participated in a test flight with a Boeing 737-800 twin-engine aircraft. One engine used conventional fuel, the other a mix of algae-and jatropha based fuel. The flight was a success, with the algae-based jet fuel meeting all performance standards and burning approximately 4% more efficiently – thus saving 100 gallons of biofuel – as compared with the petroleum-based fuel. This incredible fuel savings was due to the higher energy density of the algae-based fuel. The test pilot said that the biofueled engine's performance was "textbook." This and other tests show that algae-based fuel works well in existing vehicles and planes.

In terms of production, we currently operate a 100-acre R&D facility in Las Cruces, New Mexico, and will soon open an additional 300-acres of processing capacity in rural New Mexico. We will continue to expand as production increases. We plan to meet ambitious milestones, producing one million gallons of fuel per year by 2012, 135 million gallons by 2018, and 1 billion gallons by 2025. We believe that it is realistic to expect that, by 2050, Sapphire's algae-based fuel can replace more than 25% of conventional petroleum, which would reduce CO_2 emissions by 3.6 billion metric tons.

And I'm just talking about the output from one company – my company - Sapphire Energy. I haven't even begun to touch upon the 90 plus algae-based fuel companies that have sprung up in the past two or three years. Noteworthy companies like Algenol – a Florida based

company with operations in Baltimore, Maryland – are developing other types of algae-based fuels, such as algae-based ethanol, as well as valuable co-products, such as plastics and animal feed. Solazyme, General Dynamics, LiveFuels, Aurora Biofuels, and OriginOil, are just a few of the many other prominent names in the algae-based fuel industry. Most are producing transportation fuels or developing fascinating algae-based biological carbon capture and beneficial reuse applications. As an industry, we're growing at an extraordinary rate.

We're also creating jobs - thousands of green collar jobs - all across the country. In San Diego alone, research on algae-based fuel employs about 272 scientists, and provides nearly $16.5 million in payroll and $33 million in economic activity for the region, according to a recent San Diego Association of Governments assessment.[4] Add to that jobs and spending related to service industries, and algae is responsible for 513 jobs, $25.4 million in wages and $63.5 million in economic output in the region.[5]

In December 2008, President-elect Obama's transition team asked the Algal Biomass Organization (ABO), one of the algae industry's associations, to estimate the number of jobs that could be created over the next three to four years. The ABO estimated that approximately 11,700 direct jobs will be created, with an additional 30,000 jobs from indirect sources. Clearly, the algae industry already is having a significant impact on green collar job creation and is stimulating the economy. And Congress could further boost these numbers by adopting carefully tailored climate change policies that account for algae's unique role in beneficially reusing CO_2.

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[4] "New Center to Focus on Algae, Biofuels," San Diego Union Tribune, April 29, 2009.
[5] *Id.*

The Relationship to Climate Policy

Sapphire's commercial success is closely tied to the important work that this Committee has undertaken on climate policy. Our business model works best if this country is on a path towards reducing the emission of greenhouse gases and is doing so in the most economically efficient and environmentally sustainable way. Accordingly, we support legislation to establish a cap and trade system, and we have been working with this Committee and with others to assure that cap and trade legislation provides a proper carbon accounting for algae-based fuel.

Let me be more specific. As previously noted, CO_2 will be one of our principal feedstocks. Therefore, the price of securing enough industrial-source CO_2 to keep our algae growing at a steady rate is one of the primary factors determining the price of our algae-based fuels. Currently, CO_2 costs an exorbitant amount – somewhere in the range of $130 per metric ton. This is particularly ironic, given the fact that so many industrial entities are desperately seeking methods to dispose of their CO_2 emissions!

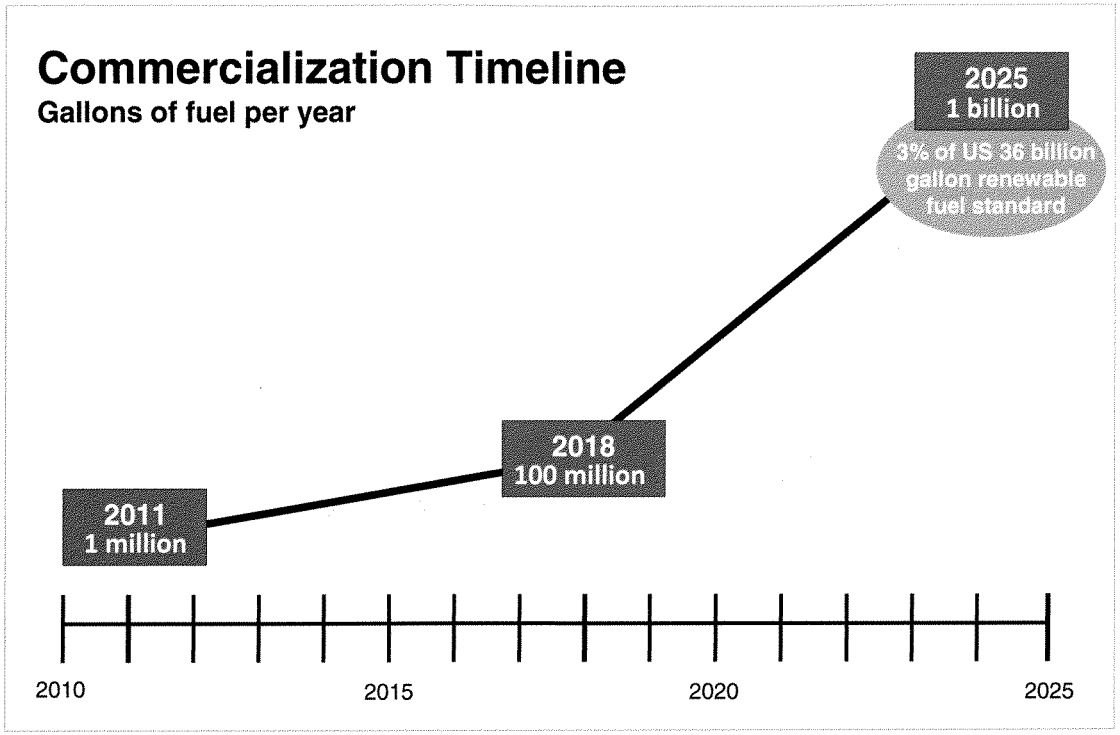
We ask that this Committee adopt legislation that would allow the beneficial reuse of CO_2, through a medium like algae, to be added to the list of Congressionally-approved ways in which industrial emitters, like coal fired power-plants, can off-load their CO_2. This will incentivize emitters to capture their CO_2 and sell it to us as a substantially lower price, so that we can turn that CO_2 into renewable fuel. It will also allow algae-based fuels to become truly competitive with a petroleum industry that has received decades of governmental incentives and support. This simple legislative action would make all the difference to our nascent algae industry and would give us the boost we need to help America become truly energy independent.

Conclusion

Madame Chairman, Sapphire Energy believes that the business opportunity presented by climate policy can be transformative. By getting ahead of the curve, we can produce a new generation of transportation fuels for the world, that are low-carbon, produced right here in the United States, and that generate renewed economic growth and new green-collar jobs.

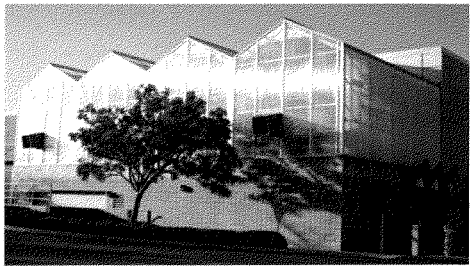
We look forward to working with this Committee to turn this opportunity into reality.

Thank you again for the opportunity to testify, and I would be happy to answer any questions.

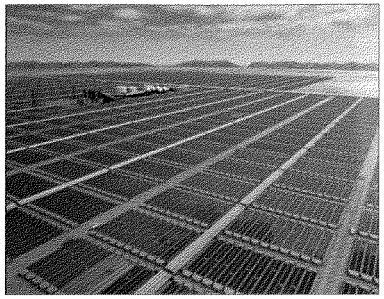


Sapphire Energy

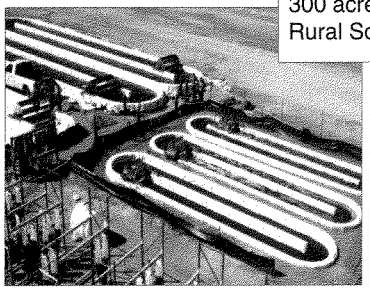
The Time Is Now



R&D Facility
San Diego, CA

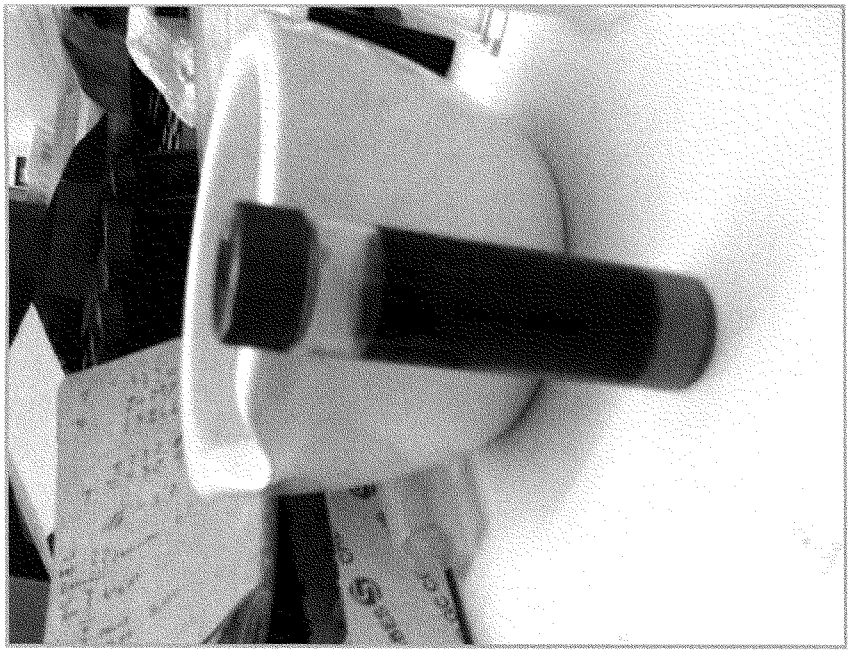


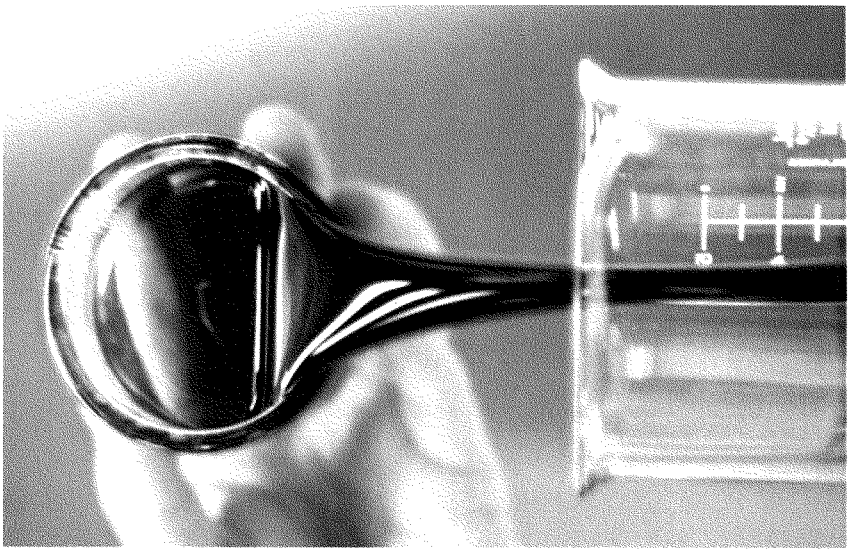
300 acre Integrated Algal Biorefinery
Rural Southwest



100 acre Pilot Facility
Las Cruces, NM

Sapphire Energy





Senator BOXER. Thank you so much for that.

And now, last but not least, Tim Healey, Director of Regulatory Affairs at Lange-Stegmann. Welcome.

STATEMENT OF TIM HEALEY, DIRECTOR OF REGULATORY AFFAIRS, LANGE-STEGMANN COMPANY

Mr. HEALEY. Thank you very much, Chairman Boxer, Ranking Member Bond, Senator Carper, Senator Voinovich, Senator Lautenberg and Senator Udall for the opportunity to testify today about the impacts of climate change policy such as cap-and-trade and the carbon tax on our business and our customers.

I am Tim Healey, Director of Regulatory Affairs for Lange-Stegmann Company. Lange-Stegmann is a fertilizer wholesale distributor, selling fertilizer for agricultural applications. We have 42 employees. The company has been in business since 1926. Lange-Stegmann also owns Agrotain International, which manufacturers and markets nitrogen fertilizer additives that make urea nitrogen more efficient and reduce greenhouse gas emissions to the environment.

We are concerned about the increased costs that will be associated with the manufacture and transportation of fertilizer. The manufacture of nitrogen fertilizer is very energy intensive. Natural gas is the feedstock for ammonia, the basic building block for all nitrogen fertilizers and this accounts for 70 to 90 percent of the production costs of ammonia.

Climate change legislation may cause the power industry to switch fuel in order to meet greenhouse gas emission goals established by Congress. Switching to natural gas will cause an increase in demand with the only incentive to increase supply being price.

When the price of fertilizer increased as it did from January 2007 to the apex in the third quarter 2008, our small company, and by the way we have a very strong financial statement, had to increase our line of credit by 50 percent in order to continue to purchase fertilizer. This additional line of credit came at a very steep cost to us: 1.5 points in up front fees, a 50 percent increase in the interest rate and soft costs (appraisals, audits and legal fees) exceeding $70,000. Our customers had to increase our lines of credit as well, with similar additional costs. Fertilizer dealers who were unable to increase their lines of credit simply closed their doors.

In addition to increased fertilizer costs from natural gas prices and borrowing costs, we will experience increased costs to operate our facility. A cost of $30 per ton of a carbon dioxide equivalent would have increased our electric bill over last year by a minimum of $90,000, our natural gas bill by a minimum of $33,000, and our mobile equipment fuel bill by $16,000. To a small business such as Lange-Stegmann Company, the increased energy costs of approximately $140,000 per year, coupled with higher input and transportation costs, will be crippling to the company. These types of impacts will be multiplied by businesses nationwide at a staggering cost to our economy.

Farmers cannot afford to pay more for fertilizer inputs. Farmers felt some pain last year but were able to offset higher input costs because crop prices were also higher. The same scenario does not apply this year because crop prices are considerably lower. In the

autumn of 2008, very little fertilizer was sold due to historically high fertilizer prices and declining crop prices.

The U.S. cannot unilaterally enact legislation regarding carbon taxes, fees or cap-and-trade program and expect to reduce overall greenhouse gas emissions while expecting our industries to remain globally competitive.

Rather than penalizing Americans through a cap-and-trade system or a carbon tax, we recommend legislation that encourages the development and adaptation of energy efficient products and processes. During these tough economic times, our economy cannot bear the significant costs associated with unilateral implementation of a massive cap-and-trade program or a costly carbon tax. Such a program will significantly raise costs on our manufacturers, retailers, growers and, ultimately, the consumers who will be forced to pay higher prices for food, fuel and other products.

Thank you very much.

[The prepared statement of Mr. Healey follows:]

May 19, 2009

Written Testimony of Tim Healey

Director, Regulatory Affairs

Lange-Stegmann Company

Before the Senate Environment and Public Works Committee

On

"Business Opportunities and Climate Policy"

Thank you very much Chairman Boxer, Ranking Member Inhofe, Senator Bond and other members of the Committee for the opportunity to testify today about the impacts of climate change policies such as cap and trade and carbon tax on our business and our customers.

I am Tim Healey, Director of Regulatory Affairs for the Lange-Stegmann Company. Lange-Stegmann is a fertilizer wholesale distributor, selling fertilizer for agricultural application within a 150-mile radius of the City of St. Louis and we warehouse granular urea fertilizer for basic manufacturers for distribution throughout the Midwestern United States. We have forty-two employees. The company has been in business since 1926. Lange-Stegmann Company also owns Agrotain International, L.L.C., which manufacturers and markets nitrogen fertilizer additives that make urea nitrogen more efficient and reduce greenhouse gas emissions into the environment.

In particular we are concerned about increased costs that will be associated with the manufacture and transportation of fertilizer. The manufacture of nitrogen fertilizer is very energy intensive and requires the use of natural gas as a feed stock for ammonia, the basic building block for all nitrogen fertilizers. Approximately 32,000 cubic feet of natural gas is required to produce one ton of ammonia. The cost of natural gas accounts for 70 to 90 percent of the production cost of ammonia.

We fear climate change legislation may cause the power industry to switch fuel in order to operate and meet greenhouse gas emission goals established by Congress or promulgated by a regulatory agency. Switching to natural gas will cause an increase in demand with the only incentive to increase supply being price.

In the last decade, 26 U.S. ammonia plants have closed primarily due to the high natural gas prices. Presently we import more than half of this country's nitrogen needs.

We believe the remaining domestic nitrogen production cannot stay operational through any transition period where utilities turn to natural gas as an alternative for generating electricity. Once closed, they may never reopen. These plant closures could have a strategic affect on this nation's ability to produce food. They would also result in the loss of American jobs and a reliance on overseas fertilizer producers.

Stable fertilizer production and stable fertilizer prices are essential to a stable, affordable and abundant food supply. A cap and trade scheme not only results in higher fertilizer costs, but Lange-Stegmann and our customers would also face higher transportation and delivery costs, all of which will result in higher food prices for American consumers.

When the price of fertilizer increased as it did from January 2007 to the apex in the third quarter, 2008 our small company had to increase our line of credit by 50% in order to continue to purchase fertilizer. This additional line of credit came at a price of 1.5 points in up front fees, a 50% increase in the interest rate and soft costs (appraisals, audit and legal fees) exceeding $70,000. Our customers, the fertilizer dealers and their customers,

the farmers had to increase their lines of credit accordingly with similar additional costs. Fertilizer dealers who were unable to increase their lines of credit simply closed their doors.

One should note that these lines of credit were increased when credit was plentiful. In today's market, small businesses like Lange-Stegmann are finding it near impossible to borrow money.

In addition to increased fertilizer costs from natural gas price increases and borrowing costs, we will experience increased costs to operate our facility. A modest cost of $30.00 per tonne for carbon dioxide (CO_2) equivalent would have increased our electric bill over last 12 month period, May 2008 – April 2009, by a minimum of $90,000, our natural gas bill by a minimum of $33,000 and the fuel bill to power our mobile equipment by a minimum of $16,000. To a small business such as Lange-Stegmann, the increased utility costs of approximately $140,000 per year, coupled with the higher input and transportation costs described above will be crippling to the company. These types of impacts will be multiplied by businesses nationwide at a staggering cost to our economy.

The cost of delivering fertilizer to our facility for distribution by barge and rail will increase as will the cost of delivering fertilizer to our customers by rail or truck. At a modest $30.00 per tonne of CO_2 equivalent the additional cost per gallon of diesel for the delivering carriers will be in excess of $0.32 per gallon.

There is no guarantee that we can pass these additional costs along to our customers, as we must sell fertilizer at the market price. Overseas fertilizer producers will not be subject to the same high operating costs as American fertilizer producers, and could force us to sell our products at a loss.

Further, farmers cannot afford to pay more for their fertilizer inputs. Farmers felt some pain last year, but were able to offset higher input costs because crop prices were also higher. The scenario does not apply to this year because crop prices are considerably lower. If fertilizer prices had not come down due to the economic downturn resulting in reduced demand for natural gas costs, many farmers would not be able to afford to sow a crop this year. In the autumn of 2008 very little fertilizer was sold due to historically high fertilizer prices and declining crop prices.

The cost of other agricultural inputs will increase as well. With limited credit availability and higher prices, farmers may be forced to choose among crop protection chemicals, equipment, fertilizer and seed. These choices will have a negative affect on yield and profitability.

Furthermore, all Americans will see increased costs in heating and cooling their homes, food prices, and everyone driving a motor vehicle will be paying more in fuel costs. We should remember the turmoil $4 and $5 per gallon gasoline prices caused last year, and that this contributed to the economic downturn we are now experiencing. At a modest $30.00 per tonne for CO_2 equivalent the additional cost of gasoline will exceed $0.30 per

gallon. At a consumption rate of 20 gallons per week the increased cost will exceed $6.00 per week or $312 per year.

The United States cannot unilaterally enact any legislation regarding carbon taxes/fees or a cap and trade program and expect to reduce overall greenhouse gas emissions while expecting our industries to remain globally competitive. Industry will follow the path of least resistance and relocate where regulations are least. Any type of legislation that is passed must be similar to that passed and enforced in any country or region. The playing field must be level. It must be recognized that a tonne of greenhouse gas emissions has the same affect no matter where on this earth it is generated. If a product is generated here in the United States the water and air impact associated with its manufacture will be less than if it were produced in a country that does not have the same level of environmental regulation.

The goal of any legislation should be the reduction of greenhouse gas emissions with the least harm to the economy. It must be recognized that additional costs associated with a carbon tax or cap and trade system will be borne by the consumer and in order to protect our agricultural and industrial economies any climate change program must be global.

Our company, like all companies and all Americans are concerned about the impact greenhouse gas emissions may have on the environment. The industry has made great strides in reducing its carbon footprint in the manufacture of nitrogen fertilizer.

The agricultural community can offset greenhouse gas emissions from other sources and reduce its own carbon footprint through the use of Best Management Practices (BMPs) including the further adoption of continuous conservation tillage which helps sequester greenhouse gases, use of enhanced efficiency fertilizers which reduce greenhouse gas emissions, and other conservation practices. The barrier to wide spread adoption of these BMPs is education in the market place.

Instead of penalizing Americans through a cap and trade system or carbon tax, we recommend legislation that encourages development and adoption of energy efficient products and processes. Incentivizing the adoption of best management practices and promoting energy efficiency will promote the goal of greenhouse gas reduction without the significant economic losses associated with a cap and trade or carbon tax scheme. During these tough economic times, our economy cannot bear the significant costs associated with the unilateral implementation of a massive cap and trade program or a costly carbon tax. Such a program will significantly raise costs on manufacturers, retailers, growers and ultimately consumers who will be forced to pay higher prices for food, fuel and other products.

Senator BOXER. I want to thank our witnesses. We will each have 5 minutes for questioning.

Mr. Healey, let me start with you. I want to make sure I understand your issue. You need natural gas to make your product. Is that correct?

Mr. HEALEY. Natural gas is required to make urea nitrogen, yes.

Senator BOXER. OK. Right. Don't you think, because as a capitalist you believe in competition, you are sitting next to a woman here is going to offer us other ways to generate the fuel we need, et cetera. You are sitting next to gentlemen here who are telling us this is an opportunity. I guess what I am asking you is, if there is more competition for natural gas in the future, would that not keep the price down? If there is more competition?

Mr. HEALEY. If there is more competition, there is going to be more demand and that could raise the price.

Senator BOXER. Competition raises the price? Or more supply? More supply?

Mr. HEALEY. Competition for the supply.

Senator BOXER. Well, what if there is more supply?

Mr. HEALEY. If we could guarantee it, and keep the price down——

Senator BOXER. Is it not true that more supply in a capitalistic system, is important for you to keep your prices down? Is that correct?

Mr. HEALEY. Yes.

Senator BOXER. OK. More supply of what you need. I think that means you want to have more opportunities out there for people to use other things other than natural gas. If everybody relies just on natural gas, you have got a problem. But if there is other ways for people to get their needs fulfilled, I think you are in much better shape.

Let me turn to, I guess I would ask Mr. Holliday and Mr. Stiles this question. I believe our Country has some of the most innovative companies and workers in the world. I think the three of you, as you spoke, and I am sure Mr. Healey is very innovative as well, so all of you represent innovation. If we pass legislation limiting carbon pollution, what do you think it will mean for U.S. companies' ability to compete internationally?

As I look around the world, everybody is moving toward a low carbon future. Here in America, we see our President doing it. We tried to do it last year here but we have a lot of no, no, no, no, no, no. So, what does it mean if we have good legislation, let us say cap-and-trade, that gives you the flexibility? What do you think it would mean for us to complete internationally? Will it make you stronger? Will it make you weaker? What do you think?

Mr. HOLLIDAY. Chairman, I will speak first and then turn to my colleagues. I think clearly we see other countries will follow the leadership, which is a question that must be on your mind. If we make the changes, but China and India do not make the changes, will we be disadvantaged? And if they do not make the changes, we would be. I think they will follow.

The questions I had from many Chinese leaders I met with 2 months ago is: Is the U.S. going to act? Because they were getting ready to seize the job. Fifty percent of the solar sales today are

made in China. They want to grow that market. So, I think the issue back to us is to be sure, as I described in my testimony, that we provide the environment so that not only is the development done here—we have the greatest scientists in the world in the U.S., bar none, we will do the best development—then we have to make sure the manufacturing is put in place here so that we create the jobs here and not just create the technology. That is a big challenge, I think, for your Committee.

Senator BOXER. And you believe that if there is good legislation passed limiting carbon that will be an incentive to move this quicker?

Mr. HOLLIDAY. I think that is absolutely right. That is step one. That is essential to get the whole train moving. And then you need to think about how we do, just like Singapore and Hong Kong do, as I described, to be the most attractive place for everybody to build those plants.

Senator BOXER. So, Mr. Stiles, as we hear from you, you have shown us that you are building wind towers. You have shown us the innovation that we talk about and putting people to work in clean industries to power our Nation. Do you think that legislation limiting carbon, if it is drawn up right, will help your business create more manufacturing jobs in this Country?

Mr. STILES. Senator, you said earlier that we are innovative people. We are. I believe we are a very entrepreneuristic company. I will tell you that I think that everything has to be done in moderation and, if there is a good piece of legislation, there is proven move in it, then positive results are going to occur.

I think as a manufacturing company, and there is not many of us left, quite frankly, as long as there is a level playing field and we do not have to be subjected to subsidies from foreign countries, and at the same time do not kill off everything that we have, I mean, do not forget that when we are building wind towers, we are also hauling coal in rail cars and tank barges and chemicals and those things, I think that as we move into this and move into the changes that we have to do for our climate, we have to protect the jobs that we can. But if we prove and move those and keep a level playing field, I think it is going to be very positive for the Country.

Senator BOXER. So, what I hear you both saying is, if it is good legislation, it is a real positive. If it is well thought out and well drafted.

OK, Senator Bond.

Senator BOND. Thank you, Madam Chair.

You asked Mr. Healey about lower demand. If I remember my economics correctly, if the demand goes up and the supply stays the same, the price goes up. We have already seen plastics manufacturers, fertilizer manufacturers moving overseas because they do not have the same red tape, they do not have the same demand that we do in the U.S. We have gone to natural gas too much, in my opinion, for generating electricity, which has raised the price and hit the farmers.

Now, a unilateral carbon tax puts us further at disadvantage. I would agree with Mr. Holliday that we need to bring other countries along and develop the technology. But it seems to me that we need to cut red tape. Unfortunately, folks on the other side of the

aisle have been the ones who have said no to more expiration and production of natural gas in the U.S.

Mr. Healey, would that help if we could produce the natural gas that we have in the U.S.?

Mr. HEALEY. Yes, Senator. It would help tremendously.

Senator BOND. Ms. Warner, I strongly support your algae production. I have seen it in Missouri. The Danforth plant science center and many others have shown, and we want to compete with you to be the most effective producer of algae-based green crude. You take the carbon from a coal fire plant and convert it directly into your fuel; therefore, while you still release the carbon, it is used twice. You are saying it commands a higher price. I assume that you do not require very great tax subsidies to make this viable. Is that correct?

Ms. WARNER. That is correct. Our planning basis is to compete directly with the price of crude as it goes. So, we just want to have a level playing field during the period of time that we are developing and make sure we are treated the same as other renewable options.

Senator BOND. I am all for that. Mr. Stiles, we are delighted to have your barge manufacturer in Caruthersville but, unfortunately, the red tape and the environmental restrictions have cut down significantly on our river transportation and I believe that rail transportation is certainly more efficient than truck transportation of bulk materials, but to me the river transportation which you support is probably the most economical and energy efficient way to move bulk products. What do you see as the future of river transportation?

Mr. STILES. Well, Senator, thank you very much and we have appreciated your help in Caruthersville. The Mississippi River lock system has got to be upgraded and maintained if we are going to have a good viable barge——

Senator BOND. Would you repeat that? With emphasis? With feeling?

[Laughter.]

Mr. STILES. Senator, we have never met and you did not set me up for this, but I will tell you that the Mississippi River barge and lock system has got to be upgraded because barge transportation in that part of the Country is by far the lowest cost and mode of transportation in any facilities or any locations that are in the Country.

In order for it to be manageable though, you have to have things to move and right now there are just not a lot of things moving.

Senator BOND. You might also include in your prayer to start reusing the Missouri River for barge transportation which would serve the Upper Midwest and unclog highways with the polluting trucks and lessen the pressure on rails.

Mr. STILES. Senator, I am an equal opportunity prayer. I pray for everybody right now.

[Laughter.]

Senator BOND. I think we all need it. Not only leadership.

Mr. Holliday, I appreciate your leadership at DuPont. In one of our reports on green jobs, one of the most effective ways to reduce carbon emissions is first, through energy conservation. I believe

that energy conservation is one that reduces costs. Do you have any time line on how quickly a homeowner can recoup the price of putting your——

Mr. HOLLIDAY. Tyvek.

Senator BOND. Tyvek. How long is required before the reduction in heating costs pays for the installation?

Mr. HOLLIDAY. It varies by place in the Country, but about 5 years. It is a very good investment for the homeowner if he is thinking long term at all. And somehow we have got to get them incentives to think that way. There are other new technologies coming out, such as a system that will retain heat during the day and release it at night, which also could be very effective.

Senator BOND. Well, that, and commercial buildings. I also appreciate your work in batteries for battery-driven cars. We happen to be the battery capital in Missouri so if you want to work with us we would be happy to do that.

Mr. HOLLIDAY. Your companies in Missouri are very good customers for our thin membranes that go in those batteries and we appreciate it.

Senator BOND. Thank you, Madam Chair.

Senator BOXER. Thank you, sir.

I have a special request, if it is OK. Since Senator Carper has got to run to a health care meeting, he has asked, because he has a very special constituent here, if he could have 2 minutes out of order and then I will go to Senator Lautenberg. If that is OK.

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

Senator CARPER. Thank you, Madam Chair.

I thought the special guest would be Chad Holliday. But after listening to Cynthia Warner's testimony, she can be a special guest, too. I am just really delighted that you are here, Chad, and I want to welcome you.

We have got three things going at once and Senator Nelson on the Finance Committee wants to work on health care reform 24/7 which is real important as well.

I just wanted to come by and thank you for the leadership you have provided at DuPont, not just for DuPont, but really for a whole bunch of folks. We especially appreciate your leadership on the U.S. Climate Action Partnership. DuPont has been one of the founding members.

I have a statement that I would like to leave for the record.

Senator BOXER. Sure.

Senator CARPER. Thank you for being a very good example, individually and collectively, DuPont.

Thank you.

[The prepared statement of Senator Carper follows:]

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

Thank you, Madam Chairman, for convening this hearing to discuss business opportunities in light of forthcoming climate change policies. I would like to welcome DuPont CEO Chad Holliday. Albert Einstein once said that "In the middle of every difficulty lies an opportunity." As you will hear today—clean energy provides real opportunity.

I applaud the leadership of the businesses here today—I especially would like to applaud the leadership of DuPont, which is based in my State of Delaware. DuPont's investments in clean energy technology will ensure they are a global leaders in the energy tech revolution, while creating new jobs in States like mine.

Not only has DuPont been providing Americans clean energy jobs, but the company has also reduced its own pollution through maximizing energy efficiency since the 1990s. Through energy efficiency, DuPont has held its energy use flat while increasing production. Its efforts reduced their greenhouse gas emissions by more than 70 percent, and actually saved the company $3 billion.

Clean energy does create jobs. This is a story we are hearing throughout Delaware—a State participating in a regional approach to reduce climate pollution. Through one offshore wind project—we expect 1,200 direct and indirect jobs to be created in Delaware during construction—and approximately 300 jobs for operation and maintenance.

Our economy cannot survive dependent on old, dirty fossil fuels—we must break free of our dependence. We have a choice—do we give our businesses certainty and lead the world in clean energy technology—or do we become dependent on foreign energy technology and lose jobs to our competitors overseas?

Senator BOXER. Thank you very much. And thanks for your work on health care. Please figure it out for all of us.

Senator Lautenberg.

Senator LAUTENBERG. Madam Chair, I think that Senator Udall may have been here a step earlier if that is how we are doing it. Or are we doing it by seniority?

Senator BOXER. Oh, I should have actually called on Senator Udall.

Senator LAUTENBERG. Too much barge traffic on the Mississippi. [Laughter.]

Senator BOXER. I should have called on Senator Udall. But it is up to you and Senator Udall.

Senator LAUTENBERG. Well, that is very kind. Thank you.

Senator BOXER. I apologize, Senator Udall.

Senator LAUTENBERG. Ms. Warner, your testimony is very exciting. It is kind of really more of a new idea than other alternatives that we talked about. What is left over after the fuel is consumed in the algae mix? What kind of a discharge do we get, and is there any residual environmental question that has to be answered?

Ms. WARNER. In terms of the fuel itself, it is essentially identical to the petroleum-based fuel that we use today, so there is an emission that we control in the same way that we control petroleum-based emissions. We use catalytic converters in vehicles and it would be identical equipment, et cetera.

There is also a biomass product which is co-produced with the algae. It is basically the husks of the plant in addition to the oil that we extract. That biomass actually contains proteins and other energies. So we have various alternatives. We can use it for animal feed. We can use it to actually create fertilizer which we give back to the algae and fully recycle. We can also use more sophisticated technologies like anaerobic digestion or biomass to liquids actually to fully utilize the energy and recycle the CO_2 that comes from that straight back to the algae.

Senator LAUTENBERG. So there is kind of an infrastructure support change of some significance, I would assume, not to suggest that the value of having a relatively easy source, as you describe it, to add to our alternative fuel reserve. It is interesting and I appreciate the fact that you brought that to us.

Ms. WARNER. Thank you.

Senator LAUTENBERG. Mr. Holliday. You are almost in New Jersey with your company. Your company is a forward-looking company and it always has been. You are a member of the U.S. Climate Action Partnership which supports an 80 percent reduction in greenhouse gas emissions by 2050. I guess the question is: Do I have to stay here that long? Scientists say it is equally important to achieve the short-term emission reductions of 20 percent by 2020. How does DuPont feel about that target? Cutting down 20 percent by 2020?

Mr. HOLLIDAY. We do have three plants in New Jersey and we appreciate the opportunity to serve you there. We fully support the 20 percent reduction as a first step and we support the 50 percent reduction by 2050. It is important, though, that we start the process now to make that happen. We believe the efficiency of my first bucket that I described in my testimony is the way you are going to get most of that accomplished. It will not be the major, new technologies, but finding ways to put those efficiency technologies to use right away.

Senator LAUTENBERG. And to those who are doubters and do not think that we are going to be able to benefit from the healthy atmosphere that we live in and at the same time to succeed in doing more business and employing more people?

Mr. HOLLIDAY. Sir, we have had, in DuPont, since we started on this drive to reduce our own emissions, we have reduced our emissions by 72 percent. Every project earned greater than 12 percent, which was our cost of capital in the company. So there are really good efficiency projects out there. But people need to have a long enough time line because it may take 5 or 7 years to get the payback on that.

Senator LAUTENBERG. Mr. Stiles. The House of Representatives currently is considering a bill to regulate greenhouse gas emissions and we hope to pass a climate change bill out of this Committee very soon. How might you be affected by a law that regulates greenhouse gases?

Mr. STILES. Senator, it is a very interesting question. The businesses that we are in, the manufacturing businesses, basically do not have any emissions of that sort. In the facilities that we do, where we paint or where we have galvanizing, we have the best available current technology as it is, so it really, other than some new products that you would have to produce, hopefully it would be business, there is not a lot of impact on our manufacturing businesses.

Senator LAUTENBERG. I would ask you the same, Ms. Warner, if I might.

Ms. WARNER. Right. Thank you, Senator. What I would say is if it is great legislation, it will be good. The whole point is, if the legislation is actually pushing us toward greater efficiency and encouraging more renewable fuels, then it will be good for us. And specifically for algae, the legislation needs to take into account that algae, in essence, is taking on CO_2 from an emitter and that emitter needs to be able to get credit for that so that we can have an incentive, or actually they can have an incentive, to sell it to us. And for us, in particular, I think the legislation needs to take into

account that we are a renewable fuel and we need to be treated similarly to the other renewable fuels.

Senator LAUTENBERG. Thank you. Thank you, Madam Chair.

Senator BOXER. Thank you very much, Senator Warner. I am sorry. Oh, gosh, I keep going back to Senator Warner. You think I wish that he was still here? I do.

[Laughter.]

Senator BOND. Well, I can see how you could do that.

Senator BOXER. I am sorry, Kit. I, I did not mean——

Senator BOND. I am trying to do my best.

[Laughter.]

Senator BOXER. I am so sorry about that.

Senator BOND. He was speaking the same language.

Senator BOXER. He was speaking the same language but he came to a different conclusion on global warming.

Senator BOND. I know. I tried to help him.

[Laughter.]

Senator BOXER. Senator Voinovich. I am so sorry, everybody.

Senator VOINOVICH. Maybe it is because I am retiring at the end of 2010 that you might think of Warner.

[Laughter.]

Senator VOINOVICH. We talked about the issue of the cost of increase in natural gas, not only to your business, Mr. Healey, but also Mr. Holliday to your business. I contend that, because of environmental policies here where we encouraged utilities to burn natural gas instead of coal and other sources, that we drove up the demand for natural gas.

As a result, the price went up and as a result of the price going up, and also some environmental policies that made it more difficult for us to go after natural gas in this Country, demand goes up and the supply is not there. You have increased costs.

I think that it is really important that we make clear that some of the decisions that we make do impact on industries and it is my understand that in your industry, that back before 2000, you were exporting a lot of chemical products all over the world and today we are a net importer of chemical products.

I know in my State I used to go to the Cather [phonetically] in Dusseldorf because we had so many plastic jobs. We do not go to Dusseldorf anymore. We have lost hundreds, maybe thousands of jobs, in Ohio because of that.

The point I am making is the cost of energy does impact on your businesses and the fact is—are all of you concerned that if we had something that would drive up your electric costs or make it more expensive to buy gasoline? Are those not considerations that you have to take when you are supporting some of this legislation?

Mr. HOLLIDAY. You are absolutely correct. The Gulf Coast natural gas was $2 per unit forever. Then all of a sudden we saw spikes to $12 and $14, which is why you see the red on the chart behind you around fertilizer plants. It impacted all of us.

That is why we think it is very important that we have a planned approach that your Committee could put forward to have the alternative fuels so there is other examples and everybody does not go just to natural gas. That would be the wrong thing for jobs in this Country.

Senator VOINOVICH. I also observed that many of the companies in U.S. cap are going to make money out of cap-and-trade. I mean they are in the business: GE, you are in the business, a lot of people are going to make money.

The question I have for all the witnesses is: If we would pass cap-and-trade legislation, would that make it unnecessary for us, particularly in the area of subsidies for wind and solar in this Country, in other words, could we back off from all of the subsidies that we are putting in these industries because the cap-and-trade would force some of the renewable portfolio standards people from going forward and doing things that maybe they would not have wanted to do without the cap-and-trade? How important are the subsidies?

Mr. HOLLIDAY. I think, as my fellow witnesses have described, if you are starting any new industry, whether it be fuel from algae or our biobutanol or cellulose-based ethanol, you need something to get you moving if you are going to move fast. So I think some incentives, like other governments are giving, would be important if we want to make sure those industries develop here. Those industries will develop somewhere. If we give the incentives, we make sure the jobs are here and the commercialization is here. That is what is really important.

Senator VOINOVICH. I would just like to make one other point because I am running out of my time here. Was it you, Mr. Holliday, or you, Mr. Stiles, that said it is easier to get something done in China and Singapore than it is here?

Mr. Holliday, OK. I know that in China they are putting on two coal-fired plants per week. And it is IGCC technology. In the U.S., the Sierra Club and other environmental groups have killed about 45 proposed coal-fired plants and China has been able to put them on. It is not a matter, in terms of the government. They do not have the non-governmental agencies that we have here in this Country. You are saying it is easier to do. Yes, because it would be easier here, too, if we did not have people saying, oh this is bad, even though China is putting them on two every week. Any comment?

Mr. HOLLIDAY. I think, as your Committee decides the technologies that you want to see developed in the Country, I think you need to put into place a regulatory process that you can make sure those occur here on the scheme you want.

Mr. STILES. Senator, you were talking about the subsidies. The Government for a long time has been doing things to encourage different businesses. There has been accelerated depreciation for a number of years, and that has helped our barge business and our rail car business and it certainly does not hurt the wind business.

But, if we are going to get away from the dependence on foreign oil to generate electricity in our homes or for natural gas to drive those prices up, there has to be some incentives to start. Now I believe it has to stop at some point in time. But there are so many problems with wind and with solar getting started because of transmission that if the Government does not get involved, then I believe that the foreign countries will produce the turbines like they have in the past and the wind towers like they have in the past and we will be importing them here because basically there

was no one building wind towers in this Country 7 or 8 years ago. That is just an FYI for you.

Senator VOINOVICH. So the subsidies have to continue?

Mr. STILES. Not for a long time, sir, but I believe they have to continue until you have the amount of renewable energy that is being produced in order to relieve the other energy sources that we are relying on.

Senator VOINOVICH. Now, we said that about ethanol.

Senator BOXER. Some people think that the big oil companies get a heck of a lot of subsidies and tax breaks and all the rest. So, I would not get into that topic because there is nobody that does not ask us to help them.

Senator Udall.

Senator UDALL. Thank you, Madam Chair.

Mr. Holliday, you have said a couple of times in your testimony we should start now, we should embark on setting these goals in law and develop a Federal climate policy. Yet, your company has already been out front. I mean, you have gone, I think you used the number that you have reduced your emissions by 72 percent. So you have seen something out there that maybe other businesses have not seen. You are doing this whether there is a requirement or not.

Could you explain your thinking? Why are you taking the action you are taking?

Mr. HOLLIDAY. I think our situation was a bit unique. We were involved in making CFCs, which impact the ozone layer. We saw it very early on in the 1980s and started to understand environmental science and saw this coming. So we got very proactive about it. Again, we are a 207-year-old company. We are planning our 300th birthday already. So we wanted to start taking the actions early on to do that.

I think what you have got is a golden opportunity, if I could. You start funding the technologies right now, to get them in place, put the legislation and the reductions in place in 2012 or thereafter, you can create the jobs now and have the technology so that there will not be this big bump in the economy.

Senator UDALL. You see this as a great business opportunity for the United States of America, to develop jobs here and to create economic opportunities here? You have talked about the international situation and how we are in a very competitive situation. Yet you believe that by aggressively going out and setting some targets that we can become a leader in this area.

Mr. HOLLIDAY. I believe that is absolutely right. From meeting with the Premiere of China, the Executive Vice Premiere and the Head of the Ministries, I know they are focused on the same thing. So if we do not move, there will be a head ups. And I think there is a very narrow window that we need to move.

Senator UDALL. I think from what Mr. Stiles or one of the other witnesses said, China is ahead of us in the manufacture of solar right now. And they are creating more jobs. So this is a great opportunity for us and I think you highlight that in your testimony.

Ms. Warner, your testimony discussed how algae-based biofuel consumes large amounts of carbon dioxide in its production, which is one of your major costs, I believe. Could you briefly describe how

a Federal climate policy to reduce greenhouse gases would promote the use of algae as a biofuel, not only as a renewable fuel but also as a carbon sequestration technology?

Ms. WARNER. Thanks, Senator Udall. Thank you very much for your welcoming words earlier on.

Senator UDALL. You bet we love having you create jobs in New Mexico, of course.

Ms. WARNER. Well, it is a great place to operate, too. It has a lot of sun, which is our energy source.

Senator UDALL. And a lot of salty water, too, down beneath the ground.

Ms. WARNER. That is right. A lot of salty water. And some real hard workers as well, I will add.

I actually want to build on something that Mr. Holliday was saying because, actually if you think in the big picture about the legislation that we are contemplating, what we really are talking about is moving forward in a transformational way early before some of these inevitabilities could occur later. When I say inevitabilities, we know that the amount of energy that we use today is using up energy at such a rapid rate that the current available sources of energy will eventually diminish to the point that our demand exceeds our supply.

At the same time, the climate change issues continue to get worse and worse. And that is a cliff that we are going to fall off in terms of energy prices. That will not be good for the economy and that will not be good for society.

So if we are forward-thinking and we start planning and creating more renewable energy sources now, when we have time to do it and we have time to actually promote the technologies and enable them to develop and get up on their feet and be viable and produce enough material to actually make a difference in this huge amount of energy that we use every day—there has to be a lot to make a difference—if we do that now, we will not fall off that cliff someday.

So if the legislation is wise, it is transformational because it is helping us do something now.

Senator UDALL. Thank you, Madam Chair.

Senator BOXER. Thanks.

Senator Inhofe, welcome.

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

Senator INHOFE. Thank you, Madam Chairman. I apologize, being the Ranking Member of the full Committee here, I should have been here. But I am in the same position on Armed Services and one of these days, we will have to figure out how to do things at different times.

I had a lengthy opening statement which I will just submit for the record. But I will read just two paragraphs out of it because I want to hear it.

[Laughter.]

Senator INHOFE. While House Democratic leaders are attempting to mark up their bills this week, they are picking winners and losers by distributing billions of dollars in pollution allowances to favorite industries. Not surprisingly, many of these companies are in

turn supporting the Waxman-Marchi bill. As former Congressional Budget Office Director Peter Orszag said, "If you didn't auction the permits, it would represent the largest corporate welfare program that has ever been enacted in the history of the United States. All of the evidence suggests that what would occur is that corporate profits would increase by approximately the value of the permits."

It did not stop there. CBO also found that giving away allowances could yield windfall profits for the producers that receive them by effectively transferring income from consumers to firms, owners and shareholders.

[The prepared statement of Senator Inhofe follows:]

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

Madam Chairman, I commend you for having this hearing and I welcome all of the witnesses from the various businesses before this Committee today. I'd especially like to welcome Tim Healy from Lange-Stegmann fertilizer company and Jack Armstrong with BASF.

The message I have is very simple and I hope it begins to make sense to my colleagues on the other side as we continue our global warming cap and trade debate this year. True innovation, job growth, and business opportunities should stem from the open and free market, and not from creation of more taxes and Government spending. Yet that is exactly the direction we will go if we pass cap and trade and create a new, Government-created market based on carbon, all at the taxpayers' expense.

I am not opposed to new green jobs, or any kind of jobs that make sense in the global economic market. In fact, my State of Oklahoma knows a thing or two about making wind power cost effective. Oklahoma Gas and Electric's wind energy program has recently been ranked No. 1 in the country by the Department of Energy's National Renewable Energy Laboratory for the price premium it charges for new customer-driven renewable power.

But what I am opposed to is increasing taxes. And cap and trade is, plain and simple, a tax. It's an indirect, hidden, sneaky tax, but it's a tax. And it's a tax on energy that will raise prices on energy and all goods and services that are produced with or use energy. It's a tax that will fall more heavily on poorer people because poorer people spend a higher percentage of their incomes on energy than do wealthier people. And finally it's a tax that, for every business opportunity it will create, it will destroy others, especially in energy-intensive industries, which are concentrated in the States that use coal for electricity. The result is a net loss for jobs and the economy.

I want to commend Senator Bond for his recent report on the cost of green jobs. The report very effectively highlights how Government-created green jobs can kill existing jobs.

In the meantime, I also point you to a new study out of Spain, which I understand the President has used in many of his speeches as an example of the direction we are heading. Spain has real world examples over the past decade of implementing these types of policies. It found that for every 4 green jobs created, 9 other jobs were lost. Other findings from this study show that Spain spent 571,138 euros on average to create each green job. Spanish energy regulators estimate that the rate paid by end consumers for electricity must be raised by 31 percent to repay this debt.

Now as the House moves toward marking up their bill, I am hopeful we will have more hearings to discuss these types of substantive issues and how they factor into the debate on cap and trade. All sides of the issue should be heard.

As we have learned though mandates in the past, with the most recent example being the RFS and biofuels, all will have unintended consequences. I am hopeful as we move forward that we provide real market-based incentives, rather than mandates, caps, and Government subsidies, for new job creation.

While I understand that today's hearing is mostly focused on small business and startups, I want to comment on this issue of industry support for cap and trade policies. My colleagues on the other side frequently rail against "big polluters" for obstructing passage of cap-and-trade legislation. Yet it is not ironic these many of these selfsame "polluters" are supporting and lobbying for passage of cap and trade.

While House Democratic leaders are attempting to mark up their bill this week, they are picking winners and losers by distributing billions of dollars in pollution

"allowances" to favored industries. Not surprisingly, many of these companies are in turn supporting the Waxman-Markey bill.

As former Congressional Budget Office Director Peter Orszag said, "If you didn't auction the permits it would represent the largest corporate welfare program that has even been enacted in the history of the United States. All of the evidence suggests that what would occur is that corporate profits would increase by approximately the value of the permits." It didn't stop there. CBO also found that "giving away allowances could yield windfall profits for the producers that received them by effectively transferring income from consumers to firms' owners and shareholders."

Now I am all for companies seeking to generate a profit in the market and competition and making a buck, but when it comes on the backs of my consumers in an artificially created market that is not economically sustainable, I must object.

Once again I welcome all the businesses here before the Committee today and I look forward to hearing their testimony.

Senator INHOFE. I have a comment to make about what I think is going to happen on this whole issue. But before I do that, Mr. Healey, I understand that in the last decade, half of the nitrogen industry was shut down as a result of high natural gas prices and foreign competition. American farmers, and I get this from my farmers in my State of Oklahoma, import 55 percent of their nitrogen needs as a result of this leakage. Do you see this trend continuing and how will this reliance on foreign sources of fertilizer effect American agriculture?

Mr. HEALEY. If we have continued increases or an unstable price in natural gas, we will see more nitrogen plants in the U.S. idle and perhaps even close. And once these plants close, the generally do not start up again. The price of natural gas here in the U.S. is, I think Mr. Holliday said, for a long time it was at $2 per million BTUs. Once the price started going above $2 per million BTUs, we started seeing fertilizer plants closing. When the price of natural gas here in the U.S. gets up to $8, $9, $10 per million BTUs and the price overseas at foreign nitrogen manufacturing plants is less than $2, it is really tough for American companies to compete, not only in the world market but domestically.

Senator INHOFE. Yes. That being the case, we have huge natural gas reserves our there right now.

Mr. HEALEY. Yes.

Senator INHOFE. I mean, like never before. The problem is us. It is Washington saying what you can and cannot do out there. We cannot drill in the places where we have these reserves. I agree with what you are saying. I think the best way to bring that down is to increase the supply. It is an old concept that no one believes in Washington, but it is still there. It is called supply and demand.

In my State of Oklahoma, we still have three plants, three nitrogen plants, that are still operating. Tell us a little bit about the kinds of jobs because I am concerned. I want to keep our three operating. What kind of jobs do these fertilizer plants offer and what do they mean to the rural areas that are located in, such as Oklahoma?

Mr. HEALEY. Well, each nitrogen plant employs about 150 people. They are located, basically, in rural areas and the average salary at those nitrogen plants in those rural areas is around $74,000 per year. When those plants close, that has a terrific impact on the local economy.

Senator INHOFE. Well, Senator Lautenberg asked a question. I will ask it a little bit differently. Tell us, what happens to your

business if cap-and-trade specifically does not pass? To what extent is your business reliant on Federal Government mandating of carbon cap? Or is your business model sustainable without that? Would anyone like to respond to that?

One of the things before doing that, because I see my time is rapidly expiring here, I think the answer probably will be yes. It is interesting that we are having this hearing right now. I have no doubt in my mind, Madam Chairman, that the House is going to pass the bill, and it will come over here and it will not pass here. There are not the votes right now for cap-and-trade in the U.S. Senate. It is not even close.

And I would say to you, Mr. Holliday, I mentioned several times when we had our hearing on U.S. CAP, you remember that, Madam Chairman, we had a hearing on the U.S. CAP and several of the companies, I think we had five including DuPont that came and testified. I have to tell you, Mr. Holliday, that I spent 25 years in the real world. I was building companies. I was sitting on boards and all that. If I were on your board, I would be doing exactly what you are doing because, as I said during that hearing, you can stand to make a lot of money. There are a lot of winners in a mandated cap-and-trade system.

The Wall Street Journal said DuPont has been plunging into biofuels, the use of which would soar under a mandatory CO_2 cap. They called the cap-and-trade seeking corporations a "pack of climate profiteers." That is not really a dirty word. That is what we are supposed to be doing, doing the best we can for our companies and our corporations. I think the Competitive Enterprise Institute, Fred Smith, said that DuPont would realize more than a 900 percent return on investment.

I guess the best question to ask you now is what happens if I am right and you are wrong in terms of what is going to pass this Congress?

Mr. HOLLIDAY. I think the best way to address your comments is that this U.S. Climate Action Partnership was very unique. It was NGO's, it was auto companies, chemical companies, science companies, energy companies, and we worked for a year and a half to try to deal with exactly this issue. If one profits greatly, that is going to come out of the pockets of another. So I think what we proposed in our blueprint is a good place for you to start looking and work away from.

Senator INHOFE. But you did not answer the question though. What happens if I am right and you are wrong?

Mr. HOLLIDAY. If you are right that we make a lot of money?

Senator INHOFE. No. That we do not pass the cap-and-trade that would give a lot of people the opportunity to make a lot of money.

Mr. HOLLIDAY. Cap-and-trade is a term. The details behind it are what is critical.

Senator INHOFE. Thank you.

Senator BOXER. Thank you. The Senator went 2 minutes over his time so I am going to take a minute to make a few comments.

First of all, I thought I had seen it all. But now Republicans are criticizing Democrats for being pro-business. Think about it.

Second, Senator Inhofe, before he has even seen what we produce out of this Committee is predicting the Senate will vote no. Party

of no. No, no, no, no, no, no. So the whole world passes us by and no, no, no. I just think the people of America expect more of us than to predict the failure of a bill that we have not even worked on. We worked on one last year that did not get the votes and Congressmen Waxman and Marchi are sitting with people and we are sitting with people one at a time, so I hope we can, instead of saying, yes, it will pass, or no, it will not pass, is try to work together. But that does not seem to be possible.

To Mr. Healey, I am going to send something over to you that will make you smile. Can you smile? Good.

[Laughter.]

Senator BOXER. This shows that, because of our energy bill in 2006 where we opened up for more drilling even though we were told no, no on drilling, we opened it up. In the Gulf of Mexico, there has been a 25 percent increase of natural gas from the level reported in 2006. So I am going to send this over to you because I want you to take a look at that.

And here is where we going to go from here. Senator Klobuchar is going to close out with her questions and then she is going to have the gavel because, as you may have read, President Obama has reached an agreement with the State of California and the auto industry which is really historic because he believes in yes we can, not no, no, no. It proved that we can come together around a national fuel economy standard.

So, I am going to be going over there and Senator Klobuchar is going to take over here and I am very happy and pleased that she is willing to do it.

With that, Senator, I am going to hand you the gavel. After you finish your comments, you can call the new panel up and we will move forward.

Senator KLOBUCHAR. OK.

Senator VOINOVICH. In other words, we are not going to get any more questions of these witnesses.

Senator BOXER. No. This will be the last round. She has not had one round yet. We are just doing one round. And we have a second panel, Senator Voinovich, for questions.

Go ahead.

Senator KLOBUCHAR [presiding]. Very good. Thank you, Chairman Boxer and thank you to our witnesses for being here.

My State has one of the most aggressive renewable portfolio standards in the Country and we have truly seen the advantages of the jobs that can come out of homegrown energy.

Just picking up on what I have heard in the last few minutes, I wanted to say, Mr. Holliday, that I was just recently in China and Vietnam and Japan with Senator McCain. I saw first hand some of the work that has been going on, and heard about the work that has been going on with energy efficiency. I think we had a space race many years ago, but it is truly going to be a race for energy efficiency. I was trying to think of word that rhymed with race that fit this, but it really did not. I think that we are just seeing a modern day version of that and we want to be in the best position possible competitively for our Country.

The second thing is just for the U.S. as we look at this revolution with energy technology. One of the things I always like to tell my

people back in Minnesota is that this is different from the IT revolution. The ET revolution is different.

First of all, the IT revolution was very focused. It brought benefits to all of us in certain areas of the Country and certain States. I see the ET revolution as being much more broad based in terms of the jobs that it can bring to our Country, little towns to big towns all over this Country.

Second, the ET revolution, if done right and with the incentives for manufacturing, can also have more jobs across demographic lines, while the IT revolution was very focused on graduate student degrees and Ph.Ds. The ET revolutions, with the production of wind turbines or solar panels or other things, I have seen in my own State can involve some blue collar and green collar jobs as well as jobs for the people with the PhDs.

I wonder if you would comment on that.

Mr. HOLLIDAY. From our perspective, I think that you are exactly right. I think we are going to need all the different forms of energy and more efficiency and I think there are reasons why every State can participate and each one will probably have their own niche.

Senator KLOBUCHAR. The President has called for increased development of biofuels, Mr. Holliday, and I know DuPont's Pioneer Hybrid International facility in Jackson, Minnesota, produces advanced agricultural seeds that will play a critical role in our transition to the new energy economy. I am also aware that DuPont is also working on the development of cellulosic ethanol demonstration facility. We have the work you are doing with algae. Can you talk, perhaps you and Ms. Warner, about plans to develop the next generation of biofuels and how we can do this in a way that will reduce greenhouse gas emissions.

Ms. WARNER. The plans we have I outlined in my testimony and I am glad to go into more detail there. We are actually accelerating rather rapidly because the technology is proving itself quite quickly. We can see that we can compete with current energy, actually, as long as do not have any barriers in our way in terms of permitting and in terms of legislation that does not create a level playing field. But we view that we will be making over a million gallons per day of biomass and bio-oil, rather, in 2011, which is coming rather quickly.

Senator KLOBUCHAR. One of the things that we have been working on with the EPA is trying to increase the blend level with fuel for biofuels. We have the E85. Minnesota has the most pumps in the Country. It is corn-based ethanol which we know is going to be transitioning to other parts of corn. But we would like to see E12 and E15 and that we do not lose this biofuel component of this, which is so important for our national security and such things.

Ms. WARNER. Right. The beauty of the algae-based fuel is that you can essentially blend it at any percentage that you want to because it is not just chemically compatible, it is chemically identical. So there is not a limit as far as that goes.

Senator KLOBUCHAR. Mr. Holliday, you talked about DuPont's role in promoting the Montreal Protocol Agreement in the 1980s, which was one of the more successful international environmental agreements.

I recently introduced my former law professor, Cass Sunnstein, as Head of the White House Office of Regulatory Affairs. He has compared the debate regarding the Montreal Protocol and the Kyoto Protocol and he mentioned DuPont's role, when he spoke at his hearing, in helping to get President Reagan and more than 80 Senators in the Senate to support the ratification of the agreement to phase out CFCs.

In his account, he mentioned how the Europeans claimed that America was engaged in scare-mongering and that the speculative science of the benefits of reducing CFCs did not justify the severe economic costs. That was back then.

Mr. Holliday, we find ourselves in a similar place today. However, in the 1980s, President Reagan was able to see that the economic costs of letting the ozone layer disappear were more severe than the costs of finding a replacement for CFCs. Can you tell how DuPont's 1994 decision to reduce your greenhouse gases has been a positive one for you?

Also, when you look back in history at the role that DuPont played in that debate with that Montreal Protocol, fast forward to today with Copenhagen and some of the work that we have to do in terms of how we need to have the business community strong in support of what we are trying to do here.

Mr. HOLLIDAY. Thank you for your question.

Just to put it into perspective, the Montreal Protocol has reduced five times more CO_2 equivalents in the atmosphere than the Kyoto Protocol would have if it was done completely, which it does not look like it will be. So the leadership of the U.S. in that step, we should take pride as a Country, I think as an example.

What we had with the Montreal Protocol was certainty. We had a timeframe and phase out, what is going to happen, what is going to happen in developed countries and developing countries, and with that certainty we unleashed more technology than we have ever had before. We found six companies working on it, and we shared technology cross-license and we had a commercial plant within 5 years.

I think that same kind of thing could be done with certainty in your legislation.

Senator KLOBUCHAR. All right. Thank you very much. Thank you to the panel and we are going to be moving on to our second panel. This has been very enlightening. We appreciate it.

As the second panel is coming up, I would just like to ask Mr. Lowenthal if he would raise his hand. I wanted to particularly welcome you, sir. We are very proud of your work with Coulomb Technologies and I am going to stay as long as I can and I so appreciate your being here.

If everyone could get seated, please. It looks like we are having a large object being installed. This should be good. We are really trying to move on to our second panel because we also have votes today and we are hoping to get done by around noon. I cannot wait to hear what this is.

OK, I am going to go through who the panelists are today and then ask them to get started. We have, first of all, Richard Lowenthal, who Senator Boxer already mentioned, who is the CEO of Coulomb Technologies, which manufactures charging stations for

electric vehicles to provide commuters and others with flexible transportation options.

We also have Wayne Krouse, who is the CEO of Hydro Green Energy, which uses a new form of underwater turbine to generate electricity. These underwater turbines were first installed in the Mississippi River at an Army Corps dam in Hastings, Minnesota.

We have Richard Taylor who is with Imbue Technologies Solutions, which distributes and installs efficient lights that are manufactured in Pennsylvania. And, finally, we have Jack Armstrong who is with Leader Construction Markets with BASF which is one of the world's largest chemical companies and manufacturers of various products including installation, auto emissions reduction technologies and low-friction wind turbine blades.

Please get started, Mr. Lowenthal.

STATEMENT OF RICHARD LOWENTHAL, CHIEF EXECUTIVE OFFICER OF COULOMB TECHNOLOGIES

Mr. LOWENTHAL. Thank you very much for having me here today. Thank you, Madam Chair and the Senators of the Committee for this opportunity to address you.

I introduce my friend here. This is one our charging stations designed for the city of San Jose, California.

[Slide shown.]

Mr. LOWENTHAL. My responsibility is building companies and we do that in Silicon Valley and especially we like to kick off new industries and we see this as an opportunity to help a new industry get started. I will say up front that we are speaking in favor of cap-and-trade legislation.

We make and sell charging stations for electric vehicles because a lot of the people in the U.S. cannot fuel an electric vehicle without some help from us, without infrastructure. We have five times as many cars, 247 million cars, but only 53 million home garages to charge them in. So, we build infrastructure for EVs.

In a place like San Francisco, 51 percent of the people park curbside at night. So, what we do is we change parking meters into combination parking meters and charging stations for EVs.

Our charging stations all have a way to pay for recurring costs and they are all Smart Grid enabled and full integrated with the Smart Grid. We provide access to a fuel that is cheap, it is clean and it reduces our dependence on foreign oil.

[Slide shown.]

Mr. LOWENTHAL. We are creating jobs nationwide that cannot be outsourced. We have distributors across the U.S. with local installers. They have to be here. They have to be on the ground. They are electricians that can get permits from cities and install our stations. And we are excited about that.

We have stations in California, Illinois, Florida, North Carolina, New York and Hawaii and new places every day. Our stations in Chicago charge cars off the sun. Our stations in Hawaii charge cars off of windmills. So we have a way to fuel cars that is actually quite clean. Next slide.

[Slide shown.]

Mr. LOWENTHAL. Electricity as a fuel is cheaper for the consumer than gasoline. Gasoline costs us about 10 cents per mile. That is

with $2.30 gasoline which may soon be a thing of the past. Running your car on home electricity at home rates is about 2 cents per mile, so quite a bit cheaper than gasoline, and on a public infrastructure it is about 5 cents a mile to drive a car. So, a little bit less, actually less than half the cost, of driving on gasoline for the consumer. Next slide.

[Slide shown.]

Mr. LOWENTHAL. I want to talk about the story in San Jose where we put out our first network. This was an ad hoc cap-and-trade system. The Mayor of San Jose, Mayor Reed, made a statement that he wanted his city to have a clean, zero emission streetlight system. So we took that on.

What we do is we put these charging stations on streetlight poles in San Jose. And when you charge there, each time you charge your car there, it saves 19 pounds of greenhouse gases. The production of electricity for this costs about 9 pounds of greenhouse gases. So there is a net savings is 10 pounds of greenhouse gases every time you fuel your car at one of these stations. That is enough to pay for the greenhouse gases that are produced by lighting 9 street lights. So, through this mechanism, the city of San Jose is getting a carbon free streetlight system. Next slide, please.

In San Francisco, the story was different. We have a network of stations there as well. In San Francisco, it was all about greenhouse gas savings and accountability of greenhouse gas savings. So we provide reports like these, these are actual active accurate reports from the city of San Francisco, about greenhouse gases saved by charging cars at our stations and the City uses that to justify further investment in clean fleet. Next slide.

[Slide shown.]

Mr. LOWENTHAL. I just want to highlight our growth. We are a tiny little company. But the percentages are good. We have 3,000 percent year-on-year growth, which is easy to say when you are as small as we are. We had two people in September 2007. We went to 12 in July 2008 and that is when Mayor Reed announced his initiative to have a clean streetlight system. That, you see, increased the slope of our growth to 40 people at February of this year. Then Mayor Newsome announced his program to measure his fleet in San Francisco and, as of today, we are about 95 people in the company. Next slide.

[Slide shown.]

Mr. LOWENTHAL. So, I just wanted to say thank you for addressing this issue of global importance. It has caused a lot of growth for us to have clean policy decisions and we look forward to continuing that. We are happy to hear the announcements today about emissions with cars and incentives for EVs and those things are all greatly beneficial to our industry.

Thank you.

I would also like to submit for the record a copy of the agenda for the legislative action by the Battery Electric Vehicle Coalition and highlight its support of EV infrastructure.

[The referenced material was not receive at time of print.]

[The prepared statement of Mr. Lowenthal follows:]

Fueling The Electric Transportation Industry

Testimony of Richard Lowenthal, CEO of Coulomb Technologies
Hearing on Business Opportunities and Climate Policy
U. S. Senate Committee on Environment and Public Works
Senator Barbara Boxer of California, Chair
Tuesday, May 19, 2009 – 10:00 AM
Dirksen Senate Office Building – Room 406

Richard can be reached at 408-370-3851 or richard.lowenthal@coulombtech.com

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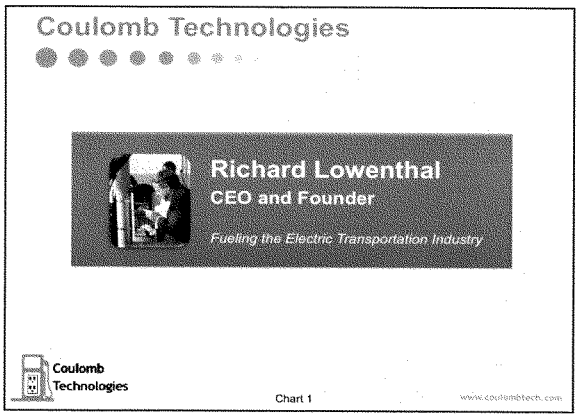
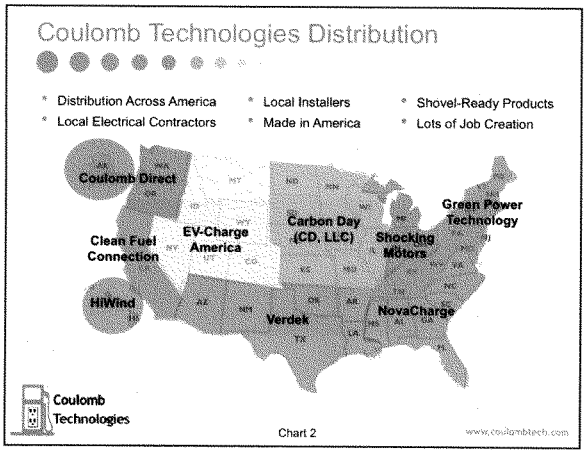


Introduction – Chart 1

Hello Madam Chair and members of the Committee, and thank you for inviting me here to testify today. My name is Richard Lowenthal and I am the founder and CEO of Coulomb Technologies. I am also a former Mayor of the City of Cupertino, California. Coulomb is a startup company, founded in 2007, that is developing charging stations for electric vehicles.

Over the next few years, major automakers will begin ramping up production and sales of plug-in electric vehicles. As we attempt to reduce our dependence on oil, and are increasingly conscious of protecting the environment, there is tremendous opportunity for growth in the electric vehicle market. These vehicles run on electricity, which we make here in the US and is cheaper per mile than gasoline, and they don't produce greenhouse gas emissions.

Coulomb Technologies provides electric charging stations for these vehicles. In the US, there are 247 million cars but only 53 million garages. In San Francisco, for example, 51 percent of cars are parked curbside at night. Coulomb provides charging stations that go curbside, in condominiums, apartments, public lots, at the workplace, or anywhere consumers park. Our stations are unique because they include Smart Grid integration, and a billing system that provides money to pay for all recurring costs. We have the capability to build charging infrastructure to enable rapid growth of the electric vehicle market.



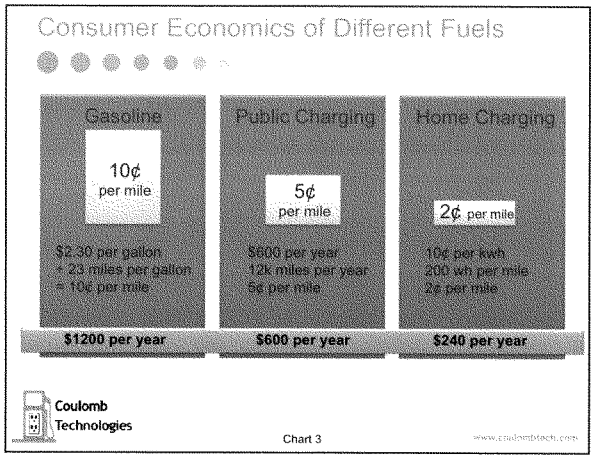
Distribution and jobs and endorsement of Carbon Credit – Chart 2

Coulomb designs and manufactures our products in the US and has distribution now covering all 50 states. We have distributor and installer contracts for 46 states and the remaining 4 we handle directly. Because our products are "shovel-ready" and require the skills of local electricians and contractors to install, we provide jobs nationwide. Our young company already has stations installed and operating in California, Illinois, North Carolina, New York, and Hawaii.

We believe that a cap and trade system will strengthen our business and trigger significant growth for us. We like the system because it incentivizes good behavior without raising taxes. Cap and trade will provide incentives for companies like ours to deploy products that allow for reduced emissions. It will provide incentives for our customers to buy products that produce less carbon waste.

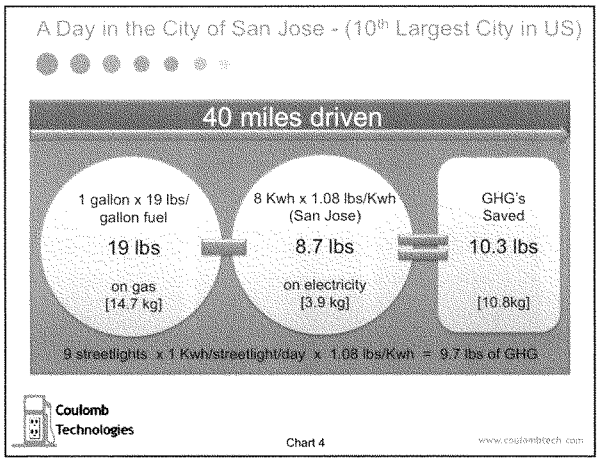
Coulomb Technologies

Fueling The Electric Transportation Industry



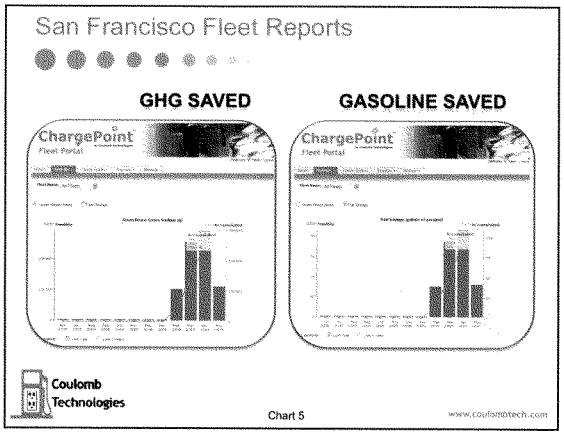
Consumer Economics – 2/5/10 – Chart 3

Electric vehicles reduce the cost to consumers for fueling their cars. Driving on gasoline at the national average of 23 miles per gallon, with gasoline at $2.30 per gallon, costs consumers 10 cents a mile. Of course with the volatility in gasoline prices, this was as high as 20 cents a mile last summer. Driving on home electricity at 10 cents per kilowatt hour will costs consumers approximately 2 cents a mile. Using Coulomb's public charging infrastructure, drivers pay about 5 cents a mile, half the price of gasoline travel.



San Jose – 10th GHG Policy Effects – Chart 4

This chart represents emissions reductions initiated through climate change policy and attained using Coulomb's technology. Mayor Chuck Reed of San Jose, California set a goal to "replace 100 percent of our streetlights with smart, zero emission lighting" in 15 years. Working with the Mayor, Coulomb Technologies took on that goal, provided the equipment, and installed charging stations on light poles in San Jose. The challenge in this situation was to compensate for emissions of electricity generation. However, for every charger deployed, gasoline consumption is reduced by about 1 gallon per day. That effectively eliminates more greenhouse gasses than would be emitted by powering the car plus 9 streetlights. In other words, getting the car off of gasoline compensates for 9 light poles worth of streetlights.

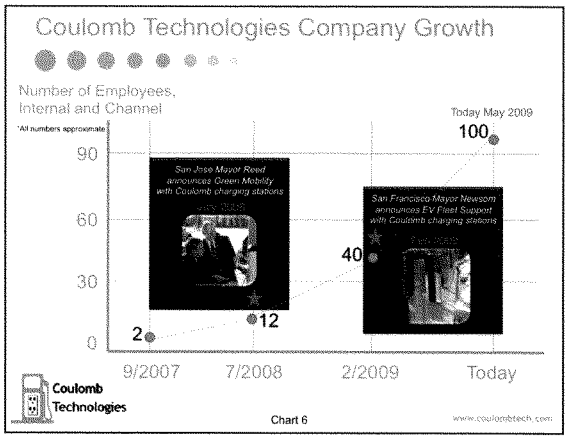


San Francisco – Measurable Results – Chart 5

The City of San Francisco justifies its electric vehicle fleet and infrastructure by the savings they realize in gasoline costs and greenhouse gas emissions. These charts show San Francisco's real life savings every month. Measurement and accountability tools for greenhouse gas emissions and fuel savings are here today. This demonstrates that a cap and trade system designed to reduce emissions can be implemented immediately, with auditable results.

Coulomb Technologies

Fueling The Electric Transportation Industry

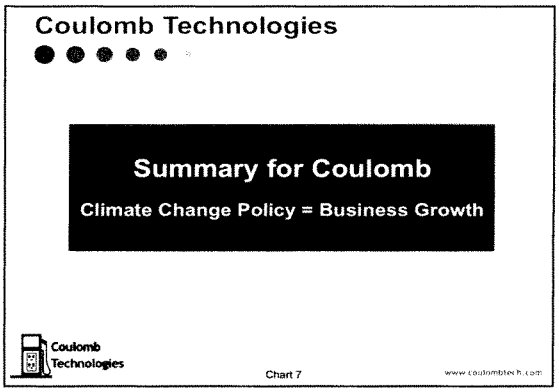


Summary – Climate Change Policy has driven growth – Chart 6

In purely business terms, a national cap and trade policy will help our company grow. Similar public policies are already working for us on a smaller scale, as demonstrated with the streetlight system in San Jose. Cap and trade policies move us toward greater oil independence, cleaner air, and cheaper transportation for consumers. This chart shows the growth of our, admittedly tiny, company with results driven by climate change policies implemented in San Jose and in San Francisco. Coulomb Technologies has grown to 45 employees inside and 50 outside, across the US. We have already spun off two new US companies, Nova Charge and EV Charge America. In fact, we have also begun exporting our products to European countries.

Coulomb Technologies

Fueling The Electric Transportation Industry



Close – Chart 7

Thank you Madam Chair and members of the Committee for the opportunity to appear before you today, and I applaud your efforts toward this issue of global importance.

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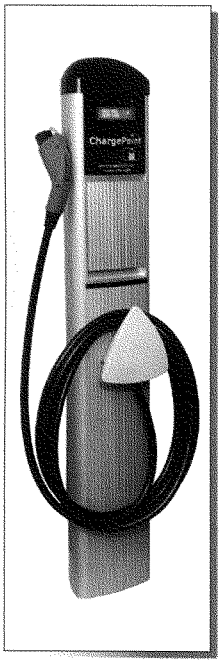
About Coulomb Technologies, Inc.
Coulomb Technologies (www.coulombtech.com), headquartered in Campbell, Calif., offers a family of products and services that provide a plug-in vehicle charging infrastructure, which includes ChargePoint™ Networked Charging Stations ranging in capability from 120V 15A to 240V 80A AC charging to 120kW DC charging. Coulomb applies networking technology to the challenge of charging electric vehicles and plug-in hybrids in order to fuel the electric transportation industry. Coulomb's ChargePoint℠ Network (www.mychargepoint.net) addresses the needs of drivers, utilities, governments, and parking space owners. For more information, please visit www.coulombtech.com. Follow Coulomb on Twitter at twitter.com/coulombevi.

Coulomb Technologies

Fueling the Electric Transportation Industry

CT1000 AND CT2000

CHARGEPOINT NETWORKED CHARGING STATIONS



The CT1000 and CT2000 families of ChargePoint™ Networked Charging Stations, manufactured by Coulomb Technologies, are specifically designed for the North American market. The CT1000 family of charging stations supports Level 1 (120V @ 12A) charging. The CT2000 family of charging stations supports both Level 1 and Level 2 (208V/240V @ 32A) charging.

The ChargePoint Networked Charging Stations combined with the ChargePoint Network Operating System (NOS) form a smart charging infrastructure for plug-in electric vehicles called the ChargePoint℠ Network. Each local group of charging stations automatically forms a robust self-healing Radio Frequency (RF) mesh network managed by a single gateway charging station—a version of the networked charging stations incorporating an embedded CDMA or GSM cellular modem in addition to RF mesh network functionality. Up to 100 charging stations can communicate to and be managed by a single gateway charging station. The gateway charging station, in turn, utilizes the local cellular network to communicate with the ChargePoint NOS, which runs on a remote secure hosted server managed by Coulomb Technologies. The ChargePoint NOS provides multiple web-based portals for drivers, charging station owners, installers, fleet operators, and utility companies.

Coulomb's ChargePoint NOS communicates with and individually controls the networked charging stations in order to provide authentication, management, and real-time control. The ability to individually control each charging station in real time allows the ChargePoint Network to be open to all drivers of plug-in vehicles. Drivers have the option of paying for a single charging session by placing a toll free call to the 24/7 number on each charging station or they can become a ChargePoint Network subscriber by going to www.mychargepoint.net and choosing a monthly subscription plan that fits their lifestyle. Other future payment options include using any smart (RFID) credit/debit card to authorize a session or using a standard credit or debit card at a remote payment station (RPS) to pay for charging sessions. The ChargePoint Network has been designed with an open, standards-based architecture. Drivers who are members of other charging systems will be able to use their authorization smart cards at any ChargePoint networked charging station just like they can roam between cell phone networks.

ChargePoint Networked Charging Stations perform bi-directional energy metering via an embedded utility grade electronic meter. The ability to precisely measure and report electricity use enables a sustainable, flexible business model that meets the needs of drivers, corporations, fleet operators, utility companies and municipalities. This revenue generating business model includes flexible subscriber payment methods like "free" charging, pay per use, by subscription, and by kWh (where allowed).

NETWORKING CAPABILITIES AND BENEFITS

ChargePoint Networked Charging Stations provide unique benefits when compared to non-networked charging stations. Those benefits include:

- A charging infrastructure open to all drivers without requiring subscriptions
- A revenue stream to pay for electricity, capital equipment and maintenance
- Ability for drivers to find unoccupied charging stations via web-enabled cell phones
- Notification by SMS Text or email when charging is complete
- Authenticated access to eliminate energy theft
- Authorized energizing for safety
- Remote monitoring and diagnostics for superior quality of service
- Smart Grid integration for utility load management with future V2G capabilities
- Green House Gas savings calculation per driver and per fleet
- Fleet vehicle management

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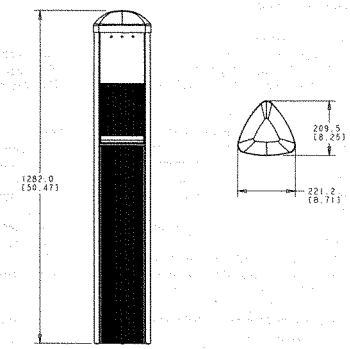
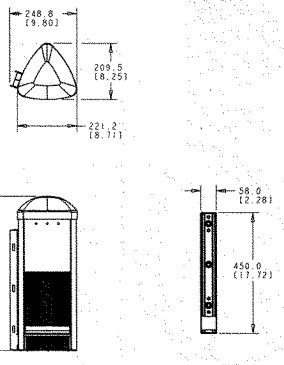
Coulomb Technologies

MECHANICAL DRAWINGS
CT1000 FAMILY

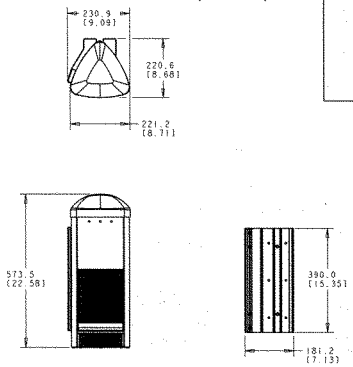
BOLLARD (CT1001)



POLE MOUNT (CT1002)



WALL MOUNT (CT1003)



Coulomb Technologies reserves the right to alter product offerings and specifications at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

Coulomb Technologies

Fueling the Electric Transportation Industry

CT1000 AND CT2000

CHARGEPOINT NETWORKED CHARGING STATIONS

CITY OF SAN FRANCISCO

CITY OF SAN JOSE

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info@coulombtech.com
www.coulombtech.com
www.mychargepoint.net

FEATURES

- Smart Card: open, standards-based RFID provides authorized network access control preventing electricity theft, enhancing safety, and minimizing liability
- Automatic SMS Text and/or Email notification: alerts drivers of events and issues
- High Availability: real-time remote control monitoring and management features, minimizes station downtime and enables start/stop charging sessions with lock/unlock door
- 24/7 ChargePoint Network Customer Support: via toll free telephone number
- Advanced Level 1 Safety Features: power not energized until:
  1. User is authorized 2. Plug is fully inserted 3. Door is relocked
- Locking Door (Level 1): retains the charging cord to prevent theft, with auto unlock in case of power outage
- Auto Plug-out Detect (Level 1): automatically detects if charging cord has been un-plugged at the vehicle, de-energizes outlet and optionally notifies driver (patent pending)
- GFCI: integral hardware ground-fault protection circuitry with auto retry minimizes nuisance GFCI trips
- Fast Over-Current Detect at Charging Station: minimizes nuisance breaker trips at service panel
- Bi-Directional, Utility-Grade Power Measurement: integral power metering circuitry provides accurate measurement of energy delivered for charging and allows calculation of Green House Gas savings
- Wide Area Network Connection - CDMA or GSM: only one gateway charging station with cellular modem required per local group of charging stations
- HTTPS and 128-bit AES Encryption: ensures secure network communications
- Integrated RFID Reader: recognizes and identifies ChargePoint Network Smart Cards, RFID credit cards and authorization smart cards from other charging systems
- Future Proofed: all firmware can be upgraded remotely via the network as new capabilities and functionality become available
- Electric Utility Demand-Side Management: communication via HTTPS secure link to utility and third party "Smart Grid" management systems provides real-time load shedding of any group of charging stations
- Vacuum Fluorescent Display: bright and easy to read

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Coulomb Technologies

CHARGEPOINT NETWORKED CHARGING STATION INSTALLATION OPTIONS

Both the CT1000 and CT2000 ChargePoint Networked Charging Stations are available in three mounting configurations:

BOLLARD

POLE MOUNT

WALL MOUNT

	CT1000 FAMILY	PRELIMINARY SPECIFICATIONS CT2000 FAMILY
Charging Connection	NEMA 5-15	NEMA 5-15 and SAE J1772™ Document (plug on 5m cable)
AC Charging Power Output	1.4kW (120V at 12A)	1.4kW (120V at 12A); 7.7kW (240V @ 32A) Note: Only one output enabled at any time.
AC Power Input; Connections	120V 12A Single Phase; Line, Neutral, and Earth	208V/240V 32A 2 Phase; Line1, Line2, Neutral, and Earth
Recommended Service Panel Breaker	15A breaker on dedicated circuit	40A dual breaker on dedicated circuit
Recommended Service Panel GFCI	None. Do not provide GFCI at service panel as it can conflict with integral GFCI.	
Integral Hardware GFCI	5mA CCID with auto retry (15 min delay, 3 tries)	20mA CCID with ground continuity monitor, and auto retry (15 min delay, 3 tries)
Automatic Plug-Out Detection	Programmable arm and trip current thresholds (patent pending)	
Power Measurement	1% @ 5 min interval; IEC class 1 capable (special order)	
Local Area Network	2.4GHz 802.15.4 dynamic mesh network	
Wide Area Network	Commercial CDMA or GPRS cellular data network	
Network Communication Protocol	TCP/IP	
Network Security	HTTPS; 128-bit AES Encryption	
Maximum Charging Stations per 802.15.4 Radio Group	100 Each charging station must be within 150 feet of at least one other station	
Smart Card Reader	ISO 15693 compliant	
Standby Power	2W typ.	
Outdoor Rated	NEMA 3R per NEMA250-1997	
Safety Compliance	NRTL Tested; GFCI per UL 2231-1 and -2; Meets UL 2202; NEC Article 625 Compliant	
Surge Protection	6kV @ 3,000A In geographic areas subject to frequent thunder storms supplemental surge protection at service panel is recommended	
EMI Compliance	FCC Part 15 Level A	
Operating Temperature	-30°C to +60°C	
Operating Humidity	Up to 95%	
Voltage and Current Rating	120VAC @ 12A	208VAC/240VAC @ 32A
Terminal Block Temperature Rating	100°C	
Approximate Shipping Weights	Bollard (CT1001) 50lb / 23kg Pole Mount (CT1002) 30lb / 14kg Wall Mount (CT1003) 33lb / 15kg	Bollard (CT2001) 60lb / 27kg Pole Mount (CT2002) 40lb / 19kg Wall Mount (CT2003) 43lb / 20kg

Senator KLOBUCHAR. Thank you very much.

Mr. Krouse. It is hard to see you with that big light.

Mr. KROUSE. It is quite large.

Senator KLOBUCHAR. I am sure Mr. Taylor will explain.

STATEMENT OF WAYNE F. KROUSE, CHAIRMAN AND CHIEF EXECUTIVE OFFICER OF HYDRO GREEN ENERGY, L.L.C.

Mr. KROUSE. Thank you, Senator Klobuchar. I want to thank Chairman Boxer for having me to the Committee. I also want to thank the rest of the Members.

My name is Wayne Krouse and I am the Founder, Chairman and CEO of Hydro Green Energy. I really appreciate the opportunity to be here today to discuss clean energy companies like mine and how we can contribute to addressing the serious environmental and energy issues that this Country faces, while at the same time creating a large number of jobs for Americans throughout the Country. This will ultimately lead to economic development opportunities now and into the future.

Hydro Green is a Texas-based renewable energy company in the water power industry. And as my written testimony shows, our patented power systems generate clean electricity for moving water at a variety of application points without the need to build new dams.

We are presently developing 15 projects in eight States. Our projects will cumulatively generate over 500 megawatts of base load zero carbon renewable energy.

Overall, the U.S. has 20,000 megawatts of water power potential that could be developed by 2025 without building a single new dam. That is enough for 15 million homes—that is million—and replace some 40 coal plants.

Hydro Green is a startup company. We closed our Series A Funding in 2008 with a $2.6 million investment from the Quercus Trust, which is a prominent investor in alternative energy companies. The founder of Quercus has committed hundreds of millions of dollars to environmental causes and land conservation efforts and we are honored and proud to have Quercus as our lead investor.

I am a chemical engineer by degree and left Exxon Chemicals Joint Venture in 2001 to start Hydro Green Energy. Prior to my job with Nalco/Exxon Energy Chemicals, I worked as a field engineer for Schlumberger out in the Gulf of Mexico oil fields. So I have a little perspective on some of the discussions that were going on here today.

While I might not be as well-known as a certain other Texas oilman who is now interested and committed to renewables, I am also using my conventional energy background to ensure that promising new clean energy technologies are delivered to America. Hydro Green is the first company in America with a grid connected and FERC-licensed hydrokinetic power station at Army Corps of Engineers Lock and Dam No. 2 in Hastings, Minnesota. Our hydrokinetic power project was developed in partnership with the city of Hastings and began operation this year, the first in the Country to do so.

The project led to the creation of 61 jobs in seven States over a 2-year period. It was a major milestone for our company and for

U.S. clean energy policy. We hope that the Hastings project with act as a catalyst for growth in the promising new water power technology sector, which is the potential to deliver literally tens of thousands of megawatts of clean, carbon-free domestic power to America's electricity consumers, including those specifically in the Midwest and the Southeast where we have many of our projects in development.

There is a common belief in some locations around the Country, on Capitol Hill and in the environmental community, that the U.S. water power industry is tapped out. Nothing could be further from the truth, as my written testimony will show. And if the Country is committed, truly, to reaching the clean energy goals of the Obama administration and of the current Congress, water power technologies must play a strong role and be given an opportunity to develop in a timely and efficient fashion. Currently, they represent between 7 and 8 percent of U.S. energy production on an annual basis.

I was asked to focus today on job creation that could occur as a result of the potential climate policy. The best way I can do that is to discuss the job opportunities that we created to date with the Hastings project.

The development of the Hastings project resulted, as I said, in 61 exciting and high-paying jobs in several States. It also created work for those who were out of work or who were soon to be without work due to jobs going overseas.

These activities that resulted from the Hastings project will be replicated on a much larger and more permanent scale as Hydro Green develops these other 500 megawatts of projects. We are eager to create more employment and economic activity. Our current project pipeline that I discussed a few minutes ago is in position to potentially create as many as 2,000 jobs over the next 3 years, not only in other parts of the Country but specifically in the Midwest and Southeast where we have a number of our projects located.

These are great jobs. These are engineering jobs, civil engineering, mechanical engineering, marine engineering, structural engineering, computational fluid dynamics engineering. Very well-paying jobs. But in addition to these engineering jobs, there are also green collar manufacturing jobs, jobs that may have gone overseas and we can now bring them back to help build America's energy future.

The company currently plans to hire as many as 30 employees in 2009. Today, we are a company of three. Two years ago, we were a company of one.

I am here today to state very clearly that policies that you are considering, such as the climate change legislation, that recognizes and sends a market price signal on carbon, has many benefits and that the clean energy technology, particularly their carbon-free profile, it will act as a huge driver for growth and development of the clean technology industry in America.

Recent policies have helped insure our traction in the marketplace, as well as some interest from the investment community. Additional policies are needed, though. As the U.S. continues to struggle and emerge from the economic crisis, debt finance really

still remains on the sidelines and properly drafted legislation will help bring some of that back.

Even the idea of carbon policy being enacted has brought some of the major utilities in the U.S. to come to discussions with Hydro Green Energy, discussions that may not have taken place just a few years ago.

The Committee knows that America is in a position to lead the world in clean energy technology development. Categorically, no other country in the world can match American ingenuity and creativeness. But only by taking decisive action on the policy in front of us can we accomplish these goals.

Scores of companies like Hydro Green are fighting every day to make progress and we hope that the adoption of these particular legislations will help accelerate that trend.

[The prepared statement of Mr. Krouse follows:]

Testimony of

Wayne F. Krouse

Chairman and CEO

Hydro Green Energy, LLC

Before the

Committee on Environment & Public Works

United States Senate

Business Opportunities and Climate Policy

May 19, 2009

Introduction

Good morning Chairwoman Boxer, Ranking Member Inhofe and members of the Committee. My name is Wayne Krouse and I am the founder, chairman and CEO of Hydro Green Energy, LLC. I greatly appreciate the opportunity to briefly share Hydro Green Energy's story with the Committee, and to discuss how clean technology companies like Hydro Green Energy can contribute to addressing the pressing environmental and energy issues this country faces, while at the same time creating a large number of jobs for America's skilled and experienced workforce, leading to economic development opportunities now and in the future.

I am also here to state very clearly that policies, such as climate change legislation that recognize and financially value the many benefits of our nation's clean energy technologies, particularly their carbon-free profile, will act as a huge driver for growth and development of the clean technology industry. Recent policies that I will later highlight have helped ensure our traction in the marketplace, as well as some interest from the investment community, but additional policies are needed now, especially as the U.S. continues to struggle to emerge from the economic crisis and venture capital and debt finance largely remains on the sidelines. Properly structured policy can drive growth and market activities. New policy, as well as policy refinement, is needed if we are to see the explosive growth of the clean tech sector that we all desire.

About Hydro Green Energy

Hydro Green Energy is a Texas-based renewable energy systems developer and integrator operating in the waterpower industry. Hydro Green Energy holds U.S. Patent #6,955,049, two international patents, and has over 100 pending patents. Hydro Green Energy's hydrokinetic power systems generate electricity exclusively from moving water, such as river, tidal and ocean currents, without having to first construct dams, impoundments or conduits. The company's hydrokinetic technology platform is also deployable downstream from existing hydropower projects, which is a system we call Hydro+™. These projects bolster the clean power output of an existing hydropower facility in an environmentally-sound manner using a cutting-edge waterpower technology. They are essentially turbochargers for existing hydropower facilities, creating more clean power from the same water.

Hydro Green Energy, a start-up company, closed its Series-A funding in April 2008 with a $2.6 million investment from the Quercus Trust, a prominent and leading investor in alternative energy companies with intellectual property. We hope to soon close our Series-B funding, placing the company in a position to grow rapidly, advance all power projects in our pipeline and continue our innovative technology development. We are presently developing 15 waterpower projects in Alaska, Iowa, Illinois, Louisiana, Minnesota, Mississippi, New York and Wisconsin. We also plan to develop projects in Ohio and Pennsylvania. These projects will cumulatively amount to over 500 MW of base load, zero carbon energy.

The founder of the Quercus Trust, Minnesota native and California resident David Gelbaum, is a conservationist and environmentalist who has over the years committed hundreds of millions of dollars to environmental causes and land conservation efforts. We are honored and proud to have him as our lead investor. I am a chemical engineer by degree and left an Exxon Chemicals joint venture in 2001 to start Hydro Green Energy. Prior to my job with Nalco/Exxon Energy Chemicals, I worked as a Senior Field Engineer in the Gulf of Mexico oil fields for Schlumberger. While I might not be as well known as a certain Texas oil man now committed to renewables, I am also using my conventional energy resources background to ensure that promising new clean energy technologies are delivered to America and I am deeply committed to this cause, as are my Hydro Green Energy colleagues and partners.

I am also pleased to let the Committee know that Hydro Green Energy is the first company in America with an operational and federally-licensed hydrokinetic power project. Located in Hastings, Minnesota, our hydrokinetic power project, which was developed in partnership with the City of Hastings, was approved last December by the Federal Energy Regulatory Commission by a 5-0 vote. The project led to the creation of 61 jobs in seven states over a two-plus year period, and I will discuss our job impacts in greater detail later in my testimony.

The Hastings project, a public-private partnership with the City at U.S. Army Corps of Engineers Lock and Dam No. 2, was installed over the winter and began generating clean, renewable electricity this spring. It is the only hydrokinetic power project exporting electrons to the U.S. power grid in U.S. history. Two weeks ago, I was honored to provide a tour of the facility to Brigadier General Michael J. Walsh, Commander of the United States Army Corps of Engineers Mississippi Valley Division, and Colonel Jon L. Christensen, USACE St. Paul District Commander. Both of these decorated, experienced officers and their staff played a key role in the successful deployment of this groundbreaking renewable energy project.

At the Hasting project, we proved that new clean energy projects can be developed at Corps' sites without interfering with the Corps' important navigation and flood control mission. We look forward to working with the Corps on many other projects in the same manner so we both can work to see that the Commander-in-Chief's clean energy goals for America are met. The Hastings project was a major milestone for our company, and for U.S. clean energy policy. We hope that the Hastings project will act as a catalyst for growth in the promising new waterpower technology sector, which has the potential to deliver tens of thousands of megawatts of clean, carbon-free, domestic, renewable power to America's electricity consumers, including those in the Midwest and Southeast.

Hydro Green Energy has also developed a patented technology that allows for power generation at existing non-powered lock and dam infrastructure. Known as Lock+™, this new technology is a power-generating lock gate that is deployed in the downstream portion of an auxiliary or active navigational lock, thus converting the facility into a renewable, baseload waterpower generation facility at prices up to 40 percent below conventional hydropower facilities.

Lock+ projects, which are installed within existing infrastructure without being structurally attached to the existing dam or lock walls, are removable and designed to work seamlessly with existing United States Army Corps of Engineers' navigational operations and can aid in the improvement of aging U.S. infrastructure, reducing costs to the taxpayer. This technology can also be modified and deployed in the cooling water discharge systems at thermal power plants (coal, nuclear) for energy recovery or energy efficiency purposes and is called Efficiency+™.

Hydro Green Energy is a proud member of the National Hydropower Association, the trade association representing the interests of the nation's waterpower industry. At a ceremony in Washington, DC last week, we were delighted to receive the 2009 NHA *President's Award.* This prestigious award is given to an NHA member company that has "blazed new pathways to strengthen and invigorate the waterpower industry." It was only the third time a member company has received this award.

Not only is Hydro Green Energy interested in addressing energy and environmental issues while creating new job opportunities, but we are also committed to investing in our future by providing educational opportunities for America's undergraduate and graduate students. We are beginning to accomplish that goal through the creation of a co-op program with Texas A&M University. Through this program, we

hope to ensure that our nation's engineering, business and environmental students enter the renewable power industry and contribute to its long term, sustained growth.

The motivating concept behind Hydro Green Energy is to reduce the costs of baseload, non-emitting renewable energy production from water resources so that it is less expensive than power generated through the use of fossil fuels and to maximize the use of existing U.S. infrastructure. The robust development of new waterpower technologies, such as those of Hydro Green Energy, will substantially bolster efforts to reduce the impacts of climate change, help improve air quality, boost reliability of the electric power grid, better help meet growing electricity demand and lessen dependence on fossil sources for the production of electricity.

U.S. New Waterpower Potential

There is a common belief, especially on Capitol Hill and within the environmental community, that the United States' waterpower industry is tapped out. That could not be further from the truth. And, if we are truly committed to reaching the clean energy goals of the Obama Administration and Congress, waterpower technologies and waterpower projects must play a strong role and be given an opportunity to develop in a timely and efficient fashion. Canada, the United Kingdom and other European countries realized these fact years ago and have made tremendous strides in advancing a variety of new waterpower technologies through aggressive R&D, financial and regulatory commitments. We have lost ground and precious time thorough our indecisiveness. The U.S. has some work to do if it wants catch up, and even pass, our friend in Europe and Canada.

Hydrokinetic power holds great promise as a new, carbon-free, domestic energy source. And, unlike wind or solar power, in-stream and ocean current hydrokinetic power projects can operate in baseload fashion, providing power over 99% of the year. A 2007 study by the Electric Power Research Institute (EPRI) found that the U.S. could develop at a minimum 13,000 MW of river (in-stream) and ocean-based (wave, current, tidal) hydrokinetic power by 2025. In short, there is an abundance of hydrokinetic potential in the U.S. ripe for development. A current update to that study estimates that 429 TWh could be provided each year in the U.S. alone.

In addition to our hydrokinetic resources, the U.S. is in a position to develop new waterpower resources at existing infrastructure and without building any new dams. According to the same EPRI study, there are roughly 7,300 MW of waterpower that could be developed at existing hydro sites or non-powered dams

by 2025. Combine that with the above mentioned hydrokinetic potential, the U.S. is sitting on over 20,000 MW of unused waterpower capacity, which is roughly the same amount of power provided by today's wind industry.

Lastly, the Department of Energy in an April 2004 report estimated that there are still over 175,000 MW of low head hydropower opportunities in the U.S. Combined, this generation would offset over 200 new large coal plants and increase the renewable output of the country to well over over 20 percent of current demand in a way that ensures protection of the environment and our marine life. Enacting clean energy policies, such as carbon legislation that values non-carbon emitting resources, will ensure that these megawatts are developed, which will help control greenhouse gas emissions and create an abundance of American jobs, bringing new life and innovation to our struggling American economy and job base.

Green Job Creation

I was asked to today focus on job creation that could result in the clean energy sector as a result of climate policy. The best way I can do that is to discuss the jobs that Hydro Green Energy has created at its first project, and to discuss what we expect in terms of future job creation as our company grows. What I will discuss, I will offer to the Committee, is only a fraction of what could be done with an aggressive expansion of new waterpower technologies in the United States. I would also like to inform the Committee that Navigant Consulting has been hired by a CEO Leadership Council within the National Hydropower Association to perform a jobs study, which should be available in a matter of months. We will be eager to share these results with Congress and this Committee in particular.

As I mentioned earlier, the development of the Hastings project resulted in a number of exciting, high-paying employment opportunities in several states. It also created work for those who had lost work to overseas competition. The employment activities that resulted from the Hastings project will be replicated on a much larger and more permanent scale as Hydro Green Energy's project portfolio grows. In other words, despite the great economic and employment uncertainty facing the United States workforce, Hydro Green Energy is providing work for Americans, creating local economic development and presenting exciting new opportunities to America's skilled workforce. And, we are eager to create more employment and economic activity.

Below are the brief highlights, by company and type of work, of the "green collar" employment activities (61 jobs in total) resulting from Hydro Green Energy's historic first project in Minnesota. As you can see, we created jobs in several states from a variety of skill sets.

- **Aluminum Alloys** (*Sinking Spring, PA*) – Foundry that handled the pouring of the blades for Hydro Green Energy's patented turbine.
- **TC/American** (*Waite Park, MN*) – Steel fabricator for the hydrokinetic units' superstructure. Turbine and array assembly.
- **Portable Barge Service** (*Newport, MN*) – Surveys, on-site final assembly and installation of the hydrokinetic power units. O&M service contract.
- **RPS Barge Company** (*Bagdad, KY*) – Barge manufacturing for hydrokinetic turbine array.
- **Manley Brothers** (*Valley Park, MO*) – Marine engineering and installation, with a focus on in-river industrial applications.
- **AA Precision Machine Company** (*Fall River, MA*) – Manufacturing and machining of the turbine shafts and hubs.
- **Normandeau Associates** (*Bedford, NH*) – Environmental consultants to Hydro Green Energy. Performing comprehensive fish mortality studies, mussel control plan, avian studies and water quality monitoring.
- **Concepts NREC** (*White River Junction, VT & Woburn, MA*) – Assisted in the final design of Hydro Green Energy's patented hydrokinetic system, comprehensive research & development on hydrokinetic systems, performed extensive engineering and modeling work and helped lead the entire fabrication and installation process for the Hastings project.

As stated above, these types of jobs will be replicated on much larger scale as future project sizes grow and as our project pipeline gets built out. The company also plans to hire as many as 20 employees in 2009. Today we are a company of three, and two years ago we were a company of one.

As I alluded to earlier in my testimony, Hydro Green Energy is presently developing Lock+ power projects. For our Lock+ technology, we have assembled job figures for those types of projects. At every project we build, and we are today developing seven projects, the expected jobs, by category and number of jobs, are as follows:

- Project Management and Operations (cost controls, quality assurance, scheduling, logistics): **11**

- Modeling and Design Phase (engineers and analysts – structural, power, mechanical, electrical, civil; independent review on all design features): **14-19**
- Procurement Phase (materials buyers): **5**
- Fabrication Phase (foundry workers, welders, machinists, steel fabricators, assembly, testing): **75**
- Installation Phase (construction workers, electricians, water transportation, site prep, cranes, foreman, QCIP manager, electrical, IT): **60**
- Operations, Maintenance, Information Processing and Security: **5-10**
- General Administration and Regulatory: **10**

As you can see, at each Lock+ project, we will create approximately 180 to 190 jobs. These jobs range in diversity and skill set, but they are all well-paying and desired jobs. For our seven current projects, we will create as many as 1,330 jobs. As I stated earlier, I am only highlighting to the Committee what Hydro Green Energy expects to accomplish on the job development front. There are scores of companies across the waterpower sector and other renewable energy sectors looking to do the same.

Policies That Will Ensure Aggressive Development of New Technologies and New American Jobs

Waterpower is emissions-free, renewable, reliable and domestic. If fully exploited, America's waterpower resources will substantially bolster the United States' efforts to reduce the impacts of climate change. Properly drafted carbon legislation that provides economic benefits to carbon-free technologies like ours will serve as a driver for economic growth and power project development. Such policy will also help coax some of the venture capital and debt finance that today is being held back from the marketplace. Even the mere idea of carbon policy being enacted this session is causing some of the largest power companies in the U.S. to enter into conversations with Hydro Green Energy about potential project partnerships. These are companies that would not talk to us several years ago, but I think we are all encouraged by the dialogue now taking place.

In order for promising clean energy technologies to rapidly advance in the near term, which is clearly in the interest of the U.S., federal incentives and policies are needed. The *Energy Independence and Security Act of 2007*, the *Emergency Economic Stabilization Act of 2008* and the *American Recovery and Reinvestment Act of 2009* all made tremendous strides in ensuring a more robust future the waterpower industry. Below, however, are additional policies that Hydro Green Energy believes Congress must adopt to further the role of waterpower technologies in our national energy strategy. While I understand that the focus of today's hearing is on climate policy (which I do mention), all of the policies mentioned below

will help drive activities to address climate change. Carbon legislation, while necessary and important, is not the only driver.

- Inclusion of all hydrokinetic power technologies, incremental hydropower and waterpower technologies at non-powered dams in climate change legislation;
- Section 45 Production Tax Credit parity for qualifying waterpower technologies of ARRA 2009;
- A long-term extension of the PTC for qualifying waterpower technologies;
- Inclusion of all hydrokinetic power technologies, incremental hydro and waterpower technologies at non-powered dams in a federal Renewable Portfolio Standard (RPS);
- A long-term extension of Clean Renewable Energy Bonds funding;
- Tax credits for companies investing in studies or monitoring programs that gather environmental performance data at installed new waterpower technology power projects;
- Significant research, development and deployment dollars from DOE specifically dedicated to advancing new waterpower technologies, with a special focus on better understanding environmental issues; and
- Compression of the licensing process for new waterpower technologies and compression of Clean Water Act Section 401 Certification timelines by 50 percent.

Closing

I want to again thank the Committee for inviting me to testify and for its attention to the issues before the Committee. It was a great pleasure to appear before the Committee today and Hydro Green Energy stands ready to work with the Committee in the future as its moves forward on crafting new energy and environmental policies. This Committee knows that America is in a position to lead the world in clean energy technology development, but only by taking more decisive action we will catch and surpass our Canadian and European counterparts in waterpower technology development. And by doing so, we will create an abundance of new jobs and help better tackle the environmental issues we face as a country in an increasingly competitive world.

Scores of companies like Hydro Green Energy are fighting every day to make progress and to provide the solutions you seek as federal policymakers. As I stated earlier, the adoption of aggressive policies at the federal level that recognize and financially value carbon-free energy sources will only serve spark the aggressive expansion of innovative clean energy companies and renewable energy power projects nationwide, creating a significant number of energy, environmental and economic benefits.

Thank you for your time.

Contact Information

If the members of the Committee or their staff would like additional information, please do not hesitate to contact Hydro Green Energy at your convenience. Contact information is found below.

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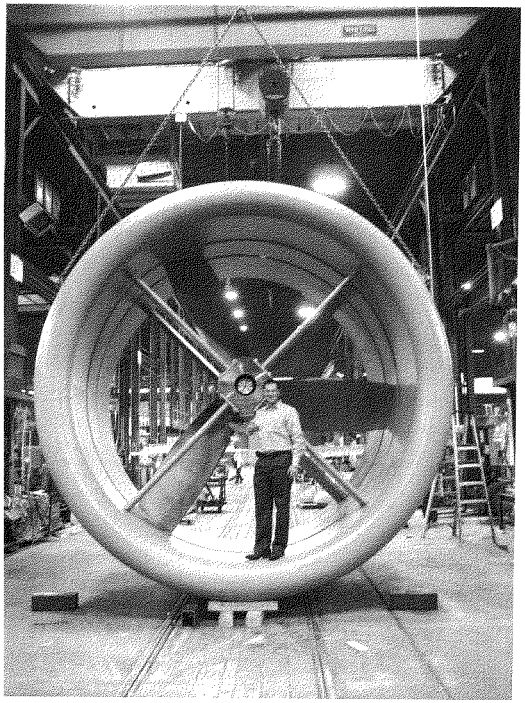
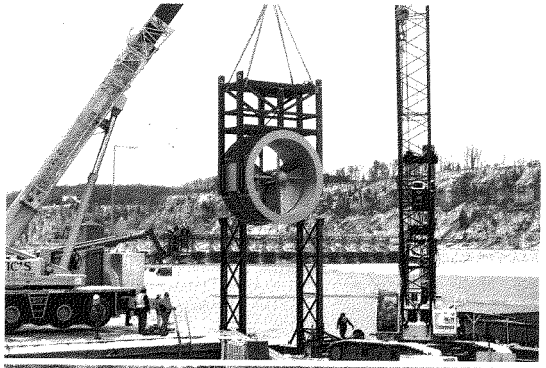
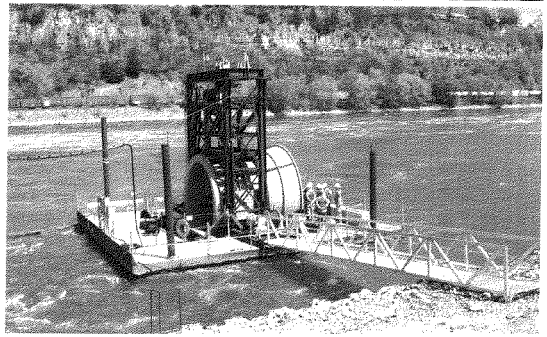
mark@hgenergy.com

The First Commercial Hydrokinetic Power Turbine in U.S. History
Mississippi River, Hastings, MN
2009

Hydro Green Energy







Senator KLOBUCHAR. Mr. Taylor, with your light.
[Laughter.]

STATEMENT OF RICHARD W. TAYLOR, CHIEF EXECUTIVE OFFICER OF IMBUE TECHNOLOGY SOLUTIONS, INC.

Mr. TAYLOR. Thank you, Madam Chair. I apologize to my fellow panelists for the bright light but I am excited to have the opportunity to enlighten the Committee on the benefits of LED lighting technology, Light Emitting Diode technology, and how it fits in the broader framework in the discussion around carbon cap-and-trade legislation.

My name is Richard Taylor. I am CEO of Imbue Technology Solutions, ImbuTec. We are headquartered in Pittsburgh, Pennsylvania and we provide energy efficient lighting technology products and services to commercial, industrial and municipal customers.

The reason why a discussion about LED lighting is important in the context of carbon cap-and-trade legislation is because, as several of the Committee members have pointed out, when you look at reducing carbon emissions, one of the most effective ways of doing that in the first instance is reducing energy consumption either through the use of energy efficiency technologies or through energy conservation. The lighting products that are before you are a great example of technology that can have a significant impact in that regard.

There are three reasons why the lights that you are looking at, and the other products made by Appalachian Lighting Systems out of Elwood City, Pennsylvania, should be of interest to you.

First of all, they are highly efficient. On average, products produced by Appalachian Lighting Systems reduce energy consumption by 80 percent or more. As you can see, the decorative acorn fixture, which is ubiquitous, you are looking at a light that replaces 150 watt fixture with 32 watts of energy drawn. The parking lot light, which still has the shield over it because clearly it would be very blinding, it is a fixture that draws 70 watts of power but replaces a light fixture that uses 400 watts of power, actually even more than that, 465 watts when you add in the ballast. So you are looking at significant reductions in energy consumption that benefit American consumers.

The second reason why these products are important is because they are made in America. Most LED lighting products are produced in China or Taiwan, or they are made by manufacturers that rely on Chinese or Taiwanese components to make them. Seventy-five percent or more of the components of these products are from American companies. And if anyone likes to cook, you know that if you are going to make something, the quality of the ingredients that go into the product really help to produce a better result. What you find with LED technology is that the American components are of a much higher quality component and the enable the products to produce as advertised.

That brings me to the next reason why this is important. It is the technology that drives these lighting products that is a quintessential example of American ingenuity. What Appalachian Lighting has done is patented the process of dissipating heat in these light fixtures. By dissipating heat in the fixtures and allow-

ing these fixtures to operate cooler, you get dramatically longer life out the fixtures. In fact, these fixtures will operate, maintenance free, for 20 to 25 years and that is an extremely conservative estimate.

To give you an example of the impact of these types of products, I will share with you an example of a project we recently completed converting the lighting in the Allegheny County Jail in Pittsburgh, Pennsylvania. As a result of that conversion to LED lighting, and this, by the way, is the largest interior LED lighting conversion in the Country, Allegheny County reduced its energy consumption by 83 percent, again with fixtures that will be maintenance free for 20 to 25 years. Not only does the county benefit from the reduced energy consumption, but they also benefit from reduced operating expenses because you do not have to buy or stock bulbs and ballast and you do not have to pay for the labor to change them out. So, long after they realize the return on the investment, which is just over 5 years, the county will continue to reap dramatic reductions in energy consumption and operational savings.

When you look at the impact of this type of technology, it has a very significant impact throughout the supply chain on American jobs. So I use the Allegheny County project as an example. Not only did we put Union electricians to work doing the installation, there was also a positive impact in the manufacturing of the fixtures themselves.

When you look at American-made ingenuity, there is an impact in the supply chain that really has a geographic diversity as diverse as the composition of this Committee. For example, the circuit boards in these fixtures are produced by The Berquist Company in Minneapolis, Minnesota, lenses produced by Jamestown Plastics in Brocton, New York, housing and lenses from Lumax Industries in Altoona, Pennsylvania, Lytech Solutions in Salem, Oregon producer the drivers, the control boards and the LED chip-mounting services. Transformers are made by MCI Transformers in Babylon, New York. Peres Pattern Company in Erie, Pennsylvania produces castings. Housing, reflectors and lenses are made by the Warren Company in Erie, Pennsylvania and the LED lighting chips themselves are made by the Cree Company in Durham, North Carolina.

This ripple effect throughout the supply chain with expanded use of energy efficient technologies has the benefit of not only providing significant benefits to the end users, but also has a positive impact on job and employment throughout the Country.

Thank you for the opportunity to be with you.

[The prepared statement of Mr. Taylor follows:]

Prepared Testimony of

Richard W. Taylor

President, ImbuTec Inc.

Hearing on Business Opportunities and Climate Policy

Before the U.S. Senate Committee on Environment and Public Works

May 19th, 2009

Madame Chair and Members of the Committee:

It is an honor to appear before the Committee today to shed light on the significant business opportunities presented by the proposed climate change legislation for the Light Emitting Diode ("LED") lighting industry. My name is Richard W. Taylor, CEO of Imbue Technology Solutions, Inc. ("ImbuTec"), headquartered in Pittsburgh, Pennsylvania. ImbuTec provides energy-efficient lighting technology products and services to commercial, industrial, and municipal customers.

As a distributor and installer of energy-efficient lighting solutions, I can share the perspective of both the manufacturer who supplies our products, and the end-users who purchase them. As lighting technology continues to evolve, we are always in search of the most cost-effective lighting solutions for our customers. At this point in the technological evolution, it is clear that LED lighting provides the best return on investment to our customers who are seeking to replace High Intensity Discharge ("HID") lighting sources like high pressure sodium or metal halide lighting fixtures. This is because LED lighting sources yield dramatic reductions in energy consumption, and last much longer than HID light sources.

At the outset, I think it will be helpful to give context as to why a policy shift that encourages reductions in carbon emissions will positively impact the market for LED lighting technology, as well as many other energy-efficient products. One of the simplest and most effective ways to reduce carbon emissions is to reduce the demand for electricity. As I will discuss in more detail later, the LED

lighting products ImbuTec markets require, on average, 80% less energy to produce the same level of light as conventional HID lighting sources. By dramatically reducing the amount of energy needed to accomplish the same task, there is less demand for electric power generators to meet. The electricity that is required to power lighting is the most constant energy load in commercial buildings, often greater than heating, ventilation and cooling demands ("HVAC"), and reducing that energy load with LED lighting sources will have a significant impact on overall demand for electricity. Consequently, expanded use of energy-efficient lighting technology is one of the most immediate and cost-effective solutions for reducing energy consumption, and, therefore, carbon emissions.

Technology

There are a growing number of manufacturers who are entering the market to produce LED lighting products. In order to provide a reliable solution for our customers, however, ImbuTec has chosen to market exclusively the LED products produced by Appalachian Lighting Systems, Inc. ("ALSI"), which is also, coincidentally, headquartered in Western Pennsylvania. We have found ALSI's products to be superior to other LED manufacturers for several reasons that are important for the Committee to consider, including their technological superiority and their higher quality domestic production.

First, ALSI holds or has pending several cutting-edge patented innovations in LED lighting that provide a useful life of their products of at least twenty years. Among ALSI's key, patented design innovations are those that allow for dissipation of heat within the core fixture, how the LEDs are

electronically "driven", and how a multiplier effect of light output occurs by use of reflectors, rather than use of lenses. By significantly reducing the operating temperature of the fixture, very efficiently driving the LEDs, and providing for efficient heat dissipation from the core unit (separate from the outer enclosure skin), the integrated fixture design has a dramatically longer operating life. This is a critical point that bears further examination. As with all electronic products, heat within the unit shortens the operating life. The failure rate for most electronic components will *double* for every 10°C increase in temperature. This is true for both the LEDs and for the power supply. LED chip manufacturers have demonstrated that at a junction temperature of 125°C, one can expect to get 50,000 hours of operation life and the light output will have *degraded by 30%*. Conversely, for every 10°C reduction in operating temperature below 125°C at the junction, one can expect to double the operating life.

ALSI's products are designed to take advantage of this fundamental, temperature-related characteristic of electronic components. For example, the ALSI Type III streetlight design, at an ambient temperature of 25°C, the LED junction temperature is approximately 85°C. As such, these fixtures will see only a 1-3% light degradation over a 50,000 hour period as compared to upwards of 30% for other LED lighting manufacturers, and they will easily attain a useful life in excess of 100,000 hours.

Another key consideration is that at least 75% of the components of ALSI's products are made in the United States. Although it is well-known that American components provide superior quality, most LED manufacturers are

based in China or Taiwan, or they primarily utilize cheaper components produced in Asia. By using higher-quality domestic components, ALSI's products provide a much greater level of reliability and consistency in their performance.

Another advantage of LED lighting generally is its overall environmental impact. LED products do *not* contain mercury, as is the case with Metal Halide, Induction and fluorescent lighting products. Therefore, when LED products are disposed of, they do not have to be treated as a hazardous waste and comply with the expensive, complex regulations that govern hazardous disposals. As concern mounts about increasing levels of mercury in the environment, the Obama Administration has begun calling for even greater limitations on the use of mercury across-the-board.

Besides its technical performance, ALSI's fixtures also offer important operating features that help further reduce their cost of operation. The street light fixtures contain a computer chip that can be programmed to reduce the amount of energy consumption at a designated time. For example, the street lights can be programmed to reduce power by an additional 20-80% at some point in the late evening or early morning when the reduction in light levels is deemed acceptable to the community. Also, ALSI has patented a rapid change out process. In the unlikely event that there is a defective strip of LEDs, this allows them to be replaced in the field, as opposed to replacing the entire fixture, or sending the fixture to the factory. These two features combined yield additional savings in both energy and operating expenses.

Savings

The combination of ALSI's technology and workmanship results in products that reduce energy consumption, on average, by 80% as compared to conventional HID lighting sources. I have attached a chart titled "LED Lighting Energy Savings" that shows the reduction in energy consumption a customer can expect to realize by converting to LED technology. In addition to significant energy savings, these products also yield significant operational savings to our customers, because they don't have to stock and/or replace light bulbs or ballasts for twenty years, or expend the labor to do it. By providing substantial energy and operational savings, a customer will generally realize a return on their investment in five years or less, even though LED products are more expensive than the technology they replace. Long after the payback period, however, the customer will continue to realize dramatic cost reductions.

Applications

There are a number of applications for which LED lighting is appropriate. They include parking lot lighting, street lighting, parking garage lighting, tunnel lighting, warehouse lighting, and exterior, wall-mounted fixtures.

Customer Testimonials

In order to demonstrate how this technology benefits our customers, I will share just two examples. The first is the Allegheny County Jail in Pittsburgh, Pennsylvania. Like all corrections facilities, the Allegheny County Jail incurs significant energy expense, because its facilities must be lit 24 hours/day. Faced

with rising fiscal challenges, County officials were looking for ways to reduce operating expenses at the jail, and ImbuTec proposed converting the lighting in the prison pods, the parking garage, and the recreational areas to LED lighting. As a result of the conversion, which was completed in March of 2009, the jail realized an 83% reduction in energy consumption to light those areas, and the fixtures have a maintenance-free expected life of 20-25 years. In addition, light levels actually increased by 20%. The total cost of the project was $954,700, but the County will realize savings of at least $178,000 per year, thereby realizing a return on its investment in just over 5 years. As the attached press release from Allegheny County Executive Dan Onorato demonstrates, this project helped advance the goal of "greening" the County's facilities, operating facilities more efficiently, and providing a sound return on the investment of public dollars. This is believed to be the largest installation of interior LED lighting in the United States.

Another example comes from the municipality of Ellwood City, Pennsylvania, which is north of Pittsburgh. In 2007, Ellwood City began converting 135 street lights to ALSI's LED street light fixtures, and they completed the conversions in 2008. Like most municipal governments, Ellwood City was looking for ways to operate more efficiently so as to avoid having to raise tax rates. In order to monitor the savings, Ellwood City placed special meters on two of the LED fixtures. Dom Vicari, Ellwood City's Borough Manager, reports that, "our two metered LED lights were using 7 and 13 KW range per month, respectively, compared to: 175 watt mercury vapor, 39 KW, and 250

[watt] HPS using 61 KW - all in that range, month after month, dating back to when they were first metered on January 28, 2008." This reflects a savings of 82% and 79%, respectively.

Jobs

One of the most noteworthy impacts of the expanding market for LED lighting is the increase in domestic employment throughout the supply chain. As the attached list of supply chain vendors demonstrates, ALSI purchases supplies from ten companies in six states, including Illinois, Minnesota, New York, North Carolina, Oregon, and Pennsylvania. As demand for ALSI's products grows so will the need for ALSI, as well as its suppliers, to hire more skilled workers to produce the components, and assemble the finished product. In addition, companies like ImbuTec will have greater demand for installing these products, necessitating us to hire the skilled electricians and electrical subcontractors needed to ensure that the work is done properly. This expanded employment across the LED product's supply chain has a positive impact on the local economies in each of these communities. This impact is not only limited to ALSI's manufacturing/assembly facility in Pennsylvania. It extends to the companies that provide the LED chips, circuit boards, power supplies, transformers, gaskets, housings, lenses, and control boards. All these jobs are "clean energy" jobs. And I see a bright future for these companies that are able to produce superior products which can be sold into the global stream of commerce.

Conclusion

For many years now, policy makers have been struggling to find the spark to reignite the industrial core of America. At the same time, debates have raged about how advances in environmental policy result in greater domestic job losses. As it relates to energy-efficient LED lighting technology, this old construct does not hold. Limits on carbon emissions will create additional demand for energy-efficient technology solutions, and will create more customers for Imbutec and ALSI. This will spur investment and job creation in the manufacturing supply chains for our products, as well as in the skilled trades that deploy them. Finally, in addition to adopting policies to limit carbon emissions, the federal government ought to consider becoming a customer as well.

Appendix I:

Appalachian Lighting Systems Inc. suppliers

Appalachian Lighting Systems, Inc.
101 Randolph Street
Ellwood City, PA 16117

	US Vendors/Manufacturers	Component(s)	Purchased Through
1	A.L.P Lighting Components, Inc. PO Box 95023 Palatine, IL 60095-0023	Housings & Lenses	Direct
2	The Bergquist Company SDS 12-1021 PO Box 86 Minneapolis, MN 55486-1021	Circuit boards	Direct
3	Jamestown Plastics 8806 Highland Ave PO Box U Brocton, NY 14716-0680	Lenses	Direct
4	Lumax Industries, Inc. PO Box 991 Altoona, PA 16603-0991	Housings & Lenses	Direct
5	Lytech Solutions 3915 Fairview Industrial Dr. SE Salem, Oregon 97302	Drivers, Control Boards, LED Chip Mounting Services	Direct
6	MCI Transformers 411 Manhattan Avenue Babylon, NY 11704	Transformers	Direct
7	Peres Pattern 1502 Cherry St Erie, PA 16502	Castings	Direct
8	Stockwell Elastomerics, Inc. 4749 Tolbut Street Philadelphia, PA 19136	Gaskets	Direct
9	The Warren Company	Housings, Reflectors,	Direct

-	PO Box 8440 Erie, PA 16505		Lenses	
-				
10	Cree 4600 Silicon Drive Durham, NC 27703		LED Chips	Arrow Electronics
-				

Appendix II:

LED Savings Chart

LED Lighting Energy Savings

IMBUTEC
Phone 412.322.8832 . Fax 412.322.1130
920 North Lincoln Avenue . Pittsburgh PA 15233
Contact us at: sales@imbutec.com
Or visit us at: www.imbutec.com

Application	Replaces Current Fixture	LED Wattage	% Savings
Parking Lot Light	250 Watt HID Fixtures (+45W ballast)=295 400 Watt HID Fixtures (+65W ballast)=465	35 70	*88* *85*
Canopy/Parking Garage Light	70 Watt HID Fixtures (+20W ballast)=90 100 Watt HID Fixtures (+29W ballast)=129 150 Watt HID Fixtures (+35W ballast)=185	24 24 24	*74* *82* *87*
Decorative Acorn Post Top	70 Watt HID Fixtures (+20W ballast)=90 100 Watt HID Fixtures (+29W ballast)=129 150 Watt HID Fixtures (+35W ballast)=185 175 Watt HID Fixtures (+35W ballast)= 210	32 32 32 32	*64* *75* *83* *85*
Street Light ††	250 Watt HID Fixtures (+45W ballast)=295 400 Watt HID Fixtures (+65W ballast)=465	70 91	*76* *80*
Warehouse Light	250 Watt HID Fixtures (+45W ballast)=295 400 Watt HID Fixtures (+65W ballast)=465	70 91	*76* *80*
LED Wall Pack	70 Watt HID Fixtures (+20W ballast)=90 100 Watt HID Fixtures (+29W ballast)=129 150 Watt HID Fixtures (+35W ballast)=185	24 24 24	*74* *82* *87*
LED Vertical Wall Pack	50 Watt HID Fixtures (+19W ballast)=69 70 Watt HID Fixtures (+20W ballast)=90	9 9	*87* *90*

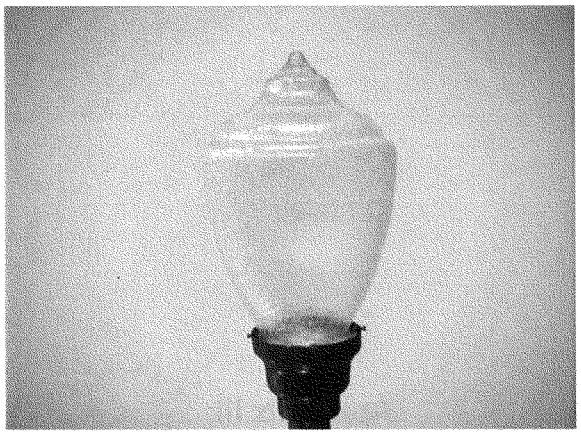
†† Additional energy savings can be achieved by utilizing the power down chip to lower light output during off-peak periods, e.g. 2 am–dawn.

**** Life expectancy of our LED fixtures is 20+ years and they are maintenance FREE. ****
The actual return on investment is significantly higher when operational savings are taken into account.

Appendix III:

Examples of LED Lighting Products

LED Lamp Post



LED Parking Lot Light

Appendix IV:

Press Release From Allegheny County Jail Lighting Project

COUNTY OF ALLEGHENY

OFFICE OF THE COUNTY EXECUTIVE

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DAN ONORATO
COUNTY EXECUTIVE

FOR IMMEDIATE RELEASE:
March 2, 2009

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Onorato Unveils "Green" Lighting Project at County Jail

County pursuing federal stimulus money for similar energy-saving projects at other facilities

PITTSBURGH — Allegheny County Executive Dan Onorato today unveiled new "green" lighting at the County Jail. More than 805 light fixtures were replaced with high-efficiency LED lights, which will consume 83 percent less energy, the equivalent of reducing the County's energy consumption by 184 kilowatts.

"The green lighting project at the jail is a win-win for Allegheny County," said Onorato. "We're increasing energy efficiency while decreasing costs to taxpayers. When I launched Allegheny Green, I promised that Allegheny County would lead by example, and we're doing just that. We will continue to look for ways to operate government more efficiently and environmentally friendly."

The cutting-edge, patented LED fixtures were installed in the pod areas of the jail where lights are required to remain on 24 hours a day. The LED lights are expected to last 20 to 25 years with a projected savings of more than $178,000 in the first year.

"In addition to the energy and cost savings, we're also looking forward to being more efficient with staff time," said Warden Ramon Rustin. "The life expectancy of the LEDs means we no longer have to purchase and store extra bulbs, and we'll cut down on the time spent changing bulbs as well."

The LED fixtures are manufactured by Appalachian Lighting Systems in Ellwood City, and 75 percent of the fixture components are produced in the United States. Pittsburgh-based ImbuTec Inc., an energy solutions company and minority business enterprise, served as project manager.

"Everything we do at ImbuTec is focused on saving money for our commercial, industrial and municipal customers, and we are pleased to bring this cutting-edge, locally-produced green technology to the market," said ImbuTec Chief Executive Officer Richard Taylor. "As the

– more –

County seeks to achieve greater energy savings, our LED products can address many interior and exterior lighting applications, such as parking garages, parking lots, street lights and warehouse lighting."

"Allegheny County will pursue federal stimulus money for similar energy-saving projects in our other facilities," added Onorato. "With these cutting-edge companies right here in Southwestern Pennsylvania, we will be stimulating our economy by putting local people to work."

The lights were installed by Sargent Electric. The total cost of the project was $954,000.

# # #

Allegheny Green is a comprehensive initiative to promote sustainable practices within County government and through countywide policies and programs. The key elements of the plan are the hiring of a sustainability manager reporting directly to the County Executive and creation of the Allegheny Green Action Team, a group of experts and stakeholders who will help the County to meet its green objectives and goals.

Appalachian Lighting Systems Inc. (ALSI) specializes in the development and manufacture of high-powered, ultra energy-efficient light emitting diode (LED) lighting fixtures. With research, development and production facilities located in Ellwood City, Pennsylvania, ALSI has developed several products using cutting-edge, patented technology. ALSI products include next generation streetlights, warehouse lighting, sign illumination, parking lot, parking garage lighting, tunnel lighting, indoor office lighting, and other specialty lighting applications. For additional information, visit www.appalachianlightingsystems.com.

Imbue Technology Solutions Inc. (ImbuTec) is an energy solutions company focused on helping commercial and institutional customers reduce operating expenses. ImbuTec operates through three divisions: lighting and energy solutions; public utility solutions; and electrical supplies. In addition, ImbuTec is actively involved in the development and deployment of energy-efficient lighting technologies that dramatically reduce energy consumption, as well as operating expenses in commercial, industrial and institutional applications. For additional information, visit www.imbutec.com.

Appendix V:

LED Lighting FAQ

AL-LED

Frequently Asked Questions

What is an LED?

LED is short for Light-Emitting Diode. An LED is a semiconductor diode that emits light when current is passed through it. LEDs have been used since the 1970's as indicator lights on electronic products. Recently the efficiency, reliability, and light output of LEDs have improved to the point where they are not only useful for general lighting applications but are becoming a long term and 'green' alternative to most other forms of lighting applications.

Where are LEDs used to provide lighting?

LEDs are used for general illumination, aesthetic, effect, or specialty lighting applications, including architectural highlighting. Traffic lights and exit signs also now use red, yellow, green or blue LEDs. ALSI has focused its LED lighting technology into commercial applications where long lasting, efficient, and generally maintenance free lighting is needed to illuminate streets, highways, parking areas, building exteriors, signs, warehousing, and office or other interior areas.

Have LEDs always been used in general illumination lighting?

No. Only now has LED technology advanced to the point where using LEDs is a viable option for general illumination. ALSI has applied this LED technology to an engineered product line via a series of patent pending innovations.

Why have past attempts to create general-illumination LEDs failed?

People started by trying to *retrofit existing fixtures*, working from a flawed principle of "lowest initial cost" as the primary design criteria, and then claiming such fixtures would last much longer than the existing fixtures they were seeking to replace. Further, existing 'non LED' light fixtures are generally very low cost, typically have a high operating temperature, and have little or no suitable fixture design to thermally dissipate the heat that is built up. LED companies made the fundamental error of designing general illumination product around a premise of 'form over function' so that the fixture had the *appearance* of the existing 'non LED' fixtures, without addressing the fundamental enemy of the LED - heat. We will address in more detail the issue of heat and LEDs later. Critically, the companies failed to understand and respect the nature of an LED, and as a result applied flawed engineering principles. In most cases, early designers failed to make the distinction regarding temperature and current control, and their affects on LED performance and longevity.

ALSI has built its entire product design around a 'function, then form' principle, and to be able keep the LED operating at a temperature and efficiency level that will provide for many years of maintenance free performance.

Why don't LEDs function correctly in traditional fixture housings?

One of the design criteria for a conventional housing is to prevent injury to the user or to prevent starting a fire. Traditionally, only enough cooling is provided to keep the body of the housing at a user-safe level. Therefore, high internal temperatures are common with such fixtures.

To operate at a temperature that supports LED longevity, *an LED fixture must provide a direct thermal path to conduct the generated heat efficiently to the surrounding ambient air.* This is accomplished by designing a large cooling surface area for heat radiation and conduction. This approach is fundamental to ALSI fixture designs, as will be addressed later.

What are the advantages of using LED lights?

With a correctly designed fixture:

- LEDs yield very high energy-efficiency, ruggedness, and superior life, as compared to other light sources.
- Required maintenance on such correctly designed fixtures is greatly reduced.
- Energy savings and maintenance savings combine to yield an overall reduction in cost of ownership, as compared to other light sources.
- LED lights are 'green' in that they utilize no hazardous materials. Mercury is a bi-product of a significant number of non LED lights on the market today. Disposal of such fixtures has become a significant environmental problem.

How does one evaluate LED products?

To fully evaluate an LED product *one must understand the individual components as well as overall system efficiency, from the power input to the light output.* That is the overall *efficacy* of the luminaire. We must also understand the difference between catastrophic failure, as experienced with conventional light sources, and the *slow depreciation of light output over time,* as it applies to LED light sources.

The US Department of Energy concluded in its Solid-State Lighting Commercial Product Testing Program that: "Until the field of SSL (solid state lighting) technologies and supporting knowledge matures, any claims regarding performance of SSL luminaires should be based on overall luminaire efficacy (i.e., from testing of the entire luminaire, including LEDs, drivers, heat sinks, optical lenses and housing), to avoid misleading buyers and causing long-term damage to the SSL market."

Most LED lighting companies have designed product that has poor *longer term* efficacy. Initially, the product may operate relatively efficiently, but because the designs have not correctly addressed the long term impact of heat in depreciating the LED light output and LED life, such designs clearly run the risk of adversely impacting the migration from conventional lighting product to LED general illumination product.

ALSI believes its patent pending designs and innovations have correctly addressed efficacy to allow its product to outlast its competitors with a generally maintenance free life of up to 100,000 hours or more.

What is the distinction between efficacy and efficiency?

Efficacy is a term used when the input and output units of measurement differ. In lighting, the light produced in lumens is compared to the electricity input in watts. The resulting measure of performance is expressed in Lumens per Watt.

Efficiency is a dimensionless term used when input and output units of measure are the same. Lighting fixture optical efficiency is the ratio of the total lumens exiting the fixture to the total lumens produced by the light source. Power supply efficiency is the ratio of power delivered to the load to the power taken from the electricity source

What happens if LED fixtures fail?

Most of the fixtures now being offered for sale must be removed from service and repaired by the manufacturer, or (more than likely) discarded. ALSI has designed their fixtures with the intent of *preserving the value of the customer's investment over the very long term.*

ALSI's patented *Rapid Change* capability offers unparalleled ability for the customer to be able to remove individual components, replace failed components, and put the fixture back in service in rapid fashion. ALSI also provides failure analysis of fixture components to determine the cause of failure and allow design improvement to occur based on the data collected.

Repair kits, tool kits, and repair training classes are offered to ALSI customers who wish to be responsible for maintaining their light fixtures without returning them to the factory.

Can LED fixtures impact radio or television reception in their area of operation?

Yes, that is possible with a poorly designed power supply or current control regulator circuit in LED lighting fixtures. ALSI's light fixtures pass the most stringent of FCC (Part 15 Level B) and international regulations. (CISPR22). When evaluating LED product being offered by other manufacturers, any potential buyer should be very careful to evaluate whether such product passes these standards.

How does lightning or other transient spikes impact operation of an LED fixture?

If a typical power supply is used for outdoor lighting, transients on the power line will cause instant failure. Most commercially available power supplies are tested to withstand typical indoor transients of 1000 volts. This is a minimal level needed to get past a short warranty period operation in a well protected building environment. It is grossly insufficient for outdoor applications.

ALSI's power supplies are designed to withstand transient events up to 6000 volts, in accordance with the specification ANSI / IEEE C62.41 level B3. This gives a very high probability of survival for up to 30 years in outdoor environments.

Why is the power supply for an LED fixture critical to the long operating life of the fixture?

The power supply *and* LED current regulators must create a precise electrical environment to assure LED longevity. An LED does not typically fail like an incandescent bulb, suddenly leaving no light. An LED fails by slowly diminishing light output over time. Protecting the LED from damaging electrical events and controlling its operating conditions is the primary purpose of the power supply.

If we were to compare the life expectancy of a well designed power supply to the life expectancy of an LED we will find that the power supply is between 100 and 500 times more likely to fail, for example, within a 10-year period. ALSI power supplies are designed to operate in difficult environments and last as long (or longer) than the LED.

Why are ALSI's patented reflector designs critical to efficient use of its fixtures?

The intention of a light fixture is to put light where you want it. This can be accomplished with lenses or reflectors, or both.

During ALSI's initial design and development efforts we discovered that we could get *more* light, and *better control* of the light, at the working surfaces, by using carefully designed reflectors. It also became clear that we needed to modify the light patterns depending on the application of the light fixture. This is very evident if you consider the difference between a sidewalk light and a parking lot light. One requires directing a narrow beam of light from side to side, and the other requires flooding a large area.

ALSI has evolved and patented a selection of reflectors for different applications and techniques for creating new reflector designs, based on customer requirements.

What is "junction temperature"?

Junction temperature is the temperature internal to the LED chip. Junction temperature is a critical measure for evaluating an LED lighting product's ability to deliver long life.

The US Department of Energy advises: "Heat management and an awareness of the operating environment are critical considerations to the design and application of LED luminaires for general illumination. Successful products will use superior heat sink designs to dissipate heat, and minimize junction temperature. Keeping the junction temperature *as low as possible*, and within manufacturer specifications, is necessary to maximize the

performance potential of LEDs." That DOE statement is the Mission Statement for ALSI and is strictly incorporated into the design and engineering of its product.

How does ambient temperature affect LED efficiency?

As an LED's junction temperature gets hotter, its light output will be diminished. At a 135° C junction temperature, the LED will meet the manufacturer's specifications.

Operating an LED at high temperature results in lower initial light output *and a much shorter life*. ALSI's fixtures are designed with thermal properties and electronic components to minimize light loss and maximize life by *operating the LEDs at a consistently lower temperature*.

Why is the operating temperature critical to the life of the LED fixture?

The failure rate for most electronic components will *double* for every 10 °C increase in temperature. This is true for both the LEDs and of the power supply. LED manufacturers have demonstrated that at an LED junction temperature of 135 °C we can expect to get 50,000 hours of operation before the light output will have *degraded by approximately 30%*.

However, the above "10 °C" rule suggests that if we operate the LED at 85 °C we will *extend* the 30% light-degradation interval out to about 16 x 50,000 hours, or about 800,000 hours. As the LED manufacturers' accelerated life tests continue, we can expect this result to be verified by actual test data.

ALSI's light fixtures are designed to take advantage of this fundamental, temperature-related characteristic of electronic components. For a typical ALSI street light design, at an ambient temperature of 20 °C, the LED junction temperature is approximately 85 °C. As such, we believe we can project that ALSI fixtures will see only a

1 to 3 percent degradation over a 50,000 hour period as compared to upwards of 30 percent by other LED lighting companies

How are LEDs able to outperform HID?

Think of a simple source of light, like a traditional incandescent light bulb, surrounded by a sphere. Light is given off in all directions and illuminates the inside of the sphere almost equally. With an LED, the light is directional, and is given off predominantly in one direction. If the LED points downward, imagine that the top of the sphere will be quite dark. If our working surface is below the sphere we will get almost as much light on the working surface, by starting with a light source of half the intensity of a traditional light source.

This is not a fully accurate model but it does express the principle. In reality, the conventional source will probably have a reflector in an attempt to redirect some of the upward and sideways light downwards. However, the LED light may also have a lens or reflector to concentrate the light at the working surface.

One advantage of the LED light is that the side glare is significantly reduced compared to a conventional light source. Again, imagine the inside of the sphere. This is quite beneficial for cities with "Dark Sky" initiatives.

In an ALSI light fixture using reflectors, we can quite accurately direct light where it is needed. We have successfully replaced 200 Watt metal-halide lamps with 85 watts of LED light source, and yet put more light on the working surface at the same time.

Do I have to replace LED diodes?

Probably not. It is not really practical since the assembly process for the individual diode requires precision control of temperature and excellent process cleanliness. A more important question is to consider the arrangement of

LEDs within the fixture. Do you remember the old Christmas tree lights where one bulb goes out and all of the lights in the string go off? If all the LEDS are connected in series, one could get the same affect.

ALSI street lights are designed with multiple strings of LEDs to minimize this possibility. Each string has its' own current regulator, and if we were to lose one string the other strings would continue to function correctly. Further, because of ALSI's patented *Rapid Change* capability, should a string of LED's fail the LED board can be easily removed and replaced without losing the entire fixture.

Why is the life span of an LED measured as "lumen depreciation"?

The LED doesn't burn out in the conventional sense. To have a way of describing what happens, product life is measured as lumen depreciation. The life span of an LED is much longer than that of incandescent, fluorescent or HID lamps. Fluorescent or HID light sources also show a reduction in light output before they fail completely.

The concept of lumen depreciation is not new. The Illuminating Engineering Society of North America (IES) current standard for calculating the life of an LED is the operating time at which the LED light output is reduced by 30%.

If a fixture is rated for 100,000 hours how long will it last?

That is based on how long a fixture is illuminated per day.

Hours of Operation:	100,000 hours is:
24 hours per day	11.4 years
18 hours per day	14.8 years
12 hours per day	22.8 years
8 hours per day	34.2 years

Senator KLOBUCHAR. Thank you very much, Mr. Taylor.

Mr. Armstrong.

STATEMENT OF JACK ARMSTRONG, CONSTRUCTION INITIATIVE LEADER, NORTH AMERICA, BASF CORPORATION

Mr. ARMSTRONG. Good morning, Madam Chairman and members of the Committee. Thank you for inviting BASF to talk about business opportunities in the context of climate protection today.

As a company formed over 140 years ago, BASF Corporation, the North American subsidiary of BASF SE, is the largest chemical company in the world. We have products that stretch across the spectrum of commerce from foam insulations to pigments and coatings and sealants to herbicides and fertilizers, to ingredients for cosmetics and nutrition. We have facilities in over 30 States employing over 15,000 people in the U.S.

In the words of our global chairman, Dr. Jurgen Hambrecht, "A business cannot be successful in the long term if it does not act responsibly toward the environment and society." This is why sustainability is an integral role of BASF's strategy.

And in fact, Madam Chairman, BASF products save three times more carbon dioxide during their life than is produced by their manufacturer and disposal. So, in essence, BASF has a virtual negative carbon footprint.

Climate change is certainly a global problem requiring global solutions and we support congressional action to address climate change and lower greenhouse gas emissions.

But what I would like to talk about today is about how BASF chemistry is used to reduce greenhouse gases and protect our climate, chemistry that reduces nitrous oxide in agriculture, plastics and coating for smooth low-friction blades on wind turbines, auto emission reduction technologies like catalytic converters, plastics and additives for sustainable transportation in roads and bridges. My written testimony certainly details work of ours in all of these areas. Suffice it to say that each one offers significant growth, not only for BASF, but for our customers. And the ultimate beneficiary is the environment and certainly the American consumer who saves energy and who saves money.

Many more consumers, though, could save a great deal of money by having sustainable building enclosures in their commercial spaces and in their residences. By this what I mean are the foundations, the walls, the roof, the ceilings, the floors and doors of a structure. This is my particular area of focus at BASF.

Department of Energy studies have shown that 40 percent of the energy we use for air conditioning and heating is lost in buildings and homes due to uncontrolled air leakage through just these same building enclosures and air duct systems. BASF chemistry improves insulation, sealants, wall and roof systems and coatings on doors and windows which aid significantly to keep the cold air in in the summer time and the hot air in certainly in the wintertime. And these integrated efficient high-performance systems allow smaller cooler and heating equipment which can be used less and save anywhere from 30 to 80 percent energy.

Improving energy performance in existing 130 million homes and 5 million buildings offers perhaps the most immediate, and cer-

tainly the most cost effective opportunity, for reduction of greenhouse gases by improving energy efficiency.

Our chemistry solutions got into both new homes and existing buildings and certainly many new jobs will be created by the construction and the retrofit, the energy auditing and product manufacturing required to update these many buildings in the building stock.

Some of the new innovations that BASF is commercializing to help the Country make the transition to a clean energy future are items like: organic solar cells that use organic compounds to trap the sunlight and turn it into electric energy; fuel cells that use the clean reaction between hydrogen and oxygen to produce energy. We just opened a factory in New Jersey; and lithium-ion battery technologies that will power the next generation of electric vehicles. I am glad to say that we are in the process of working to open a factory in Ohio for this.

BASF is certainly proud to take what was once science fiction and turn it into commercial reality, demonstrating really that climate protection and social responsibility, combined with economic growth, is an achievable goal. A sound chemical industry is certainly mandatory to achieve these ambitious and sustainable targets as it delivers innovative products and solutions to all the consumer segments for efficient growth and development of our society.

So, BASF welcomes the opportunity to work with this Committee on legislation that not only protects our climate, but ensures our Nation can press forward with its economic recovery.

Thank you.

[The prepared statement of Mr. Armstrong follows:]

BASF
The Chemical Company

Business Opportunities and Climate Policy

Testimony of Jack Armstrong
Construction Initiative Leader, North America
BASF Corporation

U.S. Senate Committee on Environment & Public Works
May 19, 2009

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Helping Make Products Better™

Madam Chairman, Senator Inhofe, and Members of the Committee:

BASF appreciates the opportunity to present its views to the Committee on Environment and Public Works on business opportunities and climate policy.

My name is Jack Armstrong. I am the construction initiative leader in North America for BASF Corporation. In this capacity, I am responsible for educating BASF customers and governments about the enormous potential for energy efficient solutions for the building and construction industry.

For BASF, there are many business opportunities in climate protection policy. These opportunities include, but are not limited to, chemistry for --

- Agriculture, which, for example, significantly reduces emission of nitrous oxide.
- Special plastics and coatings for smooth, low-friction rotor blades on wind turbines.
- Auto emission reduction technologies.
- Plastics and additives for more sustainable transportation and infrastructure.
- Efficient and environmentally friendly materials for insulation, sealants, and coatings.

BASF: The Chemical Company

BASF Corporation is the North American affiliate of BASF SE, Ludwigshafen, Germany. BASF is the world's leading chemical company: *The Chemical Company*. Our portfolio includes chemicals, plastics, performance products, agricultural products and fine chemicals. As a reliable partner to virtually all industries, BASF's high-value products and intelligent system solutions help its customers to be more successful. BASF develops new technologies and uses them to meet the challenges of the future and open up additional market opportunities. We combine economic success with environmental protection and social responsibility, thus contributing to a better future. BASF presently operates facilities, including manufacturing sites, research facilities, and distribution centers, in more than 30 states, employing 15,000 people.

BASF Corporation has won a number of awards for its work in sustainability and climate protection, including the Presidential Green Chemistry Award, which was given by the U.S. Environmental Protection Agency for our Eco-Efficiency Analysis; and the New Jersey 2006 Governor's Environmental Excellence Award. BASF is also a member of the Clinton Climate Initiative.

Globally, BASF has been a Gold Class Member of the Dow Jones Sustainability Index – the world's foremost sustainability index – since its inception in 2001. We were also the winner of the first German Sustainability Award and the Federation of Germany Industry Award for the Environment.

BASF Views on Climate Protection

BASF is committed to sustainable climate protection, and we support the work of the United States Congress to develop and enact legislation that will lower greenhouse gas

emissions (GHGs). Climate change is one of our era's most significant global challenges. Industry, science, governments and citizens across the globe must work in tandem to halt rising GHG emissions.

BASF views climate protection as a challenge that calls for global strategies, and accordingly supports a global agreement to address climate change. Greenhouse gas emissions have a global effect, therefore there is a need to take a global view, and not only in our climate models but perhaps most importantly in our analysis of the economic and social implications. The solutions to climate change require unified, coordinated global action and targets that include all major emitters, including the U.S., Europe, and major emerging markets such as China and India.

We also believe that efficient industrial growth is required for social development. In particular, a sound chemical industry is mandatory to achieve ambitious and sustainable climate targets as it delivers innovative products and solutions to all consumer segments for efficient growth and development of our society.

BASF's 3:1 Carbon Balance

In the words of Dr. Jürgen Hambrecht, chairman of the BASF Board of Executive Directors, "A business cannot be successful in the long term if it does not act responsibly toward the environment and society. That is why sustainability is an integral part of our strategy." BASF spends globally about one-third of our total research and development budget in the areas of energy efficiency, climate protection, resource conservation and renewable raw materials.

Perhaps there is no better indication of BASF's ongoing commitment to climate protection and our desire to combine it with economic success than the fact that, globally our products save three times more CO_2 than is produced by the manufacture and disposal of all of these same products. This means that BASF has virtually a negative carbon footprint. The total impact of BASF products was determined through the use of eco-efficiency analysis -- a widely accepted methodology certified by the U.S. National Science Foundation. As a rule, the eco-efficiency analysis covers the entire product lifecycle and measures a variety of ecological factors and impacts. The results demonstrating the emission reduction reality of our products were confirmed by the Öko-Institut, a leading European research and consultancy institution working for a sustainable future, at http://www.oeko.de/home/dok/546.php.

The innovative approach of the Carbon Balance has been recognized by the European Chemical Industry Council: BASF has won the European Responsible Care® Special Award for 2008. The judges considered it "to be a highly innovative global measurement approach that makes *BASF the world's first company to present a comprehensive, independently verified carbon balance for its operations by assessing the company's carbon footprint throughout the supply chain.*" (Emphasis added)

Why is Chemistry So Important in Climate Protection?
"Energy efficiency." "Wind." "Solar." "Water." "Emission reduction technology." These are words and phrases common to just about every climate protection bill that we have seen so far. All of them rely on chemistry to make them a reality.

Agriculture. If soil contains much more nitrate than the plants can absorb, soil bacteria can convert the nitrate into the greenhouse gas N_2O (nitrous oxide), which has a 300 times greater climatic impact than CO_2. Moreover, excess nitrate can also be leached out into the groundwater. Preventing the creation of too high a concentration of nitrate in the soil when using fertilizers is therefore crucial to sustainable agriculture. BASF has developed a nitrification inhibitor that can help. When added to fertilizer, BASF's nitrification inhibitor optimizes the nitrification process so that the concentration of nitrates in the soil does not exceed the plant's requirements. This allows the farmer to use fertilizer more efficiently, and reduces N2O emissions significantly. Use of the nitrification inhibitor reduces emissions of the climatically harmful nitrous oxide N_2O by an average 50 percent. In 2006 alone, the use of this innovative BASF product saved more than 400,000 metric tons of CO_2 equivalents.

Wind Power. Wind energy is undoubtedly among the cleanest sources of energy available, and one that will play a critical role in sustainably meeting the energy needs of the future. BASF products are helping to make the harvesting of wind energy more efficient. Larger and lighter rotor blades increase the performance and output of modern wind turbines. Epoxy resin-based composite materials have become the industry standard for producing wind turbine blades. A current innovation includes the replacement of balsa wood, a limited natural resource, in turbine blades with foam.

Auto Emission Reduction. BASF's catalyst group continues to lead the way in the development and commercialization of advanced emissions catalysts for both gasoline and diesel powered vehicles. Today, thousands of older diesel-powered buses and trucks, notorious for their harmful emissions, have been retrofitted with filters containing cutting edge BASF catalysts. As a general principle, a catalyst allows chemical conversions to desired products to occur more rapidly and at lower temperatures. For this reason, in addition to pollution control, industrial catalysts find use in a wide field, be it the processing of petroleum to produce transportation fuels or the production of chemicals including polymers and pharmaceuticals. Ideally, the catalyst itself is not chemically consumed during this process. Automotive emissions catalytic converters consist of special combinations of precious metals such as platinum, palladium and rhodium dispersed on high surface area carriers which in turn are coated onto the walls of ceramic or metallic monolithic structures. A typical catalytic converter is capable of destroying around 98 percent of hydrocarbons, carbon monoxide and nitrogen oxides produced by the car's engine.

Transportation. The transportation sector offers a particularly high potential for reducing carbon emissions. Automotive manufacturers are increasingly using lighter materials for applications throughout the vehicle. BASF plastics provide the solutions that make

automobiles lighter, improve fuel efficiency and reduce carbon emissions. Also, a test BASF performed jointly with a leading petroleum company on a fleet of vehicles over 64,000 kilometers showed that a premium fuel additive package reduced pollutant emissions by 20 percent and improved average fuel economy by 2 percent. An eco-efficiency analysis that compared fuel with and without additive clearly showed that our fuel additives contribute significantly to climate and environmental protection.

Focus on Building and Construction

The BASF Building and Construction (B&C) business view is that improved energy efficiency in commercial and residential construction results in lower operating costs, accelerated return on investment, and lower environmental impact. Our emphasis is on the "building envelope," a term that refers to the foundation, roof, walls, doors, and windows of a structure, which protect the indoor environment from the outside and allow for climate control. The United States Department of Energy estimates that up to 40 percent of the energy used for comfort conditioning in an average home or building is lost to uncontrolled air leakage through the building envelope, which also contributes to premature deterioration of building materials, moisture and condensation problems, ice damming, spalling and comfort issues such as cold drafts or extremes in temperature and humidity levels. This is why we have placed our focus on the building envelope.

Chemistry helps building materials not only deliver superior insulation performance, but also provide unparalleled air migration control. For example, we at BASF have developed chemistry that –

- allows for super insulated homes and buildings while controlling air leakage or in other words an insulating air barrier in one product;
- helps make exterior insulating finish systems (EIFS), hard-coat stucco and architectural finishes perform better and last longer with industry-leading weatherproofing performance;
- improves sealants around windows and air ducts that helps to eliminate air leakage, moisture build up, and mold growth;
- creates storm doors, siding, decking, and pipe with high-performance plastics; and
- is used in roofing membranes that in turn offer a strong barrier against moisture and great sealant features including high elasticity and longer life expectancy.

Energy efficiency up-front, during the construction of a home or office building, is the best use of consumer dollars. Heating and cooling systems can be downsized to save money. It is certainly cheaper and cleaner to do it beforehand, as opposed to having someone come in later in the life of the structure to make changes. And, importantly, these products are not expensive, and they are widely available today.

While a traditional home, according to the American Chemistry Council, has approximately $17,000 worth of chemistry, BASF calculates a high-performance home with the above mentioned products includes $25-30,000 worth of chemistry. The overall construction impact for the homebuyer is neutral because of the integrated design and synergy.

The above mentioned products can also be used in energy efficient strategies for retrofitting the 130 million existing homes and five million commercial buildings. Between new construction and the retrofits, many new jobs will be created, *e.g.*, construction, energy auditors, and manufacturing.

Much like a fuel efficiency rating for automobiles, equipping consumers with energy and environmental data for buildings and homes will enable them to make better informed purchasing decisions. Programs similar to the energy disclosure requirements in California's AB 1103 and Washington, DC are a good idea and ought to be pursued elsewhere moving forward. Under these programs, energy usage is disclosed upon purchasing or renting a building.

A good example of BASF's work in the field of energy efficiency is our "Near-Zero Energy Home" in Paterson, New Jersey. This project demonstrates how good chemistry helps make healthy, energy efficient and affordable homes better. BASF chemistry helps the building materials in the zero-energy home not only deliver superior thermal insulation, but also address the missing performance ingredient – resistance to uncontrolled air leakage that can waste up to 40 percent of the energy used to heat and cool a home. The near-zero project has achieved a 34 Home Energy Rating System ENERGY STAR® score (which means 80% more efficient than the average home). It has received the U. S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design for Homes (LEED-H) green rating system's highest level platinum score. And, the products used in this house have a low environmental impact. They are formaldehyde-free and water-based. There are no volatile organic compounds and zero ozone depletion.

Another recent example of BASF's energy efficient B&C products in use is the work done to rebuild a home owned by a senior citizen in New Orleans that was condemned as a result of Hurricane Katrina. The completed home achieved a rating that was 26% more efficient than the International Energy Conservation Code for a structure built in 2003 thanks in large part to BASF's closed cell spray foam insulation. The homeowner now saves $178/month on her average utility bill.

Business Opportunities for the Future

There are several exciting areas, including the three identified below, where BASF is working to improve how energy is captured, stored and used.

- Organic Solar Cells. We are presently looking at organic solar cells, which instead of very costly high-purity silicon used in conventional solar cells, uses organic compounds to trap the sunlight and turn it into electrical energy. The organic materials are expected to be easier and thus cheaper to process. Additionally, the production of organic solar cells consumes much less energy and raw materials, such as silver, giving them a decisive ecological advantage over conventional silicon-based solar cells.

- Fuel Cells. A fuel cell is like a small chemical factory. Inside the cell, the "fuels" hydrogen and oxygen react to produce water vapor, thereby generating electricity and heat. The great advantage of fuel cell technology is that pure water is the only emission formed. The cells can also produce electricity and heat very efficiently at the same time. However, fuel cell technology can only contribute to climate protection if renewably produced electricity is available to provide the hydrogen as fuel. Fuel cells could then, for example, be used as very climate friendly components for refrigerated vehicles, for automotive propulsion systems or to generate electricity and heat in private homes. I am pleased to tell the committee that BASF just opened a new fuel cell facility in Somerset, NJ, which manufactures membrane electrode assemblies (MEAs). The MEA is the heart of the fuel cell.

- Lithium-ion Batteries. Lithium ion batteries can not only be recharged faster than other available batteries, they are also capable of storing electricity more efficiently, meaning they are also much lighter. The new lithium ion battery technology is intended mainly for transportation applications, such as hybrid automotive propulsion systems. The use of lithium ion batteries together with an internal combustion engine makes propulsion significantly more efficient in energy terms – a hybrid automobile can help save up to 20 percent fuel and the associated CO2 emissions. Lithium ion batteries are also used, for example, in wind turbines for stationary energy storage. In 2006, about 15 percent of the wind energy generated could not be supplied to the grid because of the lack of suitable storage capacity. This intermediate storage option, therefore, will improve the utilization of sustainable energy sources in the future. BASF intends to conduct R&D and produce lithium-ion battery technology in the state of Ohio.

We at BASF are especially keen on opportunities in non-emissive sources of power. Congress provided some incentives for these new technologies in the recently enacted economic recovery package, and we ask that in the climate protection legislation now under consideration continue this trend so that we may soon realize on a mass scale the products I have just described.

Conclusion

Climate protection and social responsibility combined with economic growth is an achievable goal. America, its manufacturers, and its citizens possess the desire to effectuate new policies and the resources to make it possible. BASF looks forward to working with Congress on legislation that not only protects our climate, but also ensures that our nation can press forward with its economic recovery. I would be pleased to answer the committee's questions.

Senator KLOBUCHAR. Thank you very much.

Senator Voinovich.

Senator VOINOVICH. Thank you, Madam Chairman.

Just for the record, I want to make it clear that I am a great supporter of green jobs. We have Owens Corning and Solar Industries, unlike many other businesses and you are talking about doing something in our State and I appreciate it.

But I will say that because of, I think, some foolish energy police that we had that allowed natural gas prices to skyrocket, that it is going to be a long time before the new jobs in Ohio, the green jobs, are going to compensate for the jobs that we lost because of the high costs of natural gas.

The last time we considered this kind of legislation, the impact on our State would have been a 50 percent cost in electricity, 60 percent in gas and 41 percent in gasoline. One of the dilemmas we have is does green overcome red to the other industries because they are less competitive because of increased costs and also in terms of costs to the rate payers, the folks out there that are struggling right now to keep going.

Someone mentioned cap-and-trade in terms of China. They do not have cap-and-trade in China, but yet they are moving forward with manufacturing in many of these areas.

For the record, Madam Chairman, I would like to just mention that in April of this year, China said the industrialized nations should contribute $200 billion a year to help developing nations fight global warming. It also said only developed nations should reduce emissions 40 percent of 1990 levels by 2020, which is twice what the U.S. has pledged and twice what the Marchi-Waxman bill has proposed.

We have a reality of competition between our Country and other countries, the issue of whether or not we are going to be moving jobs overseas in the event if we do something that is foolish in terms of a cap-and-trade program.

That is enough of the editorial.

I have to say that I am extremely impressed with the technologies that you are using in your companies and the progress that you have made and I can just sense the excitement that you all have. You are great promoters. You are very articulate.

The question I would like to know is: How important to what you have been doing are the subsidies that we have put in place toward the beginning of your companies and also to the continued growth of your companies? And the second question is: If we do not pass the cap-and-trade piece of legislation, what impact would that have on the growth of your companies?

So the first thing is subsidies, the second, if you do not have cap-and-trade now but you are going forward, how much do the subsidies help? The last question is, say we did not do this, the cap-and-trade legislation, what impact do you think it would have on your businesses?

Mr. LOWENTHAL. I am ready to take that on, if you would like.

So, one of the things about our business is that it co-exists with the electrical vehicle business. Of course, that is a lot of jobs in Ohio, we know. But all of the American auto makers, not only General Motors and Chrysler and Ford but also the young companies

like Tesla, Fisker and Phoenix, are all developing electric vehicles. I sat recently in a roundtable with General Motors where we discussed the need for infrastructure and the conclusion of that meeting was that the existence of an infrastructure will double their market size for electric vehicles.

Senator VOINOVICH. I just want to interject something. One of the things that I recognize, and we all recognize, is that we, if we are going to talk about a subsidy, is in the grid.

Mr. LOWENTHAL. Right.

Senator VOINOVICH. The grid in this Country. We do not have the grid and we need to do it and I think if we are going to subsidize, then that is the big thing that overshadows everything that you are doing.

Mr. LOWENTHAL. Very good, Senator. I will address that specifically then.

So the first answer to your question is that the reason that we would like some money early on in this is that the existence of an infrastructure allows somebody to buy an electric vehicle who cannot otherwise do so. So, if you live in San Francisco and you park curbside and there is no way to charge the vehicle, you cannot buy a Chevy Volt. So there is a little chicken and egg problem. Nobody wants to put out infrastructure until they see cars, but nobody can buy cars without infrastructure.

This is, frankly, a good place where one-time subsidy can make a difference. Our products, in particular, have built into them a billing system so ultimately the drivers pay for the energy used and it is a sustaining business. But to get it started at the beginning of the electric vehicle industry, we could use some money. It would be a great help to us. But we do not want it directly. We want our customers to get it. Typically, our cities and businesses that want to accommodate electric vehicles.

With regard to the grid, every one of our stations is Smart Grid enabled and what that means is that they will charge these cars when the grid has plenty of energy. So we do not have to add increased transmission capacity and we do not have to add increased generation capacity. So typically these cars will be charged in the middle of the night and because every one of them is directly connected to the grid, the grid manages when the cars are charged.

Mr. TAYLOR. Senator, for energy efficient lighting technology, there is no need for subsidy. This is a cost effective investment today. The best way that the Federal Government, however, support this industry is by being a customer.

Mr. ARMSTRONG. Senator Voinovich, I would say from a BASF perspective, investing in new, incubated technologies, whether they are fuel cells or whether they are battery technologies to store that energy produced by the windmills when it cannot get into the grid, some 20 percent gets lost because it cannot go through the grid, I would say that many of these are co-share. I know as far as BASF, we put some of our money in conjunction with DOE funds. So, it certainly is not all handouts and I think that these are important technologies to allow them to come into mainstream and overcome these frictions and barriers to implementation, certainly. But the money certainly should go to the technology and not the company.

Mr. KROUSE. Senator Voinovich, with respect to the grid and the new technologies, as you know, there is a huge difficulty in integrating intermittent renewable technology, such as wind and solar, because of that intermittent nature, water power, hydro power, is a great zero carbon base load way to integrate those resources, they help firm the load curve. DOE did a study in April 2004 that said that up to 95,000 megawatts of low-head hydro still exists in the U.S. to be developed.

So when you think in respect to the grid and the incentives that might be necessary to get the renewables to market, so to speak, yes the incentives are needed and to not provide those incentives will suppress the potential growth rate of water power technologies but would also suppress the ability to integrate those other renewables into the existing electric infrastructure.

Senator KLOBUCHAR. OK. Thank you, Senator Voinovich.

Mr. Lowenthal, could you talk a little bit about the status of developing batteries? I have heard different things about how far these batteries can take us and the status of battery development in the U.S. versus other countries.

Mr. LOWENTHAL. Well, battery development tends to start here. There are very important, innovative companies like A123 Systems in Massachusetts, as an example, that have led the industry in the development of lithium-ion batteries and these are the ones that are going in many of the cars. The batteries are fine. The message that I want to give is that these cars are ready for prime time. They are ready to be sold to consumers.

The one aspect of batteries that is an issue is the cost. The cost is loaded, for example, especially by warranty costs. So to the extent that we could get some assistance in helping the auto makers warranty their batteries through some kind of guaranty from the Federal Government, it would be a great help.

What General Motors has done with their battery is to put in one that is twice as big as otherwise needed, to ensure that they have enough battery capacity for the warranty life of the car. That is not a very cost-effective strategy. We could use some help there.

Senator KLOBUCHAR. How long, if we look at 5 years, how many electric vehicles do you think will be driving on our roads? Or 10 years?

Mr. LOWENTHAL. Well, President Obama has told us there will be a million cars in 2015. We do not think that he is far off. That is pretty much consistent with Morgan Stanley that did a report a year ago about the report of the growth of the EV industry.

Senator KLOBUCHAR. And how do you think the new fuel efficiency standards being announced today affects the plug-in vehicle business?

Mr. LOWENTHAL. It will be a great help to us because there are still vehicles that need to run on gasoline or diesel, so the auto makers will compensate for those by delivering more electric vehicles and allowing people that can use an electric vehicle for their daily driving to do so. So it will be a great help to the industry.

Senator KLOBUCHAR. Mr. Krouse, I am pleased that you chose Hastings as the site of one of your first power projects in the U.S. We are very proud in our State of our roles as leaders of both biofuel area and wind fuel and other new energies. We have this

very aggressive renewable standard that has helped us a lot. How many jobs do you anticipate will created as a result of this facility and what sort of job training is necessary when you hire new people to build and maintain these turbines?

Mr. KROUSE. Well, the policies in the State of Minnesota were one of the primary reasons that drew us there in the first place. So, they are very important. We have hired people in the city of Hastings from a maintenance and operations standpoint on a permanent basis with our company.

We are also developing projects at a number of other locations within the State of Minnesota and those, when you combine manufacturing and ongoing operations, maintenance and the spin-off of jobs that are created from electrical suppliers and instrumentation vendors, et cetera, could amount easily into the hundreds if not up to 1,000 jobs just in the State of Minnesota over time.

As I mentioned area in the testimony, in that 3-year period, we easily could reach into the multiples of thousands for all of our projects across the Country.

Senator KLOBUCHAR. You mentioned in your testimony that you thought hydrokinetic power had the potential to produce tens of thousands of megawatts of clean power around the Country. Can you elaborate on that prediction and what are the impediments to making this a reality?

Mr. KROUSE. Sure. The Electric Power Research Institute, EPRI, released a study last year, toward the end of the last year, saying that 25,000 megawatts of hydrokinetic with zero head. Hydro power could be brought on by 2020 in the U.S. I was recently in Vancouver at a small hydro conference, about 3 weeks ago, where the person from EPRI had updated their projections and essentially listed out the total amount of net energy that could be created through these hydrokinetic technologies and all their variety of application points and that ended up being about 429 terawatt hours. That is just a gargantuan number.

In order to get those technologies to the market, we do need to have that climate legislation in place. It does send a price signal for carbon. Investors in projects, even though they have been on the sidelines, we continue to get a growing amount of interest as the markets begin to unlock and having that clear signal about what the value of carbon is would be very helpful is evaluating economically the project feasibility.

Right now, it is probably the single greatest unknown in terms of trying to evaluate project financial feasibility.

Senator KLOBUCHAR. Thank you. Mr. Taylor, you mentioned that your products are not being sold to the Federal Government. I know I have some energy efficient light bulbs in my office that we installed. Is it your products or just no lead products?

Mr. TAYLOR. No, I did not say there were none. But buying more, and different than the types of energy efficient light bulbs that you are talking about. These products do not contain mercury. In the whole discussion about energy efficiency, one of the things that I omitted in my testimony is that lighting is the most constant energy load in any commercial facility.

So impacting lighting or energy consumption around lighting by 80 percent or greater has a dramatic impact on carbon emission.

Not only are you talking about a cost-effective investment, but there is the benefit of the reductions in carbon emissions.

And so as cap-and-trade legislation further encourages in the marketplace companies that want to take advantage of carbon credits, it further enhances the return on investment and encourages in investing in energy-efficient lighting technologies.

Senator KLOBUCHAR. OK. Very good. And last question, Mr. Armstrong, do you have some familiarity with the cap-and-trade with the EU in Europe?

Mr. ARMSTRONG. Actually, it is not my area of expertise for the European Union. I am sorry.

Senator KLOBUCHAR. OK. I thought you maybe had participated. Your company had in that in some way.

Mr. ARMSTRONG. No.

Senator KLOBUCHAR. Now we are trying to make sure that we learn from the good things and do not do the bad again.

Mr. ARMSTRONG. I am glad to say, if I may, Madam Senator, that our spray polyurethane foam business is headquartered in Minneapolis, Minnesota.

Senator KLOBUCHAR. Now everyone has business there. You should listen to that, Mr. Lowenthal.

[Laughter.]

Mr. ARMSTRONG. And Shakopee, also, our building systems, has business there and it is actually our first lead EV building inside of our corporation so——

Senator KLOBUCHAR. That is right, and where Prince has Paisley Park, Mr. Armstrong. I am sure they are both just as famous.

[Laughter.]

Senator KLOBUCHAR. So, all right. I wanted to thank all of you. It is going to be very important to this debate that business and the businesses that have sprung up around new energy, clean energy, green energy, whatever you want to call it, technology, has a seat at the table here. So much time, the debate that I have seen gets dominated by the debate that we had 10 or 15 years ago. I think people have to understand that there are new companies coming up.

I come from a State that believes in science. We gave the world everything from the pacemaker to the Post-It note. We have always believed in new developments and that this can be a cause of great economic opportunity and you have shown it with all of your companies.

So, I want to thank you for that and have a great day. And bring that light with you, Mr. Taylor, and you will get some business. Just keep bringing it into every Senator's office and set it up until you get to talk to someone.

[Laughter.]

Senator KLOBUCHAR. Thank you. Have a great day.

[Whereupon, at 12:04 p.m. the Committee was adjourned.]

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