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CLEAN ENERGY: FROM THE MARGINS TO THE MAINSTREAM

HEARING

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CLEAN ENERGY: FROM THE MARGINS TO THE MAINSTREAM

THURSDAY, MARCH 29, 2007

U.S. SENATE,
COMMITTEE ON FINANCE,
Washington, DC.

The hearing was convened, pursuant to notice, at 10:46 a.m., in room SD–215, Dirksen Senate Office Building, Hon. Max Baucus (chairman of the committee) presiding.

Present: Senators Bingaman, Stabenow, Salazar, and Grassley.

OPENING STATEMENT OF HON. MAX BAUCUS, A U.S. SENATOR FROM MONTANA, CHAIRMAN, COMMITTEE ON FINANCE

The CHAIRMAN. The hearing will come to order.

I have a prepared statement which I am not going to give due to the time constraints now, except to say that a lot of us are inspired by Thomas Edison, who 131 years ago this week moved his lab from Newark to Menlo Park, CA, creating the world's first industrial research lab, and years after that he and his team developed the electric light bulb, and how that just has changed the world. We are at a different stage now as we try to find ways to make ourselves more energy independent and also focus on renewables, I think entering a new stage in our world's history, combined with greenhouse gas issues, and it is up to us to bring the same—no pun—energy, creativity, and ingenuity as Thomas Edison, to find ways to address all these issues.

There are provisions in our law in the United States to provide incentives to renewable energy production, and I know the European Union has its own ways to develop incentives for renewables. It will be very interesting to learn what those are and how those work. We have a panel coming up later that will certainly explain some of that in greater detail. But the goal here of this committee is to do all we can to help our country be more independent in the production of energy and also to dovetail with the greenhouse gas issues so we can control carbon as well as we possibly can. We are going to work hard on this and do what we can.

[The prepared statement of Chairman Baucus appears in the appendix.]

The CHAIRMAN. We are very honored to have with us today Ambassador Bruton, who is EU Ambassador to the United States. I want to thank you, Mr. Ambassador, for coming. You are here voluntarily. Basically you are here to give us the benefit of your thoughts. This is a little bit unconventional for the European Union Ambassador to come and testify, to come and speak before

the Finance Committee, but we are very honored that you are here, Mr. Ambassador, and that you decided that is something you wanted to do to help out. We are very, very appreciative of your participation here.

I could go on at great length about your history: Prime Minister of your country and on and on. We just thank you for all of your service to your country and to the continent and to so many people. Just let it be known that we are very, very honored to have you here with us. We are very thankful that you are here, and thank you, Mr. Ambassador, and you can proceed in any way you wish.

STATEMENT OF HIS EXCELLENCY JOHN BRUTON, AMBASSADOR, EUROPEAN COMMISSION DELEGATION, WASHINGTON, DC

Ambassador BRUTON. Senator Baucus, I am very privileged to have this chance of appearing before your committee. Historically, it was when Europe and the United States faced major challenges, as we did in wartime, that we have come most closely together, and I think as we look at the prospects of a problem of global warming and a problem of reduced energy independence, we are facing just the sort of challenge that tends to bring Europe and America together to meet and overcome that challenge.

At the moment, energy use accounts for 80 percent of the greenhouse gases that are emitted in Europe, and, if current trends continue, our greenhouse gas emissions will increase by 5 percent by 2030. In contrast, however, we have now set ourselves a target of reducing our greenhouse gas emissions by 2020 to 20 percent below the amount that was emitted in 1990. We are proposing a radical shift against current trends. We do emit somewhere in the region of about half of the greenhouse gases per head of population compared to the United States, but our emissions are still far too high.

As far as the principles of our system of using taxation to achieve our environmental goals are concerned, I have set these out in some detail in the submission which the committee has in its possession. We operate on the basic principle that the polluter should pay, so the emphasis in our system is more on disincentives to undesirable behavior than it is to incentives to desirable behavior. There are exceptions to that, of course.

The biggest form of taxation on energy currently operating in Europe is in the form of excise taxes on certain fossil fuels that are used in transportation and heating. Where these fossil fuels are used, for example, for making plastics or other processes unrelated to transport or the like, they are exempt from those taxes.

The European Union does not set these taxes. These taxes are set by member states. But in order that we may have a free and competitive market, the European Union does set minimum levels of excise taxes.

We are moving also in the direction of doing the same thing in regard to fuels used in commercial transport, because there is something that has been christened "fuel tourism." There are some countries in Europe where the excise taxes are slightly lower and truckers are literally diverting to go through that country on their route, even though it may be a longer route, in order to fill their tank at a lower price. And we have proposals which have been ta-

bled to deal with that problem. Those proposals were tabled on the 13th of March.

Also, yesterday—and I think this underlines the timeliness of your hearing—we have tabled a Green Paper on the entire issue of taxation and energy, and obviously we will be supplying you with that, and we hope that we will be able to have more intense discussion on its contents in the future.

This operates on the proposition that taxes should be neutral as between different types of energy but, that said, that they should give special encouragement to renewable energy sources and special encouragement to those energy sources that do not cause emissions of polluting gases, including CO_2.

As far as renewables are concerned, there is in existing EU law an option for countries to exempt renewables from the taxes that are levied.

As far as passenger cars are concerned, our tax systems also encourage countries to have exemptions or reductions in taxation for high-efficiency vehicles and differentiation on the basis of the emission levels of CO_2 per kilometer traveled.

We are also providing a framework in EU law for taxation that is designed to pay for the road infrastructure—so to speak, tolls. Obviously, we want to have a measure of uniformity in these tolls across Europe so that there will be an effective common market on this issue in the European Union.

The other notable matter to which I wish to draw your attention is, of course, the European Union's emissions trading system or our cap-and-trade system. This came into full operation in January, 2005. There have been some controversies about it in the sense that it has transpired that the allocations that were given initially were probably too generous. The scheme does cover 10,000 installations throughout Europe in all 27 member states, and we are currently considering extending this scheme to include aviation. Also, we are considering the full auctioning of permits after 2012 to ensure that there are not windfall gains to individual companies.

Coming towards a conclusion, I would like to refer to our concern about ensuring that as we move towards greater use of coal, which is inevitable—it is estimated that internationally twice as much of our electricity will be generated from coal by 2030 as is now the case because that resource is available plentifully—we obviously have to provide for the use of carbon sequestration and other clean coal technologies to ensure that coal does not add to the existing environmental problems that we have. And while the technology is in the course of development, we want to ensure that new plants that are being built to use coal are, so to speak, capture-ready, that the plant is designed so that it can adapt to a carbon sequestration system as soon as that becomes available.

In my submission, I have also outlined individual national measures that have been adopted by individual countries in regard to these issues, but, for reasons of time, I will not go into these in any further detail. I also outlined national schemes to support biofuels in individual member states, which differ, and systems to assist in the installation of mechanisms to maximize the conservation of energy and the use of renewable energy in the heating and cooling of buildings. And, again, there is quite a diversity of experience in

Europe in that matter, which I am sure the committee in its further inquiries will find useful to compare.

[The prepared statement of Ambassador Bruton appears in the appendix.]

The CHAIRMAN. Mr. Ambassador, thank you very much. I am curious about your feed-in tariffs and how they seem to work. We have a little different system. So far in this country we have the section 45 tax credit for renewables, and I understand that Europe has feed-in tariffs, which essentially are designed to accomplish the same purpose, namely, guaranteed renewable production, the cost essentially passed on to consumers. But there is a guarantee, as I understand it, and I am just a little curious how well that seems to be working.

As I understand it, too, it phases out a little bit over time. Just any thoughts or advice you can give us with respect to your experience with that system?

Ambassador BRUTON. Feed-in tariffs are used in France, Spain, Romania, Greece, Bulgaria, Hungary, the Czech Republic, Slovakia, Latvia, Estonia, Lithuania, Luxembourg, Cyprus, and Malta. In other countries, there is a para-fiscal levy system. A connection fee system is used in Austria, Ireland, and the Netherlands, as well as Slovenia. So there is quite a variety of different mechanisms used in the EU.

The feed-in tariffs do, as you say, digress towards the end of the period, although that may have to change. There is not, as I understand it, any proposal to standardize these systems.

There are variations in the way feed-in tariffs are used. In Germany, for example, there is a pure fixed tariff system. This means that producers of green electricity can count on the fixed and same tariff for a long period of time, because there are no fluctuations depending on market price developments.

In Denmark, there is a premium system for onshore wind energy. And while the level of the premium is fixed, other parts of the price are dependent on market prices generally.

Spain has a premium system; however, it gives the option to choose between the market price plus premium formula or a fixed price plus premium formula. So there are quite wide measures of variation within Europe on this issue.

The CHAIRMAN. I would like to ask you, if I could, a little bit about carbon sequestration and your experience and your advice on that technology. First, I guess you have some demonstration projects, and one question is: When do you think they will show results? Second, your advice on the EU regulatory framework, how to ensure that captured CO_2 does not escape, for example, and how to transport, how sites are selected. Then, third, how carbon sequestration is financed, that is, incentives. Just your basic experience with carbon sequestration, what has worked and not worked and how you regulate it and so forth?

Ambassador BRUTON. I think like the United States, we are at a comparatively early stage in the development of all of this. We have not satisfied ourselves that we have cracked the issue of ensuring that there is zero or minimal risk of the carbon escaping from the sequestered site. There are demonstration projects

planned, and we will be watching very closely developments here in the United States.

I think it will be useful for me to research further the matter that you just raised in this question, because I feel there is some more information available. We envision up to 12 large-scale carbon sequestration demonstration projects by 2015, but it would be, I think, our view that we would value cooperation not just with this committee but with all those authorities in the United States that are working on this subject, because we are learning as we go here.

The CHAIRMAN. Just my final point to you, and other Senators will have questions. What is the one message you want to give us about renewables, that is, your experience in Europe, the need for renewables, the amount which we should devote time and attention to renewables, just kind of the one basic thought with respect to renewables in this whole big issue that you think we should hear?

Ambassador BRUTON. I think the answer I would give is that renewables are a vital part of any system for dealing with our problem of energy independence and our problem of global warming. But they are not a silver bullet. They will not solve the problem on their own. They must be accompanied by very serious and tough measures to deal with conservation of energy.

The CHAIRMAN. But a necessary part of the solution.

Ambassador BRUTON. A necessary part but not the whole solution.

The CHAIRMAN. All right. Thank you very much. Thank you, Mr. Ambassador.

Senator Grassley?

Senator GRASSLEY. Mr. Ambassador, glad to have you with us, and sorry that unpredictable things in the Senate kept us from getting started, and I will put my statement in the record, Mr. Chairman.

[The prepared statement of Senator Grassley appears in the appendix.]

Senator GRASSLEY. Mr. Ambassador, I want to thank you very much for coming to share the European Union's experience in energy tax policy. The United States, much like the EU, finds itself faced with the rising reliance on fossil fuels and foreign sources of those, but it appears Europe has been much more aggressive in addressing the diversification of its energy portfolio, especially if the EU meets its goal of 21 percent of electricity generated by renewables by 2010.

Now, you have already shared your views, according to Senator Baucus's question on that issue, so I will not ask you to repeat yourself, and I will go on to a second question.

Your written testimony includes some very interesting information on the European Union's approach to the taxation of fuel and incentives for biofuels. In addition, you discuss some of the EU countries' problems with fuel tax enforcement and fraud, which you called "fuel tourism," all of which I find very interesting.

Could you please describe your most successful biofuel initiative and describe your least successful?

Ambassador BRUTON. I suppose people in my position are expected to accentuate the positive at all times; therefore, I may try

to pass on the second part of your question. But regarding the first part I would say that I think biodiesel is probably the area where we have had the most remarkable success. This has been particularly the case in Germany where a lot of investment has been put into biodiesel. And in Sweden, they have had quite an amount of success with bioethanol, similar to the experience in the United States, and in your own State in particular. So I think those are the two countries that would be most helpful and instructive as far as the United States is concerned.

I suppose our problem, the biggest problem we have, is in getting people to look at the medium-term future rather than the present in the matter of the necessary sacrifices that have to be undertaken to introduce measures of conservation. For example, there is this principal agent problem where the builder of a house who is proposing to rent that house has no incentive, in putting the house in place, to put in energy conservation measures because the electricity bill will not be paid by him but by the tenant. Finding a system and designing a system to ensure that builders have an incentive to conserve energy in the matter of heating and cooling is a problem that I do not think we have tackled adequately.

Another area where we have not, I think, achieved adequate success is in dealing with urban sprawl. In many European countries, there is quite an amount of low-density development, which is, of course, generating, I think it has been estimated by some, up to 38 percent more energy use in transport than would be the case in higher-density urban developments. And, again, that is a matter not just for national governments. It is a matter for cities and towns and counties to address, and I do not think we have adequately addressed that either.

Senator GRASSLEY. All right. Thank you, Mr. Chairman. That is all I want to ask.

The CHAIRMAN. Thank you, Senator.

Senator Bingaman?

Senator BINGAMAN. Thank you very much for having the hearing, and thank you, Mr. Ambassador, for being here to speak with us.

In addition to the feed-in tariffs, one of the ways that I believe Europe has chosen to encourage use of renewables in the electric utility sector is to have something of a Renewable Portfolio Standard. That is something we have at the State level in many States here in this country today, and I have proposed—and we have voted here in the Senate several times—to go ahead and try to do a national Renewable Portfolio Standard as well.

My understanding is you have a similar sort of Europe-wide portfolio standard, a requirement for generation of renewable energy by utilities, and you have similar country-by-country requirements. I would just like to understand that better as to whether I am right that you do have both a Europe-wide system and a country-by-country system, and if so, how that works and to what extent the Federal system preempts what countries are able to do.

Ambassador BRUTON. I will attempt to answer that question as best I can on the information available to me. My understanding is that we do not operate at Europe-wide level a Renewable Portfolio Standard, but we have set targets for the use of renewable en-

ergy for member states. It is a matter, really, for the countries to work to achieve those targets.

It may be relevant to you to be aware of the green certificate system which exists in the United Kingdom, Sweden, Italy, Belgium, and Poland, where the consumers of the electricity are obliged to purchase a certain number of green certificates, according to which a fixed percentage or quota of their total electricity consumption or production must come from green sources. If they do not, they have to pay a penalty over that amount, and the money is then used for research and development and demonstration projects.

Senator BINGAMAN. So that is a requirement on the consumers of the electricity rather than on the utilities that are producing and selling the electricity. Is that right?

Ambassador BRUTON. Well, that is the system as I understand it that applies in the countries I mentioned. But, again, the European Union is not directly involved in managing these. These are for individual countries, and the countries in question would probably be the best ones to provide you with the necessary information. But I will, if I may, seek out the information and supply whatever I can find to the committee.

Senator BINGAMAN. Thank you. That will be helpful.

Let me ask about your emissions trading, your cap-and-trade system that you have adopted there. We had a workshop in the Energy Committee with several participants from Europe to talk about that on Monday of this week, and it was very useful, I thought. The emissions trading system or the cap-and-trade system which you have adopted there in Europe applies just, as I understand it, to the electric utility sector. You mentioned 10,000, I believe, emitters that are currently covered. And you have chosen not to try to apply it to the transportation sector, not to other less energy-intensive sectors.

Can you explain your thinking on that? What we have talked about here and what various economists have advised me would make more sense in this country would be to try to have an economy-wide cap-and-trade system so that the cost of putting carbon into the atmosphere was reflected anywhere in the economy that that is actually occurring, that would be reflected in the cost of the products involved there.

What are your thoughts on that?

Ambassador BRUTON. Well, as I mentioned in the written submission, we do have quite heavy excise duties in all European countries and a minimum level set by the European Union for them on road transport and fuel use in road transport. And we reckon that actually fulfills the function that a cap-and-trade would fulfill for road transport to a very considerable extent, particularly when combined with the additional taxation that we impose on vehicles which are not energy efficient, the way in which we are proposing to redesign further our tax system on motor vehicles to ensure that there is a tax advantage for CO_2-efficient vehicles vis-à-vis others.

When we were designing the cap-and-trade system that we now have in place, there were very extensive debates about whether or not we should have gone for a carbon tax rather than a cap-and-trade, and I know that many economists will argue that a carbon

tax is more neutral and more efficient. But we felt, in terms of the amount of up-front progress that we would make in the short to medium term, that we would make more progress with a cap-and-trade system than with this economically pure carbon tax approach.

There is one exception to the exemption of transportation, and that is aviation. We are proposing to extend the emissions trading scheme to aviation. That is a matter currently under consideration.

Senator BINGAMAN. Thank you very much.

The CHAIRMAN. Thank you, Senator.

Senator Salazar?

Senator SALAZAR. Thank you very much, Senator Baucus, for your leadership on this issue of energy, and I look forward to working with you and Senator Bingaman and everybody else on this issue.

Ambassador, my question to you is regarding biodiesel and asking you to elaborate further on your response to the question of Senator Grassley. You said that there were two countries within the EU that had made significant progress with respect to biodiesel. Can you elaborate on that and tell us a little bit more about what it is that they have done and how it is that they have done it?

Ambassador BRUTON. Well, it is one country really that I would have singled out, which is Germany, where we have made major progress in the area of biodiesel. They are using crops that are available in Germany in quantity.

Senator SALAZAR. Can you tell us what the crops are and what the level of production is that they currently have under way on biodiesel?

Ambassador BRUTON. It is rapeseed, primarily.

Senator SALAZAR. Mostly rapeseed?

Ambassador BRUTON. Mostly rapeseed, but I do not think I can give you figures on the level. It is quite high, quite high by comparison with past experience and quite high by comparison with other European countries.

Senator SALAZAR. Do you know, Ambassador, whether those biodiesel initiatives in Germany have resulted in production that comes from large biorefineries? Or have they come from small biorefineries that are located on farms within Germany? If you could describe the configuration of this biodiesel initiative within Germany.

Ambassador BRUTON. I am afraid I could not, really, in any detail. But 3.7 percent of the total fuel used in 2005 in Germany was biodiesel.

Senator SALAZAR. Three-point-seven percent?

Ambassador BRUTON. Three-point-seven percent. As to whether they are large or small plants, I would have to make further inquiries.

Senator SALAZAR. All right. Within the EU, as you have embraced the initiatives on renewable energy, do you have any general information with respect to the kinds of initiatives that have helped the small producer, the small refiner move forward in this renewable energy initiative? What I have in mind, for example, is that as we look at wind farms becoming a reality for many of us

in many of our States, there is a possibility that we could create incentives out of this committee to try to make wind generation a possibility for the farmer or for a small community with small generators that essentially use wind to produce that kind of energy or using maybe a small cooperative that would bring farmers together to produce their own biodiesel.

So my general question is whether or not within the EU, as you move forward with renewable energy, there have been initiatives to try to target these smaller levels of production.

Ambassador BRUTON. Denmark and Spain are the two countries in Europe that have made the most progress in this area. Spain in particular has made major progress in the area of wind energy. And while I do not have detailed information at hand, I expect that that has featured giving special preference to smaller producers in order to establish a basic network and a sufficient volume of wind energy availability. Obviously, the smaller producer needs special help initiating it, and I imagine that that is part of the scheme in Spain. But I will, if I may, make further inquiries and supply to the committee more information on the precise incentives for wind energy in Spain with respect to smaller producers.

Senator SALAZAR. Thank you very much, Mr. Chairman. Thank you, Mr. Ambassador.

The CHAIRMAN. Thank you, Senator Salazar.

Senator Stabenow?

Senator STABENOW. Thank you, Mr. Chairman, and I appreciate this hearing, and I welcome the Ambassador.

Coming from a State like Michigan where we are seeing a major focus on fuel efficiency and alternatives and biofuels and so on, we also have companies like United Solar Ovonic which are making the new silicon alloy solar cells and doing a lot around—we wish we had a little more sun all around the year in Michigan to be able to use some of those solar cells. But there are some wonderful things going on. We are partnering with research and development into new technologies and so on. And I am wondering, Mr. Ambassador, from an R&D standpoint how you view or how the EU views partnering or the role of government in partnering with industry or working with scientists and so on as it relates to research and development into these new technologies. How do you approach that? How do you view the appropriate role?

Ambassador BRUTON. We would believe that there is a major role for government here, both at the level of the European Union assisting research and development and at the level of individual member states. We would also think that there is a role for government in promoting demonstration projects to actually apply the research and development, because getting individuals to install, for example, solar panels in their own homes or in apartment blocks is something that requires a special encouragement because the return is relatively long-term.

I think it might be of interest to the committee to look at France, for example, where an income tax credit worth 50 percent of the purchase cost of solar equipment is proving particularly popular in that country. And the structuring of that particular incentive might be of interest to—and, obviously, when public institutions install

solar panels, as I understand has happened here, that has a very important demonstration effect as well.

Senator STABENOW. Do you have any particular research programs or development programs that we might look at where universities or the government are partnering, any kind of structures which you use with private industry around R&D?

Ambassador BRUTON. Yes, and I will obtain information for the Senator on that matter.

Senator STABENOW. Great. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Ambassador, thank you very much. We really appreciate the time you have taken to come over here and give us the benefits of your friendly advice. We appreciate it very much. Thank you.

Now I will turn to our next panel. We will hear key perspectives on America's use of renewable power, starting with John Krenicki, president and CEO of GE Energy. GE Energy is one of the world's leading companies in power production, including renewables. We look forward to hearing Mr. Krenicki.

Then we will hear from Mr. Todd Raba, president of MidAmerican Energy. That company has a stake in a broad range of renewable power, including transmission. I understand that Mr. Raba will provide a real-life example of some of the challenges utilities face in dealing with section 45's periodic expiration.

He is followed by Johan van't Hof, CEO of Tonbridge Corporation. Tonbridge is in the process of developing a transportation line between Great Falls, MT, and Lethbridge, Alberta. If successful, this line will greatly augment Montana's power to sell its abundant wind power.

And we are also pleased to have with us Ryan Wiser, a scientist with the Lawrence Berkeley Lab in California. He is one of the country's leading authorities on renewable power and will provide the committee with perspectives on its implications.

So thank you very much, and I will start with you, Mr. Krenicki.

STATEMENT OF JOHN KRENICKI, JR., PRESIDENT AND CHIEF EXECUTIVE OFFICER, GENERAL ELECTRIC ENERGY, ATLANTA, GA

Mr. KRENICKI. Thank you, Mr. Chairman and members of the committee. I am John Krenicki. I am the president and CEO of GE Energy, and I very much appreciate the opportunity to testify today on policies that will significantly impact the growth of renewable energy in our country.

We believe that Congress should act this year to extend existing tax credits for electricity production from wind energy and the investment credits for solar energy. Action this year well in advance of the credits' expiration will enable growth in the wind and solar industries to continue undiminished by policy uncertainty.

The United States has some of the world's best wind resources. Although wind supplies less than 1 percent of U.S. electric generation today, the American Wind Energy Association and the Department of Energy have identified a goal of 20 percent by 2030. U.S. wind installations have nearly doubled over the past 3 years, and

new unit installations are up by more than 45 times versus a decade ago.

Over the past 20 years, the cost of electricity from wind has dropped 80 percent, today costs approximately 8 cents per kilowatt hour, and is becoming more and more competitive with other power generation technologies. By tapping wind's potential as an energy source, we are leveraging an abundant, domestic, zero carbon emissions resource and reducing overall dependence on imported energy. Wind emits zero sulfur dioxide or nitrogen oxide and consumes no water in the generation of electricity.

Consider this: a recent study conducted by GE concluded that a 100-megawatt wind farm in New York State would produce the energy equivalent of 590,000 barrels of oil per year and displace 400,000 pounds of nitrogen oxide per year, 800,000 pounds of sulfur dioxide per year, and 260 million pounds of carbon dioxide per year.

In order to realize this potential, three needs must be fulfilled: number one, predictable and stable public policy; number two, additional investment in the supply chain; and, number three, continued advances in wind turbine technology. It starts with public policy, because a clear and definable policy landscape enables investment in both the supply chain and technology.

For example, there is discussion today within the industry of a 5-year Production Tax Credit extension versus a shorter-term extension, which has historically been the norm. As a wind energy manufacturer, we believe a 5-year extension would provide greater certainty that would encourage long-term capital investment by suppliers and technology investment by manufacturers.

Currently, all wind turbine manufacturers are struggling with the same global challenge: obtaining sufficient components from their suppliers to manufacture and assemble wind turbines, particularly components that require long lead times. The on-and-off nature of the PTC since 1999 has made it difficult for suppliers to make the needed investments in plant and equipment to increase the supply of these components. As a result, the industry's ability to add new capacity has not been able to keep pace with the demand, and this is a global phenomenon.

A 5-year PTC extension would be very impactful on the growth of wind energy in the United States. However, such an extension would need to include intermediate milestones, spurring continuous investment. Without such provisions, the industry may be susceptible to a wait-and-see approach, withholding investments until the final years of the extension. This could result in the same boom-and-bust cycle that we have seen from the late 1990s through 2004. With that in mind, the committee should consider provisions in a 5-year PTC that would require participants to attain intermediate installation milestones.

National and/or State Renewable Portfolio Standards would also enable continuous, consistent growth. While that may take longer to construct and enact, fair and equitable portfolio standards would ultimately drive the industry towards large-scale deployment of wind-generated power. Think of the PTC as the spark and portfolio standards as the fuel for long-term, sustainable wind energy growth.

Timing is just as critical to success as the strategy. By acting this year, well in advance of the PTC's expiration, Congress can eliminate the uncertainty that stymies investment and growth in renewable sources.

In summary, public policy is critical to the consistent growth and success of renewable energy as a means to reduce emissions and U.S. dependence on imported sources of energy. The PTC and Renewable Portfolio Standards can and should play complementary roles.

As you consider energy-related tax policy, we urge action this year to extend and enhance legislation that will continue to foster growth of renewable sources in our national energy portfolio.

Thank you again for the opportunity to testify, and I would be pleased to answer any questions at the end of the session.

The CHAIRMAN. You bet, Mr. Krenicki. Thank you so much.

[The prepared statement of Mr. Krenicki appears in the appendix.]

The CHAIRMAN. Mr. Raba?

STATEMENT OF TODD M. RABA, PRESIDENT, MIDAMERICAN ENERGY COMPANY, DES MOINES, IA

Mr. RABA. Good morning. Thank you, Mr. Chairman, Senator Grassley, and members of the committee. I also appreciate the opportunity to testify today. My name is Todd Raba. I am the president of MidAmerican Energy Company. MidAmerican is Iowa's largest electric utility.

I am proud that MidAmerican is also number one in the Nation in ownership of wind power and electric generation among regulated utilities. We have 695.5 megawatts in operation, under construction, or under contract in Iowa. We are aggressively seeking additional opportunities to expand. By working cooperatively with our State, we have helped make Iowa the country's third largest generator of wind energy.

Our sister utility, PacifiCorp., has acquired or is planning to acquire 2,000 megawatts of renewable capacity by 2015. And then we have MidAmerican's independent generation company which owns 340 megawatts of geothermal energy in California, with significant expansion potential as well.

At MEC, we are very pleased with the performance of our wind assets. During last summer's record-setting heat wave, our wind projects made critical contributions to meeting our customers' needs.

Wind and other renewables possess distinct advantages and disadvantages compared to conventional resources. Once installed, these resources face no fuel price volatility and are comparatively easy to site. Renewables obviously are emissions free, helping reduce the potential impacts of global climate change.

On the other hand, unlike conventional resources, wind is not dispatchable and is geographically limited. Utilities must provide power to consumers 24/7, which requires that we maintain reserves with dispatchable generation resources. Renewables such as geothermal and incremental hydro are dispatchable, but they have high capital costs and geographic limitations. Our California geo-

thermal power plans, for example, lie in one of the most physically remote parts of that State.

Overall, renewable energy has a bright future, but this depends on actions you can take to support the development of a robust, domestic renewable electricity industry.

Two elements are really required to assure the role of renewables here in the U.S.: certainty on financial incentives, certainly, and transmission policies focused on the challenges of delivering renewables from their often remote locations.

Given their high up-front costs, renewables are not yet fully cost-competitive with fossil resources. However, the section 45 Production Tax Credit, or PTC, closes the gap. None of the wind investments that MidAmerican has made in the last 5 years would have occurred without the PTC, and we would not have erected a single turbine.

In late 2003, we announced our intention to build a 323-megawatt wind project, but the pending expiration of the PTC forced us to delay moving forward with the installation of those turbines. When the PTC expired on December 31, 2003, our project was frozen in place. We could not risk final acquisition and installation of the turbines without the PTC being restored, as the project would not have met the cost requirements of the Iowa Utility Board.

Fortunately, then-Chairman Grassley and you, Chairman Baucus, led the effort to restore the credit in September of 2004. We moved immediately to install as many turbines as possible, and by year-end had placed more than 150 megawatts in service. The Northwest Iowa Clipper project was completed right at 6 p.m. on New Year's Eve.

Since then, Congress has twice extended the PTC, leading to an unprecedented boom in wind development. However, demand for turbines is far exceeding available world supply. Wind turbine prices have nearly doubled in the last 3 years, largely as a result of this scarcity.

Manufacturers tell us that the certainty of incentives in Europe make that market preferable for both manufacturing and long-term customer relationships. And in order for wind energy to reach its full potential here in the U.S. and help lower greenhouse gas emissions, Congress must make a longer-term commitment.

With regard to geothermal, hydro, biomass, and waste-to-energy generation, the problem is even more acute. While these resources are more geographically limited than wind, they do function as dispatchable resources. Building the projects is capital-intensive, and most cannot be completed within short placed-in-service time frames.

MidAmerican has suggested that Congress consider allowing flexibility with regard to placed-in-service dates for projects involving base load renewables by allowing projects to opt into tax treatment that reduces the 10-year application of the PTC by an equivalent period equal to the date of expiration of the placed-in-service date and the completion of the project. In other words, if a project is brought on line 6 months after the expiration of the placed-in-service date, it would receive the tax credit for the remaining 9½ years versus the original 10.

However, the better answer would be a 10-year extension of the PTC that would provide long-term certainty and solve the base load renewable issue. It would help redistribute the PTC's benefits from manufacturers to end-use customers. There should be little additional budget cost from one 10-year extension versus five 2-year extensions, for example.

To address concerns regarding the cost of future extensions, Congress could couple this long-term extension with a gradual phase-down of the credit back to 1.5 cents per kilowatt hour. MidAmerican has included this proposal in a broader outline of policy and technology measures designed to address global climate change.

While access to transportation, transmission, and water supply are the key factors in locating a conventional power plant, renewables are different. For the most part, we cannot choose where to locate them. Unfortunately, nature chose to test our creativity in making use of the resources. If you look at the attached maps in my testimony, you will see there is almost a perfect inverse correlation between renewable potential and population distribution.

Because of this, transmission becomes a disproportionately larger component of costs compared to conventional resources, and going forward, this situation will become more and more pronounced.

Our Iowa projects provide an instructive example here. The first 460 megawatts that we built required $7 million in transmission upgrades. That translates into about $15.25 per kilowatt installed. The next 75 megawatts will require about $12 million in upgrades, or about $160 per kilowatt.

Congress took a number of constructive actions in the 2005 Energy Policy Act to facilitate transmission investment. Taking advantage of these new opportunities, MidAmerican has joined with American Electric Power in a partnership to invest over $1 billion in the State of Texas in the next several years. This is primarily to connect West Texas's vast wind potential to the State's population centers.

Do not turn back the clock on these changes. We have noted with concern that one Senate bill proposes to repeal the shorter depreciation schedule provisions of EPAct 2005.

One of the key reasons that MidAmerican and AEP chose Texas for our transmission partnership is that Texas law promotes infrastructure investments to serve renewables through CREZes, or Competitive Renewable Energy Zones. We have seen a number of proposals circulating in Congress to replicate these zones on a national level, and we encourage you to take a look at these proposals.

So, in summary, renewable energy can play a vital role in allowing the United States to meet its twin challenges of enhancing energy security while promoting a cleaner environment. Congress must provide long-term certainty for the financial incentives and promote tax and regulatory policies that support investment and transmission to achieve this goal.

Thank you for providing me the opportunity to speak today, and I will be happy to answer questions as well.

The CHAIRMAN. Thank you, Mr. Raba.

[The prepared statement of Mr. Raba appears in the appendix.]

The CHAIRMAN. Mr. van't Hof?

STATEMENT OF JOHAN VAN'T HOF, CHIEF EXECUTIVE OFFICER, TONBRIDGE CORPORATION, TORONTO, ONTARIO, CANADA

Mr. VAN'T HOF. Chairman Baucus and members of the committee, I am Johan van't Hof, CEO of Tonbridge Power, a publicly traded development company that intends within the next couple of months to begin construction on a 200-mile, 240-kV merchant power line between Lethbridge in Alberta and Great Falls in Montana.

Senator Baucus, I am especially pleased to be testifying before you because of your well-deserved reputation in Montana, in Canada, and internationally for promoting innovative and actionable solutions to tough problems, and that is what I think our line does.

I would also like to commend the State of Montana and Governor Schweitzer for a can-do approach to supporting good projects.

The Montana Alberta Tie Limited, or "MATL," as I will call it, is unique because it is the first international transmission line connecting a State and a province otherwise unconnected. It is a merchant line that will provide a valuable complement to the traditional utility lines. It is the enabling infrastructure that will allow renewable and increasingly essential energy to flow from Montana where it is generated to serve native Montana load and meet demand in other areas.

The Senate Finance Committee is uniquely positioned to identify and adopt policies that make clean and renewable energy supplies feasible, as well as the policies that allow construction of the transmission highway on which green energy—and all other supply-side resources—depends.

Green highways. Our goal is to take MATL from initiation to completion in 2½ years. This is nearly unprecedented for a transmission project, but is absolutely critical given North America's projected need for supply and transmission infrastructure. After its 2008 in-service date, the MATL line will be able to transmit 300 megawatts in and out of Montana. It will, thus, make a solid contribution to enhancing cross-border trade in energy and provide additional sources of stability to our respective grids. Importantly, it also serves as a critical collection system for 600 megawatts in new wind farms in Montana. In fact, all of the generators which currently have capacity contracts with MATL are wind projects. It is not an overstatement to say that MATL is a "green highway."

As we have tackled the numerous issues associated with this project, we have learned some lessons that are extremely germane to the issue facing us today. How can transmission be developed optimally and congruently with the timelines for generation development so that essential and environmentally friendly supply can be developed and reach customers?

Almost every observer of the power sector today would concur that new transmission development has badly lagged the growth in general, the growth in load, and the need for transfers of energy between markets. We are like a continent of two-lane roads with too few interstate highways, and the highways we do have do not interconnect us very well. The lack of adequate investment in

transmission has led to inefficient investment decisions, regional power prices that are often too high, and reduced reliability.

In fact, the United States Department of Energy has been sufficiently worried that it authorized a study of transmission congestion which identified areas where wind generation would require new transmission investment. Montana and the Northwest are one of five areas of significant congestion. Further, the North American Electricity Reliability Council recently released an important study of the reliability of North America's power systems. Capacity margins are forecast to decline, while the need for transmission will grow, with the need for new transmission to support diverse sources. In sum, congestion will only get worse, and action is required to support investment in new transmission.

Transmission has lagged in part because linear projects are harder to permit and build than single-site facilities. In addition, there are important challenges with factoring in positive externalities of transmission investment and coordinating transmission planning and investment among numerous parties. An important contributing factor has been the lack of commercial incentives in this area. This is potentially true, although in somewhat different ways, for utility-sponsored transmission and for merchant projects such as MATL. Few competitive generators today contemplate an investment that requires a decade to develop, yet timelines like that are now considered standard when it comes to developing transmission projects. Were MATL on a 10-year plan, my investors would wish me well and take their capital somewhere else other than a transmission project on the High Plains of North America. Their expectation is 2 years.

Lessons learned and possible actions. Our views—and they continue to evolve—are as follows: one, the value of stimulating all kinds of transmission investments, particularly for renewable electricity projects, is something we should look at; we need incentives for landowners to enhance the value of making rights-of-way available; three, we need commercial solutions to the problems associated with integrating renewable generation into utility operating areas.

Stimulating transmission investment. The problem: As the demand for renewable energy, most notably wind and small run-of-river hydro, grows, it becomes increasingly evident that the existing transmission grid was never built to connect these particular areas. To effect the "greening" of power will require not only many new environmentally appropriate generation projects but also a significant new wave of transmission development.

The solution: I believe that the tax incentives granted to renewable energy projects should be extended, on a pro rata basis, to the investment in the transmission systems that the renewable energy projects require.

Secondly, providing win-win right-of-way incentives to landowners. The problem is transmission developments are often blocked or delayed by opposition to new rights-of-way. Unless rights-of-way can be assured, transmission lines simply will not be built. Relying on condemnation, while effective, ultimately pits landowners against project developers, and we believe it is important to seek

ways for landowners to share in the benefits of transmission rather than perceive themselves as the victim.

Our proposal: MATL works hard to address the concerns of as many landowners as possible. We pay for the right-of-way on a per-pole basis. Thus, we have pledged to make annual pole rentals that reflect the impact on land values and agricultural practices. We suggest that these payments be made tax free to landowners and that their property taxes be reduced to partially compensate for the hindrances a line imposes. The new property taxes that our transmission lines will pay more than make up the difference.

Number three, integrating renewable transmission on a commercial basis. The problem is, renewable energy generation and wind energy in particular suffers from uncontrollable variability. The wind does not always blow when the demand rises, and this causes considerable difficulty for those responsible for matching load and generation.

In many jurisdictions, the system operator buys ancillary or additional generation to fill the gaps and smooth the cost of that purchase over all users. I will call this the "socialized solution." This may be more problematic as wind becomes a greater proportion of the system.

In Montana, the system operator is asking new wind generators themselves to firm their own wind generation profile, either by providing their own "firming" capacity or by contracting for it. I will call this the "privatized solution."

The solution: Neither the socialized nor the privatized solution is optimal in our view. It would be greatly preferable if all energy generators and loads shared in the responsibility for matching their planned use of the grid with their real-time use. When imbalances or electric volatility occur, as they always do, both generators and loads should be encouraged to adjust their use of the grid through that.

Only thus will the most efficient use of energy arise. Efficiency lies behind our need for renewables, and we should not lose sight of that on the way to building a more renewable-based electricity sector.

Mr. Chairman, I hope that MATL will be a contributor to Montana's "Big Sky Country" for years to come. I thank you for your leadership, and I look forward to the committee's questions.

The CHAIRMAN. I hope so, too. Thank you very much.

[The prepared statement of Mr. van't Hof appears in the appendix.]

The CHAIRMAN. Mr. Wiser?

STATEMENT OF RYAN WISER, SCIENTIST, LAWRENCE BERKELEY NATIONAL LABORATORY, BERKELEY, CA

Mr. WISER. Thank you, Chairman, members of the committee. Thanks for inviting me to testify today. My name is Ryan Wiser. I am a scientist at Lawrence Berkeley National Laboratory where for the last 10 years I have conducted renewable energy analysis.

Now, to be clear, I will not be advocating for a specific policy position this morning, but instead will be providing and reporting on the findings of some recent and ongoing research related to the

Production Tax Credit, or PTC, especially as it pertains to wind power.

In short, this work suggests that there may be significant benefits to both a longer-term extension of the PTC and to certain revisions to the PTC. In other words, given the message from some of the other speakers this morning, I will most certainly be beating a dead horse a little bit. Needless to say, there are, however, costs to the Treasury that do need to be balanced against these possible benefits.

To begin, let me say that the PTC has clearly already helped drive significant growth in the use of wind power in this Nation. For example, the United States has led the world in wind power capacity additions for the last 2 years running. And since the PTC began in 1994, roughly $13 billion has been invested in installing wind plants in the U.S., and for the second consecutive year, wind power has been the second-largest new resource added to the electrical grid here in the United States, after natural gas, with the potential for future growth also being substantial.

Though it is certainly true that some wind development would occur even without the PTC, both historical experience as well as recent analysis results have consistently shown that, if this Nation chooses to harness renewable resources at a significant scale and on an accelerated basis, then longer-term policy efforts through the PTC or through alternative policy measures will be necessary.

Since 1999, however, as we have already heard and as you are well aware, the PTC has expired and been extended on numerous occasions, typically for 1- to 2-year periods. As a consequence, wind power expansion has been compressed into relatively frenzied windows of development followed by pronounced lulls in the 3 years in which the PTC has expired. These boom-and-bust cycles in renewable energy development have led to underinvestment in domestic manufacturing capacity and variability in equipment and supply costs.

Given those circumstances, I would like now to discuss some key findings from some recent research that has investigated some of the possible shortcomings of the current boom-and-bust cycle, as well as some of the possible benefits of a longer-term, 5- to 10-year PTC extension.

First, we find that uncertainty in the future availability of the PTC may and is undermining industry planning, leading to lower levels of wind energy development than would occur if the policy had a more stable footing. In fact, other countries have already made strides towards using substantial amounts of wind energy by choosing to establish aggressive, longer-term policy commitments. Denmark, as an example, meets roughly 20 percent of its electricity needs with wind power, while Spain is currently at 10 percent and Germany is at 7 percent. The U.S., despite having a much more robust resource, currently meets less than 1 percent of its electricity needs with wind.

Second, uncertainty in the future scale of the U.S. wind power market has, so far at least, limited domestic wind turbine manufacturing. Instead, we remain heavily reliant on wind turbines and components manufactured in Europe and, perhaps in the future, increasingly in Asia and China as well, with only about 30 percent

of the average cost of wind projects currently being installed in the U.S. sourced or manufactured domestically. Many in the wind industry, on the other hand, expect that with a 10-year PTC extension, you might be able to increase this domestic manufacturing share significantly to roughly 70 percent, bringing with it jobs and local economic development benefits.

Third, perhaps somewhat less recognized as well, a longer-term PTC extension may result in both higher levels of private sector wind power R&D and greater investment in the transmission infrastructure needed to serve wind for reasons discussed in my written testimony.

Fourth, and maybe most importantly, there is reason to believe that the current boom-and-bust cycle is increasing the cost of wind power. Wind project costs in this country have decreased substantially from the early 1980s to the year 2002, but since then have risen. Recent research, however, shows that cost reductions of perhaps 15 percent may be possible under a long-term PTC extension relative to a continuation of the current 1- to 2-year extension cycle, with those savings expected to come in part from greater investments in supply chain infrastructure and manufacturing domestically, as well as reduced transportation costs.

Finally, in addition to describing some of these possible benefits of a longer-term PTC extension, my written testimony does identify for your consideration several different elements of the design of the PTC that may deserve a close look in your deliberations. Though I do not have time to discuss those in any detail this morning, they include: first, the PTC's credit offset or anti-double-dipping rules, which effectively make less valuable other State and Federal incentives provided to renewable energy, including, importantly, the USDA farm bill section 9006 grants; second, the somewhat narrow applicability of the PTC and ways to provide equivalent value to investors that are unable to take advantage of the PTC as it is currently structured; and third, and finally, ensuring that, if so desired, the PTC as well as other Federal tax incentives benefit not just large-scale wind projects but also other renewable projects as well.

With that, Mr. Chairman, I conclude my statement. I do hope this information proves useful, and I would be happy to answer any questions that you might have.

[The prepared statement of Mr. Wiser appears in the appendix.]

The CHAIRMAN. Well, thank you all very much.

The real question facing this committee is how to design it in a way that makes the most sense as extending the Production Tax Credit. We have certain budget restrictions here, but we also want to make the Production Tax Credit work a lot better than it currently has, and the main problem being the up-and-down effect, on and off and so forth.

So my question of you is the degree to which we could accomplish our objectives here generally by making the Production Tax Credit say 5, 6, 8 years or so forth, but phased down over time, and also the degree to which—I think one of you mentioned some intermediate—I think you did, Mr. Krenicki—steps, I guess benchmarks of some kind.

So I just would like it if you could give us some advice as to how we can tailor it and redesign it in a way that meets the basic objectives that we are all trying to accomplish here, but in a way that helps us meet our budget constraints. In the past, we have just these basic extensions. That has been kind of a shotgun effect, really. It has not been really tailored as well as it probably could be.

So your thoughts of what do we need to do here, what is the bottom line, and how would you design the bottom line here? Anybody who wants to take a crack at it, go ahead.

Mr. KRENICKI. Well, I would say it is a three-part answer, and it really starts with the debate on carbon policy for the country, and energy security. I think the PTC has been proven to be very effective on driving wind forward, but I think it needs to be married with State and Federal renewable standards.

The CHAIRMAN. Like portfolio standards?

Mr. KRENICKI. As that evolves, and then also on a bit of a longer-term basis, how does this all fit with the desired footprint of the country and where that debate ends up. I think wind is a big part of the answer.

The CHAIRMAN. Senator Bingaman, Chairman of the Energy Committee, is here. I know he is working on portfolio standards. How would you ideally marry the two or coordinate, say, portfolio standards with the Energy Committee and the Production Tax Credit, say, in this committee?

Mr. KRENICKI. I think maintaining the Production Tax Credit for a period of time and then transitioning to perhaps renewable standards at the State or Federal level from our perspective is a workable option.

The CHAIRMAN. Why wouldn't you just continue the Production Tax Credit, say, 10 years to give incentives for production?

Mr. KRENICKI. That is certainly an option as well, but then it comes back to the cost. And so that is just a view from our perspective. But in States where there are renewable standards, we see that being effective as well. I think part of the debate will be the time required for a fundamental discussion around fairness and who has the resources, and that is something I think is best addressed by the Energy Committee.

The CHAIRMAN. All right. Anybody else here?

Mr. WISER. Well, if I might just jump in very quickly on the latter question, the issue of how to have Renewable Portfolio Standards (RPS) policies and Production Tax Credits integrated.

The CHAIRMAN. Right. That is the basic question.

Mr. WISER. I would just provide one piece of information, and that is, it is quite clear based on State RPS experience that there are teething problems or that there can be teething problems in the design of RPS policies, especially in their early years. And so I do think that a transition during which both are operating simultaneously could make a lot of sense, given those teething problems that we see at the State level and the fact that it often takes several years for at least the State-level RPS policies to have really gotten off the ground and drive new resource developments.

The CHAIRMAN. What about national RPS standards?

Mr. RABA. Well, Mr. Chairman, I would just comment, relative to a national RPS standard, it can certainly be done, but it has to

be done very carefully. You have to take into account the wind regimes, the ability of one State to generate wind versus another, and MidAmerican has offered that as part of kind of a broader package that says put a national RPS in place over a certain period of time, connect it back to the Production Tax Credit. But, again, there has to be a pretty robust debate on the rules around not disadvantaging one State versus another.

The CHAIRMAN. Could you give me a better idea, just if I understand you correctly, there are greater incentives in Europe? Is that true, basically? Or is that not true?

Mr. RABA. Certainly the manufacturers that we are working with are telling us the environment in Europe is more healthy right now on a long-term basis to sell their product in versus the U.S. And I think a lot of that has to do with that boom-and-bust cycle.

Mr. KRENICKI. As a manufacturer, this year we will manufacture a little over 2,500 wind turbines; 2,000 will go to the U.S. And I just think Europe is certainly bigger because they have been at it longer in a more consistent fashion, but the U.S. is gaining. So the 2-year PTC that is in place is, you know, preferentially serving the U.S. market now.

The CHAIRMAN. Where are we in the technology curve and improving the efficiency of turbines?

Mr. KRENICKI. What we look at is capacity factor, and in the past few years, 3 to 4 years, it has improved about 11 percent. It is in the mid-40s now, and a 1-percent increase in capacity is equivalent to the electricity production to power 90,000 homes. So the technology is moving very quickly.

The CHAIRMAN. And you think there is considerable potential for additional improvements? Or have we kind of topped out a little?

Mr. KRENICKI. There will be a theoretical limit just based on a propeller design, but there still is room for improvement. I also think there is lots of opportunity to maximize the reliability of units, the availability, and the grid interconnection. So I think wind is still a significant technological upside.

The CHAIRMAN. When I was a little kid growing up on the ranch, we used a little windmill. Maybe it powered a light bulb, not much more. Then I went into one of the turbines that is in Montana, and I was stunned at the sophistication of the turbine, how computerized it was. It was really something.

Mr. VAN'T HOF. Mr. Chairman, I can give you the experience of the developers on our line who are all wind developers and the need for the Production Tax Credit to them. It is absolutely the sine qua non, without which their projects would not proceed. They use it for two reasons: one is to either drop their prices so that they are competitive with old coal and old transmission costs, because the market is looking for $40 to $50 per megawatt hour. The gentleman to my right is quite right that it is $70 to $80, wind, without the PTC. So they are not competitive in the market selling that way. Or they use it to sell off and drive the equity of their projects.

There are only four or five major developers in the United States doing wind projects. There are a number below that who do not have the heavy balance sheets, and without this, these projects would not proceed.

The CHAIRMAN. One quick question, and then I am going to have to leave and Senator Grassley can take over here. How do you suggest we put the firm power together with the intermittent power?

Mr. VAN'T HOF. I can tell you vicariously, because we are not a wind developer and we cannot be under the FERC rules, but we have customers who are wind developers. There are really two things. One is that the studies seem to show that up to 10 percent wind portfolio, the systems can diversify out the variability and cope. Above that, they start to have issues.

In our particular project, our wind developers are being asked by the two system operators in Canada and in the United States, NorthWestern Energy, to firm up their wind and to take that cost under their own financial statement, and basically that means that they have to have back-up generators, reciprocating gas units, or they have to buy ancillary services in order to firm up their wind so they have a firm profile.

Our northbound shipper has to come into Alberta firm on the hour, and so it is quite a—the old mechanism of just, you know, I will put wind into the system and let the system operate or diversify it out by load and so forth, as the penetration gets higher and higher, this concept of firming is becoming more and more relevant, because, otherwise, you get control area problems, you get fluctuation in frequency and so on.

The CHAIRMAN. Right, and you are finding not too much resistance to that requirement?

Mr. VAN'T HOF. There is some resistance because it imposes an economic cost on them. Having said that, firm wind power sells for more than unfirm wind power. There is also a capacity factor increase. When you have a reciprocating gas unit beside a wind farm, they can actually bid higher because they know the gas units will back them up if the wind is not there. So they actually can get a 3-, 4-, 5-percent capacity factor increase. So the economics do blend out, but it is a mind-set. The view at the moment from many wind developers is that it is for the system operator to figure out, and the system operators are pushing back.

The CHAIRMAN. Thank you very much.

Mr. RABA. Mr. Chairman, if I could comment on that as well, since MidAmerican is a control area operator and we have operated upwards of over 15 percent of our load in wind. Certainly part of it is the education process. Having utilized wind now for a couple years, the longer we go in operating higher percentages of wind, the better we get at managing it. And as part of a portfolio, at this point we are pretty comfortable with upwards of 15 to 20 percent of our capacity in wind and being able to manage it accordingly.

We have some advantages in Iowa because, frankly, our weather is pretty predictable. The ability to forecast the wind is important. Forecasting tools are getting better; our dispatch tools are getting better; and the ability to manage the dispatchable load with the wind, we are getting better and better at it. So I think there are some positives on the horizon relative to the obvious.

Two years ago if you had asked us, we would have said 10 percent, we would start getting nervous, and we are getting more and more comfortable.

Mr. VAN'T HOF. And that, Mr. Chairman, is consistent with our experience. The experienced system operators are getting to 15 to 20. The inexperienced are stuck at 10 and not getting beyond there.

The CHAIRMAN. So, bottom line, what should this committee do about renewables? You like the Production Tax Credit. Is that right?

Mr. VAN'T HOF. Yes.

Mr. RABA. Absolutely.

The CHAIRMAN. And it should be continued a longer period of time.

Mr. VAN'T HOF. And something for the landowners.

The CHAIRMAN. And do you mind if it is phased out?

Mr. RABA. Well, we do not object to phasing down. I think that is a function of how the technology plays out. And I know it is kind of a chicken-and-egg thing.

The CHAIRMAN. It is.

Mr. RABA. You pick a number, and, you know, from the view of a regulated utility, what is important to us is that, by requirement, our regulatory environment says we file what our costs are going to be and what the impact on our customers is going to be, and we take that economic decision into account. And without the PTC and the basic assumptions associated with it, the economics fall apart.

So I realize the difficulty that you have in trying to predict how to phase that number down, but the bottom line is, without it currently and based on our current forward projections over the next couple years, if you are not at that PTC level, you cannot make the economics work.

The CHAIRMAN. Well, I appreciate this. I think I can speak for this committee and Congress and say that renewables are more important now to this body than when we last renewed the credit, and we are going to try to figure out a way to make it work really well, cognizant of the costs, but we are going to do our very best.

Thank you all very, very much. I appreciate it. I am going to have to leave. Senator Grassley is going to take over.

Senator GRASSLEY. Mr. Raba, you presented a very interesting comparison in the price of transmission upgrade expense measured per kilowatt hour. MidAmerican has had 460 megawatts of wind, and those transmissions have cost $15 per kilowatt. But the next 70 megawatts required transmission upgrades of $160 per kilowatt.

Could you discuss in more detail the price volatility in the transmission upgrades?

Mr. RABA. I can, Mr. Senator. A couple of items.

First, part of that increase is certainly raw materials. I think we all recognize that raw material costs have increased particularly over the last 2 years, so it is partly driven by that, but more so it is driven by location and accessibility to the transmission.

When we look at sites for wind development, one of the key factors that we look at is the condition of the transmission system and the distance by which we have to interconnect with the transmission system. Obviously, you balance the transmission costs associated with the distance to get there and the upgrades you have to do with the wind regime itself, how well the wind blows in that given geography. And you balance those two things together and pick the most attractive site accordingly.

For every site you pick, what is left is a less attractive alternative, either on the availability of the wind itself or the availability of the transmission itself. So as we continue to develop projects, I would anticipate some combination of the wind regime being less attractive and the transmission costs being more exorbitant as a result. And that is exactly what we found between the first 460 and the next 120, and I am sure the next 500 will—you know, as we look at those sites, we find that same phenomenon.

Senator GRASSLEY. Do you have something you want to add? Go ahead.

Mr. VAN'T HOF. Yes, Senator. I would also add that in our experience, we have the most benign land to go over. We are not cutting down one tree, and we are about $300,000 a mile. We have very significant substation costs. We have phase-shifting transformer costs. So we are about $140 million for a 200-mile line.

What we are finding is that our costs today, which are current costs, are being compared to the regulated cost, which is 1985 or 1975 or 1965 costs, so that the regulated rate base rate is a 20- or 30-year-old cost which is now being compared to the current cost of building today. And so there is a sticker shock. It is a lot like buying a care in 1979 and then buying another one today.

Senator GRASSLEY. Mr. Raba, without going into a repeat of all the things that you had to go through to meet the deadline of placed-in-service, would you discuss in more detail the uncertainties of meeting such short placed-in-service deadlines like shipping from overseas and transportation and equipment shortages, any additional expenses?

Mr. RABA. I would just say that we do our best to negotiate agreements with both the turbine suppliers and the contractors that are doing the construction to take on as much of that risk as is prudent for them. So we have pretty sophisticated contracts in place in order to incentivize each of the folks in that chain to perform according to the appropriate schedule. So that is certainly part of it.

Having said that, it certainly brings an element of risk into the equation. As I said, in the State of Iowa we have a pretty good regulatory environment where we do ratemaking principles up front, where we will set a cost cap and we will take on the risk associated with that cost cap above and beyond that. And if we do not meet those cost parameters, then the company takes the financial hit.

So there is an element of risk, and, you know, one of those key elements of risk is, as I said, the potential for the PTC to expire at a given point in time where, if you do have a shipping delay that could cause you to miss that date, obviously the financial implications are pretty severe.

Senator GRASSLEY. Mr. Krenicki, you spoke of the Department of Energy's goal of generating 20 percent of the U.S. energy electricity from wind by 2030. The Ambassador of the EU said the target was 21 percent of renewables by 2010. What can the United States do, if anything, to meet our goals of 2010 like the EU?

Mr. KRENICKI. There are only very few countries in the EU that will hit that objective as well by 2010, but, given that we are at roughly 1 percent today, it is virtually impossible to get there by 2010.

But just to even put the DOE's goal in perspective, it will require us to ship a wind turbine every 15 minutes out of our manufacturing facilities for that current goal. So, again, I think the biggest thing we can do is have longer, stable public policy, and then that will drive investment in a supply chain to allow us to ship more frequently than every 15 minutes.

Senator GRASSLEY. Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman. Thank you all for your good testimony. I think it is very useful.

The one real concrete thing that we can get done here in this committee, I think, on this Production Tax Credit is to redesign it, extend it but redesign it in a way that makes more sense. The way it now operates, I think we have this 2-year Production Tax Credit, so you have to have everything in service by the end of—what is it now?—the end of 2008 in order to get 10 years of tax credit from the date that you put the facility in service on. You get 10 years of tax credit.

I think, Mr. Krenicki, you pointed out that, if we just do a 5-year extension, then maybe you will have a dip in the amount of investment in new wind projects for a few years because everyone will be looking at that 5-year deadline and saying, well, we can wait, we do not need to make a decision yet. So you have a few years of slack time, and maybe that is another version of the boom-and-bust, even though we would have a commitment to a long-term future.

Is there a solution to that? How do we redesign it and say, what if we just eliminated the date-in-service provision in the law and just said for the next 10 years you have a Production Tax Credit? If you get started right now, if you put your—or even 15 years, if you put your facility into operation now, you can keep it going for a period, and if you wait until 5 years to the end of that period, you have less of a tax credit?

Mr. KRENICKI. I just see two potential issues. The first is, in order to optimize the supply chain and get more output and lower cost, you need level loaded production. So how does the tax policy drive that behavior? Because that will allow people to make major manufacturing investments on a very large scale.

The second thing to be cautious of is having units go into storage versus actually being put in service, which is, I think, the desired effect of getting the power on line and perhaps creating—getting the CO_2 benefit as well.

My major concern is really the level loading and manufacturing facilities.

Senator BINGAMAN. Mr. Wiser, did you have a thought as to how we could structure this thing so as to—I mean, the way it seems to be structured right now, it has this sort of perverse result. What do you think?

Mr. WISER. Well, I think the Treasury concern combined with the fact that a longer-term extension has the possibility, if it does result in stable industry growth, to drive costs down somewhat does suggest, to me at least, that over a longer-term basis that some level of reduction in the PTC certainly is plausible.

I would like to raise a little bit of caution on that, however, and that is that, again, over the last 4 years, we have seen pretty con-

siderable increases in the cost of wind. Most of that has come from the increased cost of wind turbines—manufacturing, delivery, and installation. That cost increase makes it ever more important to have the PTC at a higher level than at a lower level. So I think the key caution that I would provide is that, sure, it is useful to consider reductions in the level of the incentive over time for a variety of reasons. But if you do so too quickly, it does run the risk of really halting the industry in its tracks just when it is ready to explode.

Mr. VAN'T HOF. Senator, at a micro level—because I deal with project developers doing 600 megawatts of wind—it is not possible to find land, do the anemometer data, get banking, permits, leases, turbines, order turbines and then have them installed and delivered in 2 years. You are looking at 3 to 4 years if you are really good at it.

And so for somebody to make a decision about getting into a project and then meeting a timeline for having the PTC available to it, it is a 3- to 4-year cycle. There are about 13-, 14-month delivery delays now with most of the suppliers, and so 2 years is not enough time for anybody to get a project on the ground.

Senator BINGAMAN. Let me just ask, we have talked mainly about wind here. There is some testimony in here about how—I think, Mr. Wiser, you point out, I believe, that some other types of renewable energy resources really require longer terms and a different kind of a tax credit. We have sort of a similar Production Tax Credit, whether you are doing solar, whether you are doing wind, whether you are doing whatever, in the definition that we covered.

Should we have a different one for solar? Do any of you have enough knowledge of that to give us good advice there?

Mr. WISER. I guess I could jump in here quickly and say, first of all, the PTC currently does not apply to solar. Solar receives a separate investment tax credit, as you know. I think that for the other technologies that are currently eligible for the PTC—biomass and geothermal being the two most obvious ones, and as others on the panel mentioned earlier, the placed-in-service deadline is a real barrier for wind. It is a huge barrier for these other technologies because their development time frames exceed the 12- to 24-month extensions that we have seen recently.

So while a placed-in-service deadline extension, a longer-term extension of the PTC, would certainly be valuable for wind, I would say that it would even be more valuable for some of the other technologies.

With respect to solar, solar does now receive an investment tax credit, which in absolute value is higher than the PTC, which at least from an analytic basis makes some sense. Solar is still an emerging technology relative to the more mature wind technology, and its costs are higher. There is great potential for significant cost reduction over time, but it does require a slightly different tack, and I think, appropriately so, Congress has seen fit to apply the investment tax credit to solar to date.

Mr. RABA. Mr. Senator, I would just add, I mentioned in my testimony the issue with geothermal, for example, is a very significant issue, because the way that PTC is created now, you actually cre-

ate a cliff whereby if you miss the in-service data, then you just fall off the cliff and you lose all 10 years of the credit.

Senator BINGAMAN. Right.

Mr. RABA. So if there is some way, as we had suggested, to create a mechanism whereby you would only give up the time that is between the in-service date and the time you actually get it on line for capital-intensive, longer-term projects like geothermal, that would certainly be a significant benefit.

Senator BINGAMAN. That is an interesting suggestion, building that flexibility in with the in-service date.

Mr. VAN'T HOF. Much of the problem, Senator, is that most of these emerging technologies are trying to find power purchase agreements and trying to find customers in the market where they have a competitive market where they are trying to sell and they are trying to compete against coal and natural gas and hydro and so forth. And everyone is trying to find 4-, 5-, 6-cent power. Solar is 45-cent power.

And so I do not know that you can get the tax credits down to a level where they are going to be able to compete. This is where you get into having to have portfolio requirements where you have 1-percent solar and 10-percent wind so that there is a smoothing effect, almost a socialized kind of blending of the thing. If you are just asking these projects to compete in the open marketplace and try to find a customer at the costs they are at today, wind is struggling without the Production Tax Credit, and solar will definitely struggle.

Senator BINGAMAN. Well, thank you all very much. I think we have run out of Senators here, so we will call it a day. Thank you. I appreciate your good testimony.

[Whereupon, at 12:10 p.m., the committee was adjourned.]

APPENDIX

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

Hearing Statement of Senator Max Baucus
Clean Energy: From the Margins to the Mainstream
March 29, 2007

One hundred thirty-one years ago this week, Thomas Edison moved his lab from Newark to Menlo Park, creating the world's first industrial research lab. Three years after that, he and his team of scientists produced the world's first reliable, long-lasting light bulb. Three years later, more than 10,000 light bulbs were burning in New York City. Widespread use of electricity spread from there. The world was changed forever.

Today's hearing considers Edison's legacy—the widespread use of consumer electricity. Today we ask: How do we deal with the implications of the technology that Edison produced? And how can we learn from the spirit in which he developed it?

More specifically, what can the Finance Committee do to promote the widespread use of clean, renewable power?

Let's start by looking at what we have already done. Fifteen years ago the Finance Committee—including many among us today—passed the Production Tax Credit to spur development of renewable electricity.

In 2005, we revised and extended the Production Tax Credit, now known as section 45. Last year we extended the credit through 2008.

The Production Tax Credit has contributed to a dramatic increase in the production of renewable power. Last year, we saw the largest increase ever for U.S. wind power, with enough power added to power about 650,000 American homes.

But the credit is not an unqualified success. It has lapsed three times since 1999, causing significant dips in renewable-power investment.

This partly explains why America still gets a relatively small percentage of its electricity from renewable sources. Excluding hydroelectric power, which is largely ineligible for section 45, less than three percent of American electricity comes from renewable sources.

So how do we increase the role of renewables in the American power supply? And how do we know when we have succeeded in doing so?

Should the standard be 10 percent of power from renewable sources, as the Senate approved 2 years ago? Should it be a 15 percent standard, as Montana has pledged by 2015?

This Committee hasn't arrived at an exact number. But I believe it's safe to say that we believe it should be greater than 3 percent.

To help us work through these important issues, I am pleased to be joined by a distinguished panel of experts at today's hearing, starting with the head of the European Union's delegation to the United States, Ambassador John Bruton.

Ambassador Bruton is the former Prime Minister of Ireland. Before that, he was Ireland's Minister of Industry and Energy.

He oversaw a rapid economic growth in Ireland. And he has ably served the EU as its ambassador to the U.S. since 2004. We're honored to have the Ambassador here to brief the Committee on the EU's plans to increase its share of renewable power. This is a matter of mutual interest and concern to both the United States and the European Union.

Mr. Ambassador, let me first congratulate you on Northern Ireland's power-sharing agreement, announced earlier this week. You played a key role in that peace process. And you're to be congratulated for the fruit it looks poised to bear.

Let me also congratulate you on the European Union's 50th anniversary. The EU has gone from a group of six original members to 27 today. And it is now adjusting to the additions of former communist states like Bulgaria and Romania.

Mr. Ambassador, I thought the Democratic Party was a disparate bunch. We've got nothing on the EU.

I look forward to your presentation on EU approaches to renewable power and the EU's commitment to fighting climate change writ large.

As I mentioned, renewables still comprise a relatively small share of our Nation's electricity. Given that, one might ask: "Why should we spend a significant amount of time and money on this issue?"

It's true that 15 years after its enactment, the Production Tax Credit has not realized the potential its authors hoped for.

It's also true that tax incentives for clean energy are expensive—particularly if they are extended for long periods.

But the evidence for action against climate change has never been stronger. We need to make better use of renewable power.

As for the significant cost of renewable tax incentives, I am open to ideas for reducing their cost, and I look forward to working with this committee—and the stakeholders involved—to that end.

As we consider these critical issues, let us again remember the example of Thomas Edison.

Edison once said, "Many of life's failures are experienced by people who didn't realize how close they were to success when they gave up."

Edison didn't know whether he would succeed. He didn't even know whether success was possible. But he stuck to it, and the world is dramatically different as a result.

Like the challenges Edison faced, the obstacles before us are enormous when it comes to energy. The difference between our challenges and Edison's is that we know we can succeed. All we have to do is look around the world.

We're honored to have a representative from around the world with us to begin today's discussion. Ambassador Bruton, thank you for being here, and welcome.

THE EUROPEAN UNION'S EXPERIENCE IN THE USE OF ECONOMIC INSTRUMENTS, INCLUDING TAXATION, TO REACH SPECIFIC OBJECTIVES IN ENERGY POLICY

Statement

By

His Excellency

John Bruton

Ambassador,

Head of Delegation of the European Commission to the United States

To

The Committee on Finance

Unites States Senate

29 March 2007

1. POLICY CONTEXT

Reliable energy is a vital part of our daily lives in Europe and we have come to rely on it. But the days of secure, cheap energy are over and we are already facing the consequences of climate change, increasing import dependence and higher energy prices.

Energy use is the main factor in climate change, accounting for some 80% of the European Union's (EU) greenhouse gas emissions. The EU is committed to reducing these emissions, but its present energy practices will actually result in increasing them by 5% by 2030. Therefore the EU's current energy and transport policies are not sustainable. Acting now to tackle climate change is essential.

Rising, volatile prices, blackouts and difficulties in supply have all illustrated the risks of being overly dependent on oil and gas. With global needs on the up, this pattern is set to continue. The International Energy Agency expects worldwide demand for oil alone to increase by well over a third by 2030 – so how will this be met? If energy trends and policies remain as they are, the EU's reliance on imports will jump from half to almost two thirds in 2030. 84% of gas would have to be imported, as would 93% of oil. But from where and how these supplies would come is unclear. Add to this the fact that several EU Member States are essentially dependent on one single gas supplier and factor in the lack of a crisis support structure between countries, and the EU's growing vulnerability is evident.

The EU's increasing dependency on imports threatens not only its security of supply but it also implies higher prices. If, for example, the price of oil rises to $ 100/barrel in today's money, the EU's energy import bill will be around 50% higher by 2030. While Europeans would have to pay a lot more for their energy, few additional jobs in the EU would be created this way. In contrast, boosting investment in energy efficiency, renewable energy and new technologies has wide-reaching benefits and would contribute to the EU's strategy for growth and jobs.

Even though Europe is doing quite well if we compare its energy consumption per capita and CO2 emissions per capita with the respective indicators for US and Japan (EU's energy consumption per capita is half of the US and CO2 emissions are even less than half), this gives no reason whatsoever for the EU to be complacent. Its energy situation is alarming even though it might be even more alarming in the US.

What is clear is that in order to ensure a sustainable, secure and competitive energy supply, a common response is needed.

2. THE OBJECTIVES OF EUROPEAN ENERGY POLICY

Although EU energy policy is far from being created from scratch (a number of energy efficiency and renewables promotion measures date back more than 10 years) it is just recently that the EU has opted for a comprehensive, integrated and ambitious policy set in the field of energy and fight against climate change.

The 2007 Spring European Council of heads of state and government, held on 8-9 March 2007, demonstrated that the EU is taking the lead in the fight against global warming. EU

heads of state and government adopted an energy policy for Europe which does not simply aim to boost competitiveness and secure energy supply, but also aspires to save energy and promote climate-friendly energy sources.

EU leaders set a firm target of cutting by 20% the EU's greenhouse gas emissions by 2020. The EU will be willing to increase this goal to 30% if the US, China and India make similar commitments.

EU leaders also set a binding overall goal of 20% for renewable energy sources by 2020, compared to the present 6.5%. A subordinate goal is to increase the level of bio-fuels in transport fuel to at least 10% by 2020.

The European Council also confirmed the target to improve energy efficiency by 20% by 2020 compared to the baseline (the target proposed by the European Commission – the EU executive – in October 2006).

3. USE OF ECONOMIC INSTRUMENTS IN ENERGY POLICY AND RELATED AREAS: THE OVERALL PHILOSOPHY

When using economic policy instruments for furthering energy and environmental policy goals the EU and its Member States seek first to discourage what is undesirable, and only in the second place, (and if still necessary), to use public resources to directly support desirable behaviour.

Article 174 of the Treaty establishing European Communities requires Community policy to be based on the "polluter pays" principle. The costs associated with protecting the environment should be internalised by firms just like any other production costs. In order to implement this policy, the Community will have to use a series of instruments: regulation, and in particular the adoption of standards, but also voluntary agreements and economic instruments.

Ensuring that prices reflect costs at all stages of the economic process is the best way of making all parties aware of the cost of protecting the environment. Apart from their potentially adverse effects on trade and competition, subsidies generally undermine that aim because they enable certain firms to reduce costs artificially and not to reveal the costs of environmental protection to consumers.

Thus, the "polluter pays" principle and the need for firms to internalize the costs associated with protecting the environment would appear to militate against the granting of subsidies. Nevertheless, the EU acknowledges that state aid (subsidies) can be justified in two instances:

(a) in certain specific circumstances in which it is not yet possible for all costs to be internalised by firms and the aid can therefore represent a temporary second-best solution by encouraging firms to adapt to standards;

(b) the aid may also act as an incentive to firms to improve on standards or to undertake further investment designed to reduce pollution from their plants.

4. EU-WIDE MEASURES (EXISTING AND FORTHCOMING)

Describing the EU system in a simplified way one could say that emissions from the most energy intensive sectors are currently addressed by the EU emission trading scheme, whereas energy taxation applies to energy consumption in households and in the transport sector and lighter industrial processes.

4.1. Taxes and charges

4.1.1. Energy taxation – overall approach

Traditionally the EU member states have taxed energy consumption by means of energy taxes (known as excise duties, energy taxes, or CO2 taxes for example). These taxes are always "specific taxes" – they are levied on the quantity of energy products once these are released for consumption. In practice such taxes are levied once the finished product is released from a refinery. This means that such taxes are easy to administer, since they are applied only once and the number of tax payers is extremely limited. These taxes are then included in the final price of energy paid by all consumers, be they private individuals or industry. In many cases, reduced rates of duty apply to industry in order to preserve its international competitiveness. In practical terms this is handled by means of refunds or authorised consignments without tax.

Taxes related to energy use are well-established measures in all Member States of the European Union. Although their main purpose has traditionally been to raise revenues, they also contribute to reducing energy consumption by raising the price of energy and energy-using goods and services. They thus support in a general way the goals of improving energy efficiency and fighting climate change. Energy taxes also act as a "shock absorber" by damping the impact of energy price swings on the EU economy. In this way, and by reducing overall energy consumption, they contribute to security of supply.

At the EU level the harmonisation of energy taxes started in 1992 with the latest relevant legislation dating back to 2003[1].

Energy products and electricity are only taxed when they are used as motor or heating fuel, and not when they are used as raw materials or for the purposes of chemical reduction or in electrolytic and metallurgical processes (e.g. for the production of plastics, steel and other metals).

Taxable energy products include:

- mineral oils (e.g. gasoline, diesel, LPG, kerosene, heavy fuel oil…),
- natural gas,
- coal and other solid hydrocarbons, when they are used as motor fuel or heating fuel.

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[1] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity: see http://eur-lex.europa.eu/LexUriServ/site/en/oj/2003/l_283/l_28320031031en00510070.pdf

In order to avoid fraud, *any product* used as motor fuels is taxable and *any other hydrocarbon* used as heating fuel is taxable.

Energy products used in electricity generation are exempt from tax whereas electricity itself, once delivered to the consumer, is subject to tax.

EU energy tax legislation lays down those products that are taxable together with when and how they should be taxed.

When it comes to tax rates, EU legislation only sets minimum levels of taxation. Above these minima EU Member States are free to set their own national rates as they see fit.

EU minimum levels of taxation per product and use

EURO/***USD***	Minimum levels of taxation when used as motor fuel		Minimum levels of taxation when used as motor fuel for certain industrial and agricultural uses	Minimum levels of taxation when used as heating fuel	
	Current	From 2010		Non-business use	Business use
gasoline (1000 liter)	359 / ***477***	359 /***477***	374 / ***497***		
Diesel (1000 liter)	302 / ***402***	330 /***439***	21 / ***28***	21 / ***28***	21 / ***28***
Kerosene (1000 liter)	302 / ***402***	330 / ***439***	21 / ***28***	0	0
LPG (1000 kg)	125 / ***166***	125 /***166***	41 / ***55***	0	0
natural gas (1 GJ gross calorific value)	2,6 / ***3,5***	2,6 / ***3,5***	0,3 / ***0,4***	0,3 / ***0,4***	0,15 / ***0,2***
coal and coke (1 GJ gross calorific value)				0,3 / ***0,4***	0,15 / ***0,2***
electricity (1 MWh)				1 / ***1,3***	0,5 / ***0,65***

(The volumes are measured at a temperature of 15° C).

As a result of international agreements, and due to the international nature of shipping, energy products supplied for use as fuel for the purpose of air navigation and sea navigation are exempt from taxation.

If one looks at how Member States transpose the EU legislation in their national laws, one can see that the 12 countries that have recently joined the EU (2004 and 2007 accessions) do not go beyond the EU stipulated minimum or do so by very little. In contrast Germany, Netherlands and UK have the highest rates of excise duties. In case of the UK, the minimum rate is more than doubled.

Detailed information on applicable excise duty rate on energy products in different Member States is regularly published by the European Commission in the overview called "Excise duty tables – Energy products and Electricity"[2].

As to the future development of legislation at the EU level, first one has to mention the recent European Commission proposal on commercial gas oil. The proposal is based on the fact that existing tax differentials on diesel used by trucks create distortions of competition within the liberalised Internal Market of the haulage sector. In addition, they lead to "fuel tourism", where truck drivers lengthen their routes in order to benefit from low tax rates applied in certain Member States, thereby having a negative impact on the environment. In consequence, the Commission's proposal aims at narrowing these differentials while reducing environmental damages. Inter alia, the proposal will increase in two steps the minimum rate of excise duties from 302 to 380 Euros ($402 to $505) per 1000 liter in 2014 (intermediate step at 359 Euros or approximately $477), which will reduce the distortions of competition and environmental damages.

The EU Commission is also about to launch a debate on the further options for the use of energy taxation in the EU. This discussion will start with the forthcoming publication of a "Green Paper (consultation paper) on economic instruments for environment and related policy purposes" that should provide input for a review of the Energy Taxation Directive to be proposed by the Commission before the end of 2008.

The review is motivated by two factors:

- *Making the Energy Taxation Directive more supportive of the objectives of energy efficiency*. Energy taxation is not always neutral and sometimes treats certain energy products more favourably than others without any justification. One possible idea would be to link the taxation of energy products to their energy content (as is already the case for natural gas, coal and electricity) and therefore make it fully neutral, but support the objective that each engine or combustion unit, whatever fuel it consumes, must be as efficient as possible.

- *Making the Energy Taxation Directive a more environment-related tool.* The idea is to introduce an explicitly environmental element into the Energy Taxation Directive, as is the practice already in some Member States. Such an approach would have three advantages:

    1. It would allow renewables, such as bio-fuels, to be favoured, as the environmental tax would not apply. The energy tax would, at the same time ensure that the incentive in favour of energy efficient consumption is maintained and that some revenue is generated.

    2. It would allow a better combination of taxation and other economic instruments (when emissions are addressed by the emission trading scheme, they do not need to be addressed by taxation).

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[2] See: http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_II_energy_products-en.pdf

3. Finally the "component" approach to Energy Taxation would also allow a better combination of energy taxation and infrastructure charging at the EU level (for non-greenhouse gas emissions).

In practice this would mean splitting the current minimum levels (where possible) into two separate components or counterparts. Since energy taxation is a very cross-cutting instrument that applies in many sectors and areas, it often interacts with other economic instruments used within the EU. Better structured energy taxation would make such interaction easier and more effective and would ensure fairer sharing of costs of EU energy and climate policies between all parts of the society.

Consideration still needs to be given however, as to whether focussing on energy efficiency and environmental impacts would also allow proper attention to be given to another key objective of energy policy, that is, security of supply. The Commission will have a closer look into this issue once responses to the Green Paper have been analysed.

4.1.2. EU energy taxation – approach to renewables

Since energy taxation does not apply to non-hydrocarbons used in heating, it indirectly favours almost all sorts of biomass used for heating purposes.

A different approach exists, however, for motor fuels. In order to prevent both erosion of the tax base and fraud, the general rule for taxation of motor fuels is that all additives, extenders or substitutes for hydrocarbons shall equally be taxed, at the rate of the equivalent motor fuel (gasoline or diesel). However, EU legislation provides for an option, according to which motor fuels (or their components) that are of bio origin can be exempt from energy taxation.

Electricity is always subject to taxation, irrespectively of its origin. On an optional basis, Member States are allowed to exempt electricity of renewable origin from taxation. This possibility, however, requires the origins of electricity to be traced. The application of this option cannot lead to discrimination between imported (other EU or third countries) vs. domestically-produced electricity. In practice this option is not widely used.

4.1.3. Passenger car taxation

EU Member States have intentionally encouraged the purchase of more fuel-efficient cars relative to less efficient cars by differentiating car purchase or ownership taxes according to engine size or power. Several have made the environmental objectives of these taxes more explicit by introducing differentiation based on CO_2 emissions per kilometre (or mile), and the Commission has proposed that all Member States should do so.

Notably, the European Commission has presented a proposal for a Directive that would require Member States to re-structure their passenger car taxation systems[3]. It would promote sustainability by restructuring the tax base of both registration taxes and annual road use taxes so as to include elements directly related to the carbon dioxide emissions

[3] Proposal for a Council Directive on passenger car related taxes - COM(2005) 261, 5.7.2005 http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0261en01.pdf

of passenger cars. This would mean a tax differentiation on the basis of the number of grams of carbon dioxide emitted per kilometre by a car. By 31 December 2008, at least 25% of the total tax revenue from registration and annual road use taxes should derive from the CO2 based element of the taxes and this figure should rise to 50% by 2010.

The proposal also aims to improve the functioning of the Internal Market by removing existing tax obstacles to the transfer of passenger cars from one Member State to another.

4.1.4. Taxation of freight vehicles and infrastructure charging

In May 2006 European legislators adopted the Directive establishing a new Community framework for charging for the use of road infrastructure[4]. The so called Eurovignette directive (the title comes from name for small, coloured stickers affixed to motor vehicles using highways in some European nations The affixing of a vignette on a motor vehicle indicates that the respective road toll has been paid.).

The new directive will make it possible to improve the efficiency of the road transport system and ensure the proper functioning of the internal market. The Directive lays down rules for the application by Member States of tolls or user charges on roads.

The main objective is to ensure road usage better reflects its true impact on society and the environment at large by introducing a "user pays" and a "polluter pays" principle. It also aims to shift freight away from roads onto other modes of transport such as rail and waterways.

Vehicle taxes. In accordance with Eurovignette Directive Member States may not set vehicle tax rates any lower than the minimum rates set out in the Directive (this can go beyond $1000 per year depending on the technical specifications of the vehicle).

Tolls and user charges[5]. The Directive lists the conditions to be met by Member States wishing to introduce and/or maintain tolls or introduce user charges. These conditions are as follows:

- application of the principle of no discrimination on the grounds of the nationality of the haulier or the origin or destination of the vehicle;
- no checks at internal borders;
- application of the principle of proportionality of rates for user charges, based on the duration of the use made of the infrastructures;
- possibility of varying the rates depending on the categories of emissions from the vehicles and/or the time of day;
- possibility for two or more Member States to cooperate in introducing a common system for user charges.

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[4] New directive on of taxes on certain vehicles used for the carriage of goods by road and tolls and charges for the use of certain infrastructures (Directive 2006/38/EC of 17 May 2006). See http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_157/l_15720060609en00080023.pdf

[5] "User charge" means a specified amount payment of which confers the right for a vehicle to use for a given period the infrastructure; "toll" means a specified amount payable for a vehicle travelling a given distance on the infrastructure.

Maximum amount of user charges can go beyond $ 2000 per year depending on specification of the vehicle, including emission limits according to so called Euro-norms.

Tolls shall be based on the principle of the recovery of infrastructure costs. Specifically weighted average tolls shall be related to the construction costs and the costs of operating, maintaining and developing the infrastructure network. Nevertheless, individual toll rates may vary for the purposes of combating environmental damage, tackling congestion, etc.

From 2012 onwards tolls and/or user charges will apply also to vehicles weighing between 3.5 and 12 tonnes whereas currently they only cover vehicles above 12 tonnes.

The directive's main novelty is to introduce the possibility for individual states to integrate the 'external costs' of road transport into toll prices. After intense discussion, it was finally agreed that these 'external costs' can include congestion costs, environmental pollution, noise, landscape damage, social costs such as health and indirect accident costs which are not covered by insurance. To be integrated in the charges ('internalised'), the costs have to be proved "undeniable", EU legislators agreed.

The Commission ended a dispute between the European legislators on how precisely to integrate such costs in toll prices by promising to come forward with a calculation method two years after the directive comes into force (June 2008).

4.2. European Union Greenhouse Gas Emission Trading Scheme

As regards tradable permits, the EU emissions trading scheme (ETS) is the centrepiece of the EU's efforts to reduce greenhouse gas emissions and meet its international climate change commitments. It logically complements the energy taxation system.

Strictly speaking, ETS is not a part of EU energy policy, but it has an impact both on the development of cleaner energy mix and improvement in the energy efficiency.

By increasing energy prices in general, and the cost of burning fossil fuels in particular, the ETS has the potential to contribute to improving the competitiveness of renewable energy sources.

Basically, it has the potential to be one of the most important tools for attaining EU energy policy objectives.

In January 2005 the European Union Greenhouse Gas Emission Trading Scheme commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme in the world. The ETS scheme is unique in its size and international nature. Over 10.000 installations in the 27 Member States are covered by the scheme, providing them with a clear incentive to reduce their emissions and look towards cleaner and more efficient technologies. The upcoming review, which will be prepared in close cooperation with stakeholders, will provide the opportunity to further improve the functioning of the scheme.

To date, the first phase of the EU ETS, running from 2005 to 2007, has delivered valuable lessons. These lessons are informing the review process, which is aimed at strengthening the scheme by looking at its functioning and its scope, in particular expanding it to other sectors and gases, beyond the second trading period, running from

2008 to 2012. However, the first set of independently verified emissions reports for the year 2005 was of particular importance. This indicated that aggregate 2005 emissions, at just over 2 billion tonnes, were significantly below the annual average allocation for the first period of close to 2.2 billion tonnes. Hence, the Commission is taking a much stricter approach with respect to allocation of emission allowances for the period 2008 to 2012. The decisions the Commission has taken so far on the national allocation plans for the second period is proof of this. Unlike the first trading period the second one will be characterised by scarcity of allowances in the EU ETS, thereby in turn ensuring emissions reductions are delivered and that the emerging carbon market is strengthened. This will allow the EU ETS to realise its full environmental and economic potential in terms of environmental and economic benefits.

In an effort to tackle aviation's small but fast-growing contribution to climate change, the European Commission issued a legislative proposal in December 2006. This is another important recent development concerning ETS. It suggests imposing a cap on CO2 emissions for all airplanes arriving or departing from EU airports at an 2004-2006 average level, while allowing airlines to buy and sell 'pollution credits' on the EU 'carbon market'. 2011 is the Commission's target date for the aviation sector to start trading CO2[6].

During their Spring 2007 meeting the Heads of State and Government of the member states confirmed their commitment to ETS: its functioning will continue well beyond 2012. The ambitious CO2 reduction targets they agreed on for 2020 will make the system even more effective.

The current on-going review of the ETS aimed at improving its functioning after 2012 explores a number of issues, including issues related to auctioning (In the first trading period, i.e. 2005-2007 the European Directive on the EU ETS allowed governments to auction up to 5% of the allowances; in the second – 2008-2012 – up to 10%).
The issues to be answered are: What share of allowances should be auctioned in the trading periods? Should these be nationally coordinated or EU-wide auctions? What should be auction schedules? What should be auction design? For the option of separate national caps it is being analysed if there should be a harmonised minimum of auctioning after 2012, and what share might be suitable. For the option of a single EU-wide cap, full auctioning should be considered as a possibility.

Of course, as the EU only accounts for around 14 % of global emissions, it is clear that whatever we do concerning global warming, we have to do it in broad global cooperation. In this respect we are happy to observe the latest trends in the US.

More information on the functioning of the EU's Emission trading system can be found at http://ec.europa.eu/environment/climat/emission.htm

4.3. The EU approach to Sustainable Coal Technologies

Coal and gas account for over 50% of the EU's electricity supply and will remain an important part of our energy mix in the future. On the international level, it is expected that twice as much electricity as today will be produced from coal by 2030. However, increasing concern over the effects of climate change, mean that Europe has to take the

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[6] See http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0818en01.pdf

lead in undertaking serious measures to ensure that we reduce CO2 emissions from coal and work on developing cleaner coal technologies.

On 10 January 2007 the European Commission therefore adopted an Energy Package for Europe, which included a Communication on the sustainable use of fossil fuels in electricity generation.

The Commission has underlined that the future use of fossil fuels must be sustainable and in line with Europe's climate change policy. This means that fossil fuels can continue to provide essential energy security benefits in Europe and worldwide only with the use of new technologies allowing for combustion with radically reduced levels of CO2 emissions.

For coal, which produces relatively more CO2 per unit of electricity than other fossil fuels, the sustainability objective will require the development and commercialization of new integrated technological solutions, or so-called "Sustainable Coal" technology. This combines improvements in conversion efficiency and CO2 capture and geological storage processes.

Sustainable Coal technologies will also represent important solutions to the sustainable use of other fossil fuels, particularly natural gas, in power generation.

This can also be envisaged for the co-production of electricity and hydrogen on a large scale, opening the door to the future hydrogen economy.

There are indications that the technical and commercial feasibility of new technologies for sustainable power production from coal could be achieved in Europe by 2020 and then be ready for wide penetration in the power generation industry and for application, also to other fossil fuels.
However, to achieve such development will require early bold industrial investments in a series of demonstration plants and related policy initiatives.

Strategy for the period up to 2020: during this time a first element of an EU strategy for sustainable power production from coal will be to use the best available technologies (BAT) and the most efficient coal conversion processes, when replacing or renovating outdated coal-fired power plants. Furthermore, new plants built in this period should be designed as "capture-ready", i.e. prepared for later addition of CO2 capture and storage (CCS) technologies, when these become commercially available.
At the same time such a strategy will need to actively pursue further development and demonstration of sustainable fossil fuel technologies. Up to 12 large scale demonstration projects relying on integrated technological solutions, using natural gas or coal, have been proposed by industry in 2006 and the Commission is keen to see these projects progressing to their full-scale implementation by 2015. The Commission will be ready to increase the financial support provided through its research programmes for the development and demonstration of technological solutions for sustainable fossil fuels in power production.
As a third element the Commission will engage in closer collaboration with third countries on the further development and demonstration of sustainable technologies for power production from fossil fuels, enabling the use of CCS.

A stable, consistent policy and regulatory framework removing barriers to implementation of CCS is crucial for the commercial roll-out of sustainable fossil fuels

technologies. At the EU level, the Commission will propose to amend accordingly the EU environmental legislation (a public consultation will be launched early 2007) and expects to include CCS activities in the EU Emission Trading System (when proposing the revision of this system in 2007). At the international level, the Commission plans to continue its efforts to ensure a wide international consensus regarding the future emissions reduction objectives for CO2 and other greenhouse gases. The Commission would support amendments to existing international conventions so as to allow underground storage of CO2 below the seabed.

Strategy for the period after 2020: If needed, the Commission may consider proposing appropriate measures to encourage wide penetration of Sustainable Coal. These could entail a range of initiatives including: extending the horizon of the Emission Trading System to match or surpass the usual lifetime of an investment in power generation, identifying and developing CO2 storage sites and pipelines, favouring sustainable electricity production, and implementing timed phase-out of high CO2 emitting installations. On the basis of the information available today, the Commission believes that after 2020 all new power plants using coal, and most likely gas as well, should be built and operate with CCS, whereas capture-ready plants built in the previous period should be rapidly retrofitted.

5. NATIONAL POLICY MEASURES USED BY EU MEMBER STATES TO PROMOTE RENEWABLES

5.1. Support schemes for electricity from renewable energy sources (RES-E)

According to the present green electricity directive adopted at EU level[7] the EU aims at having renewable sources provide 21% of the electricity generated in the EU by 2010. To reach national indicative targets established on the basis of this overall reference value Member States have taken a number of measures to promote market penetration of green electricity.

Currently there is a range of different support systems operational in the EU that can be broadly classified into five groups: feed-in tariffs, green certificates, tendering systems, tax incentives and investment grants. The first two support instruments are the most popular and important ones, therefore they will be described in more detail.

Feed-in tariffs exist in most of the Member States[8]. These systems are characterised by a specific price/premium, normally set for a period of several years that must be paid by electricity companies, usually distributors, to domestic producers of green electricity. The additional costs of these schemes are paid by suppliers in proportion to their sales volume and are passed through to the power consumers.

According to how the funds for the support system are collected and managed, one can distinguish 3 main sub-categories of feed-in tariff systems:

- So called Preussen Elektra system (named after the European Court judgment) used in Germany. This support scheme foresees a burden sharing mechanism between the Distribution System Operators (DSO), which are subject to the purchase obligation of

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[7] Directive 2001/77/EC on electricity produced from renewable energy sources in the internal electricity market. See http://eur-lex.europa.eu/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

[8] France, Spain, Romania, Greece, Bulgaria, Hungary, the Czech Republic, Slovakia, Latvia, Estonia, Lithuania, Luxembourg, Cyprus and Malta

green electricity at a fixed price, and Transmission System Operators (TSO). It does not foresee compensation payments to the DSO and/or TSO for the additional financial burden resulting from the purchase obligation and/or the burden sharing mechanism. Normally, DSO and TSO can pass the additional financial burden onto their clients through higher electricity prices (in the past this, however, required the prior approval of the ministry of the economy of the German Land (state) in question).

- Para-fiscal levy system. This system is practiced in the majority of Member States. Normally, under such systems TSO and DSO are compensated for the obligation to buy green electricity at a fixed feed-in tariff through a consumption-based levy paid by energy users. Usually, the collected levies are channelled to DSO/TSO through the funds specifically established for that purpose. To make such systems compatible with the smooth functioning of the EU's internal market the European Commission's practice is to ask that the imports of green electricity from other Member States is de-taxed. This is necessary because importers of green electricity do not benefit from the respective support schemes in the country of destination.

- Connection fee system. Such a system is practiced in Austria, Ireland, the Netherlands and Slovenia. Under such systems the mode of collection of the support funds is based on lump sum payments on connection, irrespective of the amount and source of the electricity consumed. When determining the amount of the lump sum payment, account may be taken of the power of the connection (fuse rating) and the voltage level at which particular consumer and consumer group is connected.

There are also variations in the feed-in systems across the EU as to the "modulation" of support paid to producers of green electricity:

- Germany, for example, uses a pure fixed tariff system. This means that producers of green electricity can count on the fixed and same tariff for a long period of time. As there are no fluctuations depending on market price developments, this system offers to producers the highest stability.

- Denmark, in turn, has a premium system for onshore wind. While the level of the premium is fixed, the other part of the price is dependent on market price. Other renewable technologies are supported by fixed feed-in tariffs.

- Spain has a premium system; however it gives the option to choose between the "market price plus premium" formula and the "fixed price plus premium" formula.

Feed-in schemes have the advantages of investment security and the promotion of mid- and long-term technologies. On the other hand, they are difficult to harmonise at the EU level and involve a risk of over-funding, if the level of support is not degressive over time.

Under the **green certificate** system, currently existing in the United Kingdom, Sweden, Italy, Belgium and Poland, green electricity is sold at conventional power-market prices. In order to finance the additional cost of producing green electricity, and to ensure that the desired green electricity is generated, all consumers (or in some countries producers) are obliged to purchase a certain number of green certificates from RES-E producers according to a fixed percentage, or quota, of their total electricity consumption/production. Penalty payments for non-compliance are transferred either to a renewables research, development and demonstration (RD&D) fund or to the general

government budget. Since producers/consumers wish to buy these certificates as cheaply as possible, a secondary market of certificates develops where RES-E producers compete one with another to sell green certificates. Therefore, green certificates are market-based instruments, which have the theoretical potential, if functioning well, of ensuring best value for investment. These systems could work well in a single European market and have in theory a lower risk of over-funding. However, green certificates may pose a higher risk for investors and long-term, currently high cost technologies are not easily developed under such schemes. These systems present higher administrative costs.

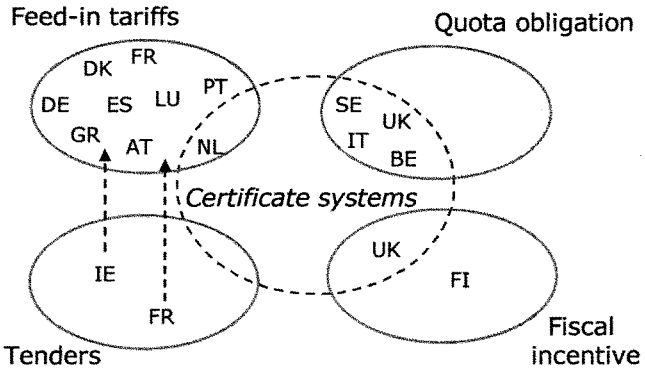
Pure **tendering** procedures existed in two Member States (Ireland and France). However, both have changed this system to a feed-in tariff combined with tendering system in some cases. The same is basically true for Portugal. Under a tendering procedure, the state places a series of tenders for the supply of RES-E, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of RES-E are passed on to the end-consumer of electricity through a specific levy. While tendering systems theoretically make optimum use of market forces, they have a stop-and-go nature not conductive to stable conditions. This type of scheme also involves the risk that low bids may result in projects not being implemented.

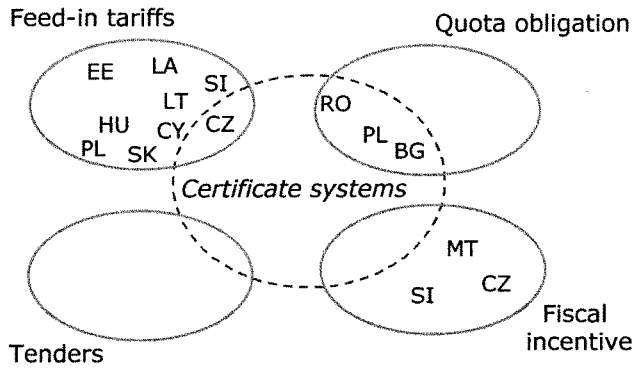
Systems based only on **tax incentives** are applied in Malta and Finland. In most cases (e.g. Cyprus, UK and the Czech Republic), however, this instrument is used as an additional policy tool.

The above categorisation into four groups is a fairly simple presentation of the situation. There are several systems that have mixed elements, especially in combination with tax incentives.

An overview of the use of the different mechanisms:

Support mechanisms in EU-15 (old EU Member States)





On 10th January 2007 the European Commission published a report on progress in renewable electricity, which shows how successful individual Member States and the EU have been so far in promoting green electricity[9].

5.2. Support schemes for biofuels

The present biofuels directive adopted at EU level[10] includes a 5.75% target for 2010 with respect to the share of the market for gasoline and diesel in transport. To reach national indicative targets established on the basis of this overall reference value Member States have taken a number of measures to promote the market penetration of biofuels.

The two Member States that have made most progress in the field are Germany and Sweden. While Germany's success has rested mainly on biodiesel, Sweden has concentrated on bioethanol. In other respects, however, their policies have several common factors. Both countries have been active in the field for several years. Both promote both high-blend or pure bio-fuels (giving the policy visibility) and low blends compatible with existing distribution arrangements and engines (maximising the policy's reach). Both have given biofuels tax exemptions, without limiting the quantity eligible to benefit. Both have combined domestic production with imports (from Brazil in the case of Sweden, from other Member States in the case of Germany). Both are investing in bio-fuel RTD and have treated first-generation bio-fuels as a bridge to second-generation.

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[9] See http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0849en01.pdf

[10] Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport. See http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_123/l_12320030517en00420046.pdf

Tax exemptions are a longstanding form of support for biofuels. In 2005 and 2006, several Member States announced the introduction of a new form of support: **bio-fuel obligations**[11]. These are legal instruments requiring fuel suppliers to include a given percentage of bio-fuels in the total amount of fuel they place on the market. Some Member States are using obligations as a complement to tax exemptions, others as an alternative. There is good reason to believe that in the long run, bio-fuel obligations will bring down the cost of promoting biofuels – in part because they ensure large scale deployment - and will prove the most effective approach. The Commission encourages their use.

Since the beginning of 2005, 13 Member States[12] have received state aid approval for new biofuel tax exemptions (via this approval procedure the European Commission checks if the way the excise duty exemption will be applied will not result in overcompensation of biofuel producers and in distortion of the EU's internal market). At least 8 Member States have brought bio-fuel obligations into force or announced plans to do so.

On 10 January 2007 the European Commission published a "Report on the progress made in the use of biofuels and other renewable fuels in the Member States of the European Union"[13].

5.3. Support schemes for heating and cooling of buildings from renewable energy sources (RES-H&C)

The renewable heating and cooling sector is more fragmented than its electricity or transport counterparts, with a range of fuels (biomass, geothermal, solar), technology and equipment included in the sector. For this reason, policy and support systems for the sector are not always coherent and are a bit piecemeal.

Support schemes in EU countries include grants and/or low interest loans for the purchase of equipment (biomass (e.g. pellet) boilers, solar thermal panels, geothermal heat pumps). Germany and Austria (two countries with significant penetration of solar thermal panels) use such schemes. France has introduced an income tax credit (worth 50% of the purchase cost of solar equipment), which is proving very popular.

Analysis of support schemes suggests that major financial support is not always necessary: continuity of the support programme, combined with publicity campaigns, are seen as key elements of successful policies.

The main barriers to the uptake of renewable energy technology in the heating and cooling sector are not always cost related (much of the equipment has payback periods of 5-10 years); local planning rules and delays and poor information on the part of installers seem to be much more significant barriers.

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[11] France and Austria's obligations came into force in 2005, Slovenia's in 2006. The Czech Republic, Germany and the Netherlands have announced the introduction of obligations in 2007, the UK in 2008.

[12] Austria, Belgium, Czech Republic, Denmark, Estonia, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Sweden and UK

[13] See http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0845en01.pdf

EUROPEAN UNION
DELEGATION OF THE EUROPEAN COMMISSION

Head of Delegation

Washington, 13 April 2007

DELUSW 2007/D 544/ (TEE 1963)

Dear Chairman Baucus,

I would like to thank you for inviting me to testify on 29 March before the Senate Finance Committee on "Clean Energy: From the Margins to the Mainstream." I agreed to provide additional information in response to questions posed by yourself and members of the Committee. You will find enclosed additional information and data.

I remain at your disposal should you have further inquiries on the EU approach to renewable energy.

Yours Sincerely,

John Bruton

2300 M Street NW Washington, DC 20037-1434 Telephone: (202) 862-9500 / Fax: (202) 429-1766

THE EUROPEAN UNION'S EXPERIENCE IN THE USE OF ECONOMIC INSTRUMENTS, INCLUDING TAXATION, TO REACH SPECIFIC OBJECTIVES IN ENERGY POLICY

Additional Information

1. Biodiesel production in Germany

Regulatory Framework for Biofuels in Germany

In Germany, a new biofuel quota law came into force in January 2007. Under the new law, all distributors of fuel have to meet a quota for biofuels, calculated as a percentage of their total fuel distribution. For diesel fuel, the quota is set at 4.4% biodiesel. For gasoline, the quota rises from 1.2% biofuel in 2007 to 3.6% in 2010. An overall quota for biofuels as a percentage of total fuel consumption (diesel and gasoline) has been set at 6.25% in 2009, rising to 8% in 2015. The minimum quota within the diesel and gasoline sector will also remain active after the introduction of the overall quota in 2009. The overall quota gives the fuel distributors flexibility to choose whether they would like to fulfill their obligation within the diesel or gasoline sector.

Under the German energy tax law of 2006, biofuels and biodiesel enjoy certain tax benefits. However, biofuels within the quota are taxed at the normal rate of €0.47/liter for standard diesel. The tax on pure biodiesel above the quota is only €0.09/liter for 2006/7, €0.15/liter in 2008, €0.21/liter in 2009, €0.27/liter in 2010, €0.33/liter in 2011 and €0.45/liter in 2012. The tax on pure plant oil is €0.00/liter 2006/7, rising stepwise to €0.45/liter in 2012. E85 exceeding the quota have a reduced tax until 2015. Second generation biofuels enjoy tax benefits until 2015 (also within the quota).

Production of Biofuels in Germany

Germany is the largest producer of biodiesel in Europe, with an output of about 1.8 million tons in 2006. The share of biofuels in German fuel consumption was 3.7% in 2005. In Germany, biodiesel and pure plant oil are produced from rapeseed. According to a 2005 study of the Wuppertal Institute, about 30 production facilities were operating or were expected to go online by 2006. Production capacity per plant ranges from less than 10,000 tons/annum to 180,000 tons/annum.

In 2005, Germany produced about 200,000 tons of bioethanol for the transportation sector. More than half of that amount was made from rye and wheat; the remainder was produced from sugar beet. The bulk of German ethanol is produced at three large plants (Kraul & Wilkening, Südzucker, and Sauter). The rest is produced in many small and medium-sized companies.

Due to the quota law, production is expected to increase up to 1 million tons/annum in the coming years.

2. Wind energy production in Spain

Spain is the second largest producer of wind energy in the world, ranking behind Germany and just ahead of the United States.

At the end of 2005, Spain had nearly 10,000 megawatts of installed wind power capacity. Wind energy accounted for an all-time high of 27% of Spain's electricity production in early 2007. In 1999 the Spanish government had set a target of 8,900 MW of installed wind capacity by 2010, but this proved to be too modest and was replaced by a new goal of having 20,000 megawatts of wind energy by 2010 in the new Renewable Energies Plan. This plan foresees increasing renewable energy production to reach at least 12% of the total energy demand in Spain by 2010.

Investment in the wind sector has been encouraged by a "special regime" that was established in 1980 for renewable energy sources. Wind energy production took off in 1990s when Spain modified the "special regime" to provide renewable energy sources with guaranteed access to the distribution grid, along with setting a premium payment for power generated from renewable sources. Currently Spain employs a feed-in tariff system for wind energy which provides two price guarantee mechanisms. Wind energy generators can choose between 1) a fixed purchase price or 2) sell freely and receive the market price plus an added premium. In 2005 the fixed price was established at €0.066/kWh for the first five years, at €0.062/kWh for years 5-16 and at €0.058/kWh for subsequent years. In 2005 the premium was set at €0.029/kWh. The price support system ensures the profitability of wind energy production and encourages increased investment.

Spain's wind industry is dominated by corporate players, with a low level of farmer and co-operative ownership. This contrasts to the situation in Germany and Denmark, where there is a relatively high proportion of co-operative activity and farmer ownership.

3. EU research and development efforts on promoting solar energy

For solar thermal under the 5th and 6th EU Research Framework Programmes (1999-2002 and 2003-2006 respectively), the EU contributed some €25 million to research projects developing Concentrating Solar Power technologies and about €7,5 million on Solar Thermal technologies. In the 5th Research Framework Programme there were 100 photovoltaic projects launched in Europe with a total cost of €285 million and an EU contribution of €119 million. The 6th Research Framework Programme (2003-2006) covered 28 photovoltaic projects with a total budget of €160 million, of which €105 million was EU contribution.

4. Renewable energy sources in the energy mix of EU Member States

Gross Inland Consumption
2004 (Mtoe)

	All fuels	Solid fuels	Oil	Natural gas	Nuclear	Renewables	Other*
EU27	1805.7	328.5	665.2	434.0	260.1	115.2	2.7
	100.0%	18.2%	36.8%	24.0%	14.4%	6.4%	0.2%
Belgium	54.8	6.1	20.1	14.6	12.2	1.2	0.7
Bulgaria	18.9	7.2	4.3	2.5	4.3	1.0	-0.5
Czech Republic	43.6	19.5	9.4	7.8	6.8	1.4	-1.3
Denmark	20.0	4.4	8.3	4.6		2.9	-0.2
Germany	347.7	85.8	125.4	78.7	43.1	13.8	1.0
Estonia	5.6	3.3	1.1	0.8		0.6	-0.2
Ireland	15.7	2.3	9.3	3.6		0.3	0.1
Greece	30.6	9.1	17.5	2.2		1.6	0.2
Spain	140.2	21.1	68.9	25.2	16.4	9.0	-0.3
France	273.7	14.1	92.8	39.2	115.6	17.3	-5.3
Italy	184.8	16.6	85.0	66.0		12.5	4.7
Cyprus	2.5	0.0	2.4			0.1	
Lithuania	9.2	0.2	2.6	2.4	3.9	0.7	-0.6
Latvia	4.6	0.1	1.4	1.3		1.6	0.2
Luxembourg	4.7	0.1	3.0	1.2		0.1	0.3
Hungary	26.2	3.4	6.3	11.7	3.1	1.0	0.7
Malta	0.9		0.9				
Netherlands	82.3	9.2	31.6	36.7	1.0	2.4	1.4
Austria	32.7	4.0	13.8	7.6		6.8	0.6
Poland	92.5	54.6	22.0	11.9		4.3	-0.3
Portugal	26.2	3.4	15.0	3.3		3.9	0.6
Romania	39.6	9.3	10.3	13.9	1.4	4.6	0.0
Slovenia	7.1	1.5	2.5	0.9	1.4	0.8	-0.1
Slovak Republic	18.6	4.5	3.6	5.5	4.4	0.7	-0.1
Finland	37.7	7.5	10.9	4.0	5.9	8.8	0.6
Sweden	53.1	2.9	15.4	0.9	20.0	14.1	-0.2
United Kingdom	232.1	38.3	81.5	87.4	20.6	3.7	0.6

Source: Eurostat

* Electrical Energy and Industrial Waste

Gross Inland Consumption
2004, Renewables (ktoe)

	Renewables	Biomass	Hydro	Wind	Solar	Geothermal
EU27	115 153	76 116	27 821	5 033	743	5 440
	100.0%	66.1%	24.2%	4.4%	0.6%	4.7%
Belgium	1 161	1 119	27	11	3	1
Bulgaria	980	708	272	-	-	-
Czech Republic	1 363	1 188	174	1	-	-
Denmark	2 926	2 346	2	566	9	2
Germany	13 755	9 367	1 812	2 173	269	134
Estonia	607	604	2	1	-	-
Ireland	325	214	54	56	0	0
Greece	1 560	953	402	96	108	1
Spain	8 977	4 853	2 713	1 341	62	8
France	17 304	11 927	5 179	49	19	130
Italy	12 528	3 791	3 671	159	19	4 888
Cyprus	97	5	-	-	92	-
Lithuania	734	698	36	-	-	-
Latvia	1 649	1 377	267	4	-	-
Luxembourg	73	59	9	3	1	-
Hungary	965	860	18	-	2	86
Malta	-	-	-	-	-	-
Netherlands	2 364	2 175	8	161	20	-
Austria	6 766	3 450	3 132	79	86	19
Poland	4 325	4 126	179	12	-	8
Portugal	3 894	2 877	849	70	21	78
Romania	4 634	3 134	1 420	-	-	80
Slovenia	822	470	352	-	-	-
Slovak Republic	737	379	353	-	-	5
Finland	8 805	7 498	1 296	10	1	-
Sweden	14 131	8 883	5 170	73	5	-
United Kingdom	3 671	3 055	424	166	25	1

Source: Eurostat

Opening Statement of Senator Chuck Grassley
Committee on Finance Hearing
"Clean Energy: From the Margins to the Mainstream"
Thursday, March 29, 2007

First of all, I would like to thank Chairman Baucus for calling this hearing on electricity from renewable energy. The Finance Committee has been very successful in identifying energy tax issues that have created domestic energy options for the nation. Everyone wants to talk about shaking our growing dependence on foreign fossil fuels, but we will never have that opportunity in our lifetimes if we do not aggressively identify domestic energy options. The Finance Committee has jurisdiction over all of the potential tax and trade provisions that can help create a consistent sustainable energy policy for this nation.

As a long-term member of this committee and the previous chairman of this committee, I have aggressively proposed utilizing the tax code to help level the playing field between renewable resources and traditional fossil fuel-powered electricity.

In fact, for years, I have worked to decrease our reliance on foreign sources of energy and accelerate and diversify domestic energy production. I believe public policy ought to promote renewable domestic production that uses renewable energy and fosters economic development.

Specifically, the development of renewable energy resources conserves existing natural resources and protects the environment. Finally, alternative energy development provides economic benefits to farmers, ranchers and forest land owners, such as those in Iowa who have launched efforts to diversify the state's economy and to find creative ways to extract a greater return from abundant natural resources.

I have been a constant advocate of alternative energy sources. I proposed the original wind energy credit which became law in the Energy Policy Act of 1992. Since inception of the wind energy tax credit, wind energy production has grown from being almost non-existent to the success story of today. In addition, wind represents an affordable and inexhaustible source of domestically produced energy.

It is my hope that the Senate continues to support this maturing green energy source that has environmental benefits. Every 10,000 megawatts of wind energy produced in the United States can reduce carbon monoxide emissions by 33 million metric tons by replacing the combustion of fossil fuels. In addition, some studies suggest that for every 100 megawatts of wind you could save an equivalent of over 500,000 barrels of oil per year. These are important issues as we consider our energy options of the future. I am proud to say that the State of Iowa has over 1000 megawatts of wind facilities in operation making a substantial contribution to emissions free electricity and displacement of fossil fuel.

Today, I expect to hear many bold plans and accomplishments on electricity policy, but I will be most interested in those ideas that help to empower our rural communities to reap continued economic benefits and diversifying our electricity portfolio and reduce our impact on global climate issues.

And finally, I have growing concerns that our U.S. trade deficit has been substantially impacted by our continued reliance on foreign fossil fuel and U.S. reliance on foreign technology and imported equipment needed to fully utilize capturing and converting wind, solar and biomass energy options. I am pleased the Finance Committee will have the opportunity to hear the views and experiences of His Excellency John Bruton, the Ambassador to the European Commission Delegation and his discussion of the European Union's experience in renewable electricity. Increased independence from fossil fuels and reducing any potential impact on global climate issues is a world wide issue. I am pleased the Finance committee energy hearing schedule has included worldwide experience as we continue to review our options for a stable long term policy on electricity.

Senate Finance Committee

Thursday, March 29, 2007
Written Testimony of
John Krenicki, Jr.
President and Chief Executive Officer, GE Energy

Mr. Chairman and members of the Committee, I am John Krenicki, President and CEO of GE Energy ("GE"). I appreciate the opportunity to testify today on tax policies that will contribute to moving renewable energy further into the mainstream of our national energy future.

GE is a power generation technology leader and has been in the energy industry for over 100 years. We currently have over 700 sites operating in more than 100 countries, and a team of 36,000 employees. Our diverse product portfolio consists of steam turbines, gasification systems, gas turbines, nuclear, solar, biomass and wind technology.

We commend the Committee for holding this hearing today to examine clean energy generation options. I will focus on the issues involved in expanding the opportunities for renewables, specifically wind and solar energy, the benefits of these resources, and challenges in growing the renewable generation sector, and particularly the wind industry. We have made considerable progress in expanding our use of renewables, and supportive tax policies, especially the renewable energy production tax credit ("PTC"), have been essential. There is much more that remains to be done, however, to secure the energy security and environmental benefits of renewable energy generation.

Summary of Key Recommendations

Congress should act this year to extend the existing tax credit for production of electricity from wind energy and the investment tax credits for solar energy. Action this year – before the credits expire – will assure that the stimulus provided for the growth of the wind and solar industries continues undiminished by financial uncertainty.

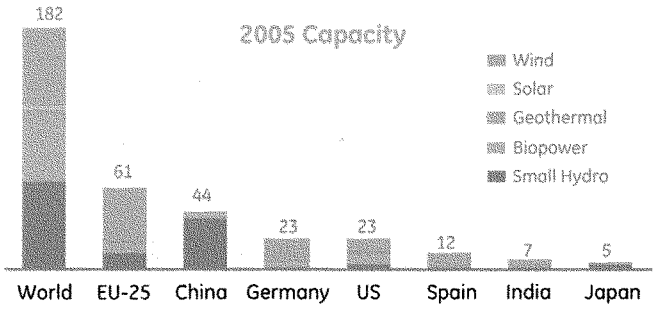
Putting Renewable Generation in Context: Global Demand For Renewables

Today, the renewable energy sector (excluding large-scale hydropower) represents only 3% of global electricity production. However the

global demand for renewable solutions is significant, growing more than 20% annually over the last five years. We expect this rapid growth to continue over the coming years. We also estimate that renewables currently represent approximately 40% of global power capital spending.

In 2006, global renewable installed capacity was over 200GW, of which wind energy represented over one-third. At present, there are 50 countries installing wind power and 38 countries with renewable targets. Some examples include the European Union, where all EU member states have adopted national targets for electricity consumption from renewable resources. If all these national targets are met, EU-wide, 21% of electricity consumption will come from renewable resources in 2010.[1] In China, a Renewable Energy Law, passed in 2005,[2] seeks to increase the country's renewable energy capacity to 10% by 2020. The government's wind power development goal is 30 GW of wind by 2020. India is targeting 10 GW of renewable energy by 2012.

While the United States does not yet have a statutory renewable energy mandate, the American Wind Energy Association and The Department of Energy have identified a goal of generating 20% of electricity from wind by 2030. In addition, there are 21 US states with renewable portfolio standards ("RPS") that have been instrumental in fostering wind and other renewable investments. However, the US is



Source: REN21, Renewables 2006 Global Status Report, *Excludes Large Hydro Power

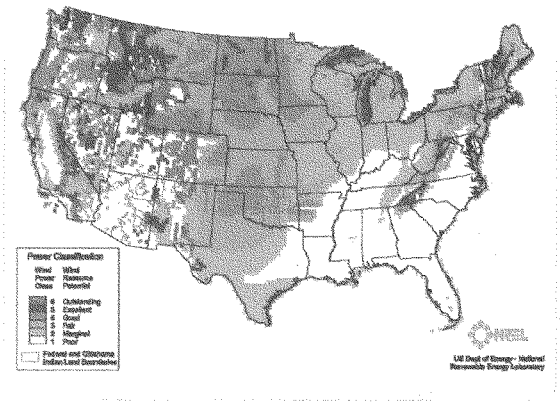
[1] A March 2007 report of the European Commission recommended the establishment of an "overall legally binding EU target of 20% renewable energy sources in gross inland consumption by 2020." *See* "Renewable Energy Road Map: Renewable energies in the 21st century: building a more sustainable future," available at: http://ec.europa.eu/energy/energy_policy/doc/03_renewable_energy_roadmap_en.pdf

still trailing other regions in renewable installations. At GE, we believe wind energy can become a significant player in the US energy portfolio.

Wind Energy in the US

The US has some of the world's best wind resources. When compared to Germany, the country with the world's largest wind energy installed base, and other top country wind installers, the US has significantly better wind resources. In fact, the American Wind Energy Association (AWEA) estimates that current US wind resources have the potential to supply up to two times the total electricity generated in the US today.

Figure 13. Wind Resource Potential



Due to our country's strong wind resources and support from the Federal and State governments, the industry has recently seen record-breaking growth; in 2006, the US installed 2,454 MW of wind energy contributing to a total installed base of 11,603 MW, which is enough energy to serve 3.2 million homes.

Although today's wind technology supplies less than 1 percent of US electric generation, the total installed base has nearly doubled over the last three years and new unit installations are up more than 45 times from a decade ago. Wind energy is currently being used to generate power in 40 states and delivers significant economic and environmental benefits:

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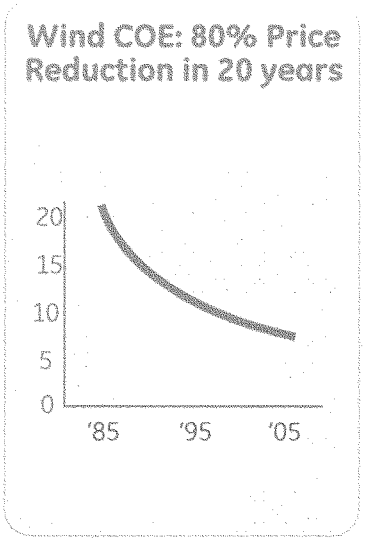
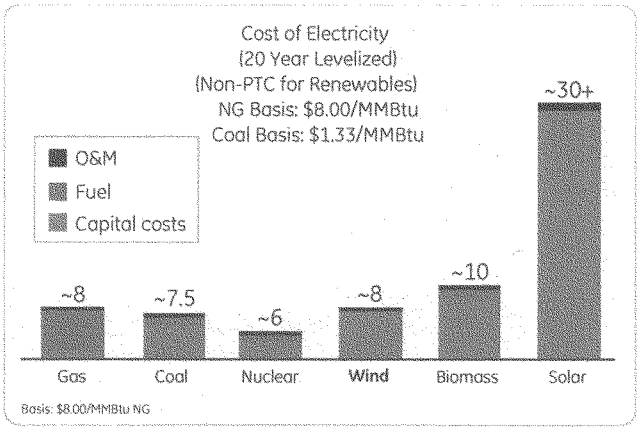
[2] The law is available at: http://china.lbl.gov/publications/re-law-english.pdf..

1) **Predictable and Competitive Cost of Electricity ("COE")**
According to the American Wind Energy Association, since 1980, the cost of wind-generated electricity has seen an 80 percent price reduction as the result of technology advancements in availability, efficiency and output.



Furthermore, wind energy is a fixed cost source of electricity which hedges rising prices of other energy sources, such as oil and natural gas. Today, depending on a site's wind resources, development costs and capacity factor, the range of the Cost of Electricity for wind, exclusive of any incentives, is approximately 8 - 10 cents/kWh and is becoming competitive with other power generation technologies.



2) Environmentally Sound

Tapping the potential of wind as an energy source makes use of this *abundant, domestic, zero carbon emissions resource* while reducing overall US dependence on imported energy. Wind also emits zero criteria emissions (sulfur dioxide or nitrogen oxide emissions) and consumes no water in the generation of electricity.

A recent study conducted by GE Energy concluded that a 100 MW wind farm in New York State would produce the energy equivalent to 590,000 barrels of oil per year and displace 400,000 pounds of NOX per year, 800,000 pounds of SOX per year and 260 million pounds of carbon dioxide per year.

As a result of these benefits, we believe wind energy is the most commercially viable renewable energy resource today. It can help us achieve energy independence while emitting zero criteria pollutants, zero greenhouse gas emissions, and consuming no water.

Challenges in Growing the US Wind Sector

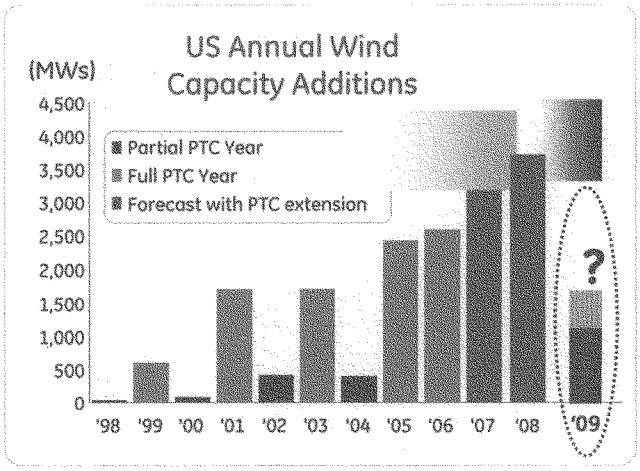
In order to grow wind in the US to 5%, 10% and even 20% of the total electricity generated, we believe there are three needs: 1) predictable and stable public policy, 2) more investment in the supply chain, and 3) advances in wind turbine technology.

1) Predictable and Stable Public Policy to Encourage Wind Generation

GE recommends the following actions to accelerate the growth of wind energy in the US: extension of the renewable energy PTC, steps to assure that wind-generated electricity will have access to the transmission grid, and national policies to expand the use of low and zero-carbon technologies.

PTC Extension: Wind is more competitive when the 1.9-cent per kWh production tax credit is applied. The PTC provides a necessary economic incentive for power producers to generate power from wind.

As illustrated below, the role of the production tax credit in stimulating the installation of wind generation is clear. This success comes despite the on again, off again nature of the PTC. When the PTC was initially enacted as part of the Energy Policy Act of 1992, Congress provided a multi-year duration for the credit. As the deadline for the credit to expire in July 1999 drew nearer, investment ramped up in order to take advantage of the credit. Congress then extended the credit, but not until December 1999. The credit was again allowed to expire in January 2002, before being extended via legislation enacted in March 2002. The longest period of expiration occurred in 2004, when the credit expired on January 1, but was not extended until October. The benefits of a timely extension of the PTC through the Energy Policy Act of 2005 and again through legislation enacted in December 2006 are already being seen in the strong capacity additions made in 2006 and forecast for 2007 and 2008.



Simply stated, when the wind production tax credit has been allowed to expire, new installed capacity has dropped dramatically in the following year due to lack of component availability.

Therefore, a more stable incentive for wind generation will create the confidence for suppliers to make the long-term investments needed to assure the availability of critical components. Today, there is industry discussion of a 5-year PTC extension, versus the 1-2 year extensions that have been common in recent years. The objective of such a multi-year extension would be to provide a greater degree of financial certainty to encourage long term investment by suppliers.

A 5-year Production Tax Credit extension would be very impactful on the growth of wind energy in the US. However, such an extension would need to include intermediate milestones spurring continuous investment. Without such provisions, the industry may be susceptible to a "wait and see" approach, withholding investments until the final years of the extension. This could result in the same "boom and bust" cycle we've seen from the late 1990's to 2004. With that in mind, the Committee should consider provisions in a five-year Production Tax Credit that would require participants to attain intermediate installation milestones.

National and/or state renewable portfolio standards, which include specific intermediate milestones, would also further enable continuous, consistent growth. While they may take longer to construct and enact, fair and equitable portfolio standards would ultimately drive the industry towards large-scale deployment of wind generated power. Think of the Production Tax Credit as the spark, and portfolio standards as the fuel for long term, sustainable wind energy growth.

Timing is just as critical to success as the strategy. By acting this year, before the PTC expires, Congress can eliminate the uncertainty that stymies investment and growth in renewable energy sources.

Transmission Investment

Delivering wind power to the grid is a significant challenge facing the wind industry. Many of the nation's most promising wind resources are located in relatively remote areas where there is little or no transmission access. In other areas, congestion on the existing grid also may limit opportunities to deliver wind-generated electricity to the areas where electricity is consumed.

Further investment in transmission lines is essential for large-scale wind installations to be built. Congress is to be commended for providing important incentives for transmission investment in the Energy Policy Act of 2005. Continued attention to the need for transmission investment in connection with the growth of renewable energy will be required.

2) Supply Chain

A major challenge for the global wind industry is meeting growing customer demand. Today, all wind turbine manufacturers are struggling with the same global challenge: obtaining sufficient components from their suppliers to manufacture and assemble wind turbines. Current bottlenecks in the wind turbine production chain result from the long lead times associated with mechanical components such as gearboxes and large bearings.

In 2006 and throughout 2007, GE is making large investments in the supply chain. We have made many long-term agreements with critical suppliers in thirteen states from coast to coast, giving them line-of-sight to our anticipated production volume, so that they have the confidence to expand with us, using their own investments as well. However, more investment in the supply chain is needed.

The ability to make this investment – particularly the investment needed from our suppliers themselves – is directly affected by Federal tax policy. When the wind production tax credit has been allowed to expire, new installed capacity has dropped dramatically in the following year as component suppliers slashed their investments in long term plant and equipment, scaled back their workforces and reduced their inventories in anticipation of reduced demand. Then, when Congress renewed the credit, the key components required to produce wind turbines were in limited supply. As a result, industry's ability to add new generating capacity has not been able to keep pace with demand.

An on-and-off policy scheme has made it difficult for suppliers to make long-term commitments. Conversely, a more stable long term incentive for wind power would generate the confidence for suppliers to make the long-term investments in manufacturing capability that are needed to assure the availability of critical components.

3) Technology

Continued development of low wind speed technologies – an important focus of government/industry research and development partnerships – will allow the use of wind turbines in lower class wind locations that would otherwise not be economically feasible. GE is investing more than $70 million annually in advancing wind turbine technology to further lower the cost of electricity. These efforts are focused in three key areas: larger and more efficient rotors, advanced loads management and enhanced grid stabilization:

Rotors: The rotors on wind turbines define the energy capture capabilities of the unit. Larger rotors, lighter weight material and computer modeling will allow significant increases in blade efficiency, resulting in more energy capture.

Load Management and Grid Stabilization: Voltage regulation is key to electrical grid stability. Wind turbines have progressively increased their capability to stay on line during grid voltage fluctuations and assist with voltage regulation. In the future, wind turbines will be a vital part of grid voltage stabilization through advanced power electronics which will be capable of managing grid voltage, even when the wind is not blowing.

In conclusion, wind power is a cleaner, viable offset to fossil fuel generation. The U.S. is well positioned to benefit from this ample, domestic resource and it is evident that wind can become a significant player in the US energy mix through its proven technology and strong growth. Predictable incentives, however, are still needed to sustain this momentum and drive costs down.

Solar Energy

GE Energy's solar products portfolio includes single crystal solar cells and modules for both on-grid and off-grid industrial, commercial and residential applications. Our industry leading roof integrated solar tiles for residential applications provide seamless integration and aesthetic appeal while maximizing the amount of solar energy provided for the homeowner. GE Energy manufactures solar cells, modules and systems in Newark, Delaware.

As with wind technology, GE sees two vital components of efforts to increase the generation of electricity from solar energy: technology advancement and supportive tax policies.

With respect to technology development, GE recently was selected as one of thirteen industry-led solar technology development projects for participation in the Department of Energy's Solar America Initiative. GE will collaborate with a team of industrial partners to develop various solar technologies, simplifying the integration of photovoltaic ("PV") systems into residential and commercial buildings currently consuming

over 60% of electricity generation in the U.S. This program will help foster solar energy industry growth, resulting in reduced greenhouse gas emissions and positive economics.

However, in addition to being able to overcome material shortages of silicone material and technology advancements that will drive down the COE, federal incentives are also necessary for continued growth of the solar industry and to help make solar energy competitive with other power generation technologies.

Solar Tax Credits

The Energy Policy Act of 2005 established 30% investment tax credits for businesses and residential taxpayers who installed qualifying solar energy property. Last December's tax bill extended the availability for these credits to property installed before January 1, 2008. GE recommends that Congress act this year to extend the Federal investment tax credit through 2016 for residential and commercial solar installations. The extended availability of this incentive will foster greater investment in solar technology and in the supply chain. The eight year extension will provide the long term policy stability that is required to support major investments in Concentrated Solar Power ("CSP") and other long term research and development programs, and in manufacturing facilities.

Provisions to extend the solar tax credits are included in S. 590, bipartisan legislation introduced by Senators Smith, Salazar, Snowe, Kerry, Wyden, Cantwell and eight others. In addition to extending these vital incentives, S. 590, and its House companion legislation, H.R. 550, would make important improvements to the tax credit provisions. The legislation proposes to remove the caps under existing law on the maximum credit available for both commercial and residential solar photovoltaic property. The credit would be based instead on the capacity of the system and calculated at $1500 per half kilowatt. This change would provide an incentive to increase the output and efficiency of solar technologies. Our analysis shows that the revised approach proposed in S. 590 would make the residential and commercial credit a far more effective incentive for new installations at both homes and businesses.

The Solar Energy Industries Association ("SEIA") has estimated the benefit of extending the solar tax credits. SEIA projects that the longer term of the credit would create approximately 55,000 jobs by 2016 and encourage the investment of billions of dollars in renewable energy infrastructure. SEIA estimated the savings to consumers from the use of the solar technologies receiving the tax credits at $32 billion over the lifetime of the equipment.

Opportunities abound to pair solar energy generation technologies with other components in an integrated product system. To provide the most effective incentive for these new technology applications, the investment made in the non-solar aspects of the product system also should be deemed a qualified expenditure and made eligible for the tax credit.

Finally, consideration could be given to an investment tax credit for investments in capital equipment to expand the capability to manufacture new solar products in the United States. Publicly funded research and development efforts are producing important technical advances. A complementary tax policy that supports the establishment of domestic manufacturing capacity to turn this intellectual property into commercial products would further American competitiveness in the global economy.

Along with the extension and modification of the credit structure, the Committee should consider providing relief from the alternative minimum tax in connection with the commercial and residential solar credits. Doing so would provide a meaningful incentive to further accelerate the flow of investment capital by third party project financiers and other investors.

Accelerated Depreciation for Solar Energy Property

Another important incentive incorporated into S. 590 is accelerated depreciation for business solar energy property. The legislation proposes to reduce from 5 years to 3 years the amortization period for qualifying property used in a trade or business. This would provide a substantial incentive for the more rapid introduction of business solar technologies.

National Policies to Encourage the Use of Low- and Zero-carbon technologies

GE is a participant in the US Climate Action Partnership (USCAP), an alliance of a diverse group of businesses and leading environmental organizations. The group came together in January to call on the US government to quickly enact strong national legislation to achieve significant reductions of greenhouse gas emissions. The USCAP's solutions-based report "A Call to Action," issued on January 22, 2007, offers a set of principles and recommendations for a policy framework on climate change. Wind energy is a strong solution that fits into this framework well.

Today, we find ourselves at a crossroads, perhaps as important as the one GE's founder, Thomas Edison, faced at the end of the 19th Century. At the dawn of the 21st century, climate change and energy security compel us to search for smarter and cleaner ways to use energy and slow, halt and ultimately reverse the impact of climate change.

This challenge is what brings us here today. What we confront is the need for a fundamental transformation in the way we do business. This is clearly recognized in the USCAP's Call *to Action*, when it states: "The scale of the undertaking to address climate change is enormous, and should not be underestimated. For this issue to be successfully addressed—and failure is not an option—the way we produce and use energy must fundamentally change, both nationally and globally." Clearly, some of the weapons in our arsenal to address this challenge include the measures we are discussing today about how to incentivize maximum deployment of wind and solar as essential elements of any solution. Clear policy is needed to achieve sustainable solutions to the climate issue.

CONCLUSION

GE Energy appreciates the Committee's early attention to mechanisms that can drive further growth in the use of renewable energy resources in the United States. With the technology advancements of recent years and the promise of continued improvements, these resources are poised to play an ever increasing role in national efforts to reduce reliance on foreign energy sources and to minimize the emissions

associated with the energy sector. As Congress considers energy and energy-related tax legislation in the coming weeks, we urge action this year to extend and enhance the available incentives for renewable resources.

Thank you again for the opportunity to testify. I would be pleased to answer any questions.

Testimony of Todd M. Raba
President, MidAmerican Energy Company
Before the Committee on Finance
United States Senate
March 29, 2007

Thank you, Mr. Chairman and Senator Grassley for the opportunity to testify today. I am Todd Raba, President of MidAmerican Energy Company (MEC). MidAmerican is based in Des Moines, Iowa. We are Iowa's largest electric and natural gas distribution utility and also serve retail customers in Illinois, South Dakota and Nebraska.

Our corporate parent, MidAmerican Energy Holdings Company (MEHC), is one of the largest owners and developers of renewable energy resources in the United States and throughout the world. As head of our Iowa-based utility, I am extremely proud that MEC is number one in the nation in the ownership of wind-powered electric generation among regulated utilities, with 695.5 megawatts of wind facilities in operation, under construction or under contract in Iowa. In addition, we are aggressively seeking additional opportunities to develop wind projects. Working cooperatively with our state government, regulators, consumer advocates, industrial customers, and the environmental community, we've helped make Iowa the third-largest generator of wind energy in the country.

Our sister utility, Portland, Oregon-based PacifiCorp, has acquired 400 megawatts of wind energy in the last year and has committed to acquiring another 1,000 megawatts of renewable capacity by 2015. MEHC's independent generation development company, CalEnergy, also owns and operates 340 megawatts of emissions-free, baseload geothermal energy in Southern California with the potential to produce as much as 2,000 additional megawatts of baseload power.

At MEC, we are extremely pleased with the performance of our wind assets, which have exceeded our expectations in terms of performance. During last summer's July heat wave that led to the United States setting all-time records in electricity usage, our wind projects in North Central and Northwest Iowa made critical contributions to meeting our customers' needs and enabling us to help other utilities meet their requirements through wholesale sales.

Opportunities and Challenges in Renewable Development

Wind and other renewable sources of energy possess distinct advantages and disadvantages compared to conventional sources of electric generation. In terms of advantages, once installed, these resources face no fuel price volatility and in many areas are comparatively easy to site. Renewables are, of course, emissions-free, an important consideration in a world increasingly concerned with the potential impacts of global climate change.

On the other hand, unlike conventional fossil fuel or nuclear power plants, wind energy is not dispatchable, and the areas where it can be deployed economically are geographically limited. Utilities must provide power to consumers whether the wind is blowing or not, requiring us to back up wind power with dispatchable generation resources. Baseload renewables such as geothermal and incremental hydro are dispatchable, but they have high capital costs and geographic limitations. Our Imperial Valley geothermal power plants, for example, lie in one of the most physically remote and economically underdeveloped parts of the state, surrounded by mountains to the east, the Salton Sea to the north, the Anza Borrego State Park to the west and Mexico to the south.

Overall, however, we believe renewable energy has a bright future and should become a core component of the United States' electric generation mix. This future depends on actions you can take here in Washington to support the long-term development of a robust, domestic renewable electricity industry.

Simply put, two elements are required to assure the role of renewable electricity in the United States' energy future: certainty on financial incentives and development of a robust electric transmission grid with policies focused on the special challenges of delivering renewables from their often remote locations to load centers.

Given their high up-front costs, wind and other renewables are not yet fully cost-competitive with fossil resources. However, the Section 45 production tax credit, or PTC, closes this gap and makes these resources viable investments. None of the wind investments that MidAmerican has made in the last five years would have occurred without the PTC.

MidAmerican's Experience with the Expiration of the Section 45 PTC

In fact, in late 2003, we announced our intention to build a 323-megawatt wind project, but the pending expiration of the production tax credit forced us to delay moving forward with installation of the turbines. When the PTC expired on December 31, 2003, our project was frozen in place. We moved forward with what we could – site preparation and transmission upgrades – but could not risk final acquisition and installation of the turbines without the PTC being restored in the tax code. The project would not have met the regulatory requirements of the Iowa Utility Board in terms of cost without the then-1.8 cents per kilowatt hour credit the PTC then provided.

Fortunately, or maybe I should say thankfully, then-Chairman Grassley and Chairman Baucus successfully led the effort to restore the tax credit in late September of 2004. MidAmerican and our project contractors moved immediately to install as many turbines as possible, and by the end of the year had placed more than 150 megawatts of power in service. When I say by the end of the year, that's exactly what I mean. The Northwest Iowa Clipper project was completed at roughly 6:00 p.m., New Year's Eve, further reducing costs by allowing us to take advantage of accelerated tax depreciation provisions that expired at the stroke of midnight that year.

Since then, Congress has stepped forward twice to extend the Section 45 PTC, first through the Energy Policy Act of 2005 and then in last year's extenders bill. This has led to an unprecedented boom in U.S. wind development, but demand for turbines is far exceeding available world supply. Wind turbine prices have nearly doubled in the last three years, largely as a result of this scarcity.

Manufacturers tell us that the certainty of incentives in Europe make that market preferable to the U.S. for both manufacturing and long-term customer relationships. In order for wind energy to reach its full potential in the United States and substantially contribute to lower greenhouse gas emissions and fuel diversity, Congress must make a longer term commitment.

With regard to geothermal, hydro, biomass and waste-to-energy generation, the problem is more acute. While these resources are more geographically limited than wind, they function as dispatchable, baseload resources, enhancing their value. Drilling new geothermal wells or upgrading existing hydro facilities to create incremental power expansions is highly capital intensive. The vast majority of these projects cannot be completed within the short placed-in-service time frames under the existing PTC legislation, thus severely limiting new investments.

MidAmerican has suggested that Congress consider allowing flexibility with regard to placed-in-service dates for projects involving baseload renewables. We believe this could be done at little budget cost if the law allows projects under construction and with output contracts in place to opt in to tax treatment that reduce the ten-year application of the PTC by a length of time equivalent to the period between date of expiration of the placed-in-service date and the completion of the project. In other words, if a project was brought on line six months after the expiration of the placed-in-service date, it could choose to receive the tax credit for only nine and one-half years instead of ten.

The better answer, though, would be a five- or ten-year extension of the PTC that would provide long-term certainty to utilities, independent project developers and manufacturers while solving the base load renewable issue. We believe it would effectively redistribute the PTC's benefits from manufacturers to end-use customers. In the real world, there would be no additional cost to the Treasury from one ten-year extension as opposed to five two-year extensions. We understand the challenge Congress faces with regard to budget rules, but at the same time, we will not be able to cost effectively achieve the goals sought by Congress and requirements of an increasing number of states without a long-term commitment to renewable energy.

One way to address concerns of some members of Congress regarding the increasing budget costs of future extensions of the PTC would be to couple a long-term extension with a gradual phase-down of the credit back to its original 1.5 cents per kilowatt hour. MidAmerican has included this proposal in a broader outline of policy and technology

measures designed to address global climate change. I have attached a copy of this broader proposal for your review.

Unique Challenges of Bringing Renewable Energy to Market

When looking for a location to place a conventional fossil electric generating plant, developers primarily look at three factors: 1) a fuel transportation network, either rail for coal or natural gas pipeline; 2) a water supply; and 3) access to the bulk transmission grid. The closer these plants can be located to population and load centers, the better. Bulk power flows on to the grid in highly economical fashion, hundreds of megawatts at a time.

Renewables are different. For the most part, we cannot choose where to locate them. Nature has done this for us. Unfortunately, nature chose to test our creativity in making use of these resources.

A quick look at the attached maps of wind and geothermal-friendly locations in the United States shows an almost perfect inverse correlation between renewable potential and population distribution. As the map of summer wind energy capacity demonstrates, this situation is even more striking during the peak load period for most of the country.

Combining the remote location of most of our renewable potential with the diffuse nature of these resources, transmission becomes a disproportionately larger component of the retail cost compared to conventional resources. This situation will only grow more pronounced as we increase the amount of renewable generation, because the most cost-effective locations have already been developed.

Our Iowa wind projects provide an instructive example. The first 460 megawatts of wind that MidAmerican owns and operates required about $7 million in transmission upgrades (transmission lines and substation transformers). That translates into about $15.25 per kilowatt installed. The next 75 megawatts that we develop will require about $12 million in upgrades or about $160 per kilowatt installed – a more than ten-fold increase. All these sites are located in Iowa, which is both more densely populated and closer to the industrial load centers of the Midwest than the areas of vast wind potential in the Dakotas and further west. For those areas, the cost of transmission as a component of delivered energy will be even higher.

Sustain Policies Designed to Facilitate Investment in Transmission

Congress took a number of constructive actions in the 2005 Energy Policy Act to facilitate transmission investment. You reduced the depreciation schedule for electric transmission from 20 years to 15. The law established National Interest Electric Transmission Corridors to facilitate siting and coordination within the federal agencies. You provided for limited backstop transmission siting authority at the Federal Energy Regulatory Commission (FERC).

Perhaps most significantly, you repealed the Public Utility Holding Company Act of 1935 (PUHCA) which has led to a flood of new capital looking at transmission investment. Taking advantage of these new opportunities, MidAmerican has joined American Electric Power (AEP) in a partnership to invest over $1 billion in Texas in the next several years, primarily to connect West Texas' vast wind potential to the population centers in the central and eastern parts of the state.

Don't turn back the clock on any of these changes. We have noted with concern that one Senate bill (S. 341) proposes to repeal the shorter depreciation schedule provisions of EPAct 2005. I'm not sure what public purpose that would serve, and I hope you will carefully scrutinize this and other proposals that would make it harder to build new transmission.

Adopt Targeted Measures to Promote Transmission of Renewables

One of the key reasons that MidAmerican and AEP chose Texas for our transmission partnership is that Texas law promotes infrastructure investments to serve renewables through CREZ's or Competitive Renewable Energy Zones. State law provides for favorable regulatory treatment and siting processes for investments in these zones.

We have seen a number of proposals circulating in Congress to replicate these zones on a national level. The best ideas we have seen would:

1) Require FERC to ensure that utilities that build transmission to serve renewable generation recover their costs plus a reasonable return on equity;
2) Automatically designate national renewable energy zones as national interest electric transmission corridors;
3) Make these transmission investments eligible for incentive-based rate treatment pursuant to Section 219 of the Federal Power Act; and
4) Establish that transmission built in a national renewable energy zone is eligible for rate treatment similar to the California ISO's trunkline proposal currently before FERC.

I recognize that these provisions lie largely outside the jurisdiction of the Finance Committee, but hope that as part of your broader efforts on energy and environmental policy you will work with the Energy and Natural Resources Committee to give these proposals due consideration.

Summary

Renewable energy can play a vital role in allowing the United States to meet its twin challenges of enhancing energy security while promoting a cleaner environment. These technologies face challenges in the marketplace that require Congress to take an active role in eliminating both economic and technical barriers to their deployment. Most critically, you must provide long-term certainty for the financial incentives that help

reduce the impact of the high up-front development costs of renewables and promote tax and regulatory policies that support investment in electric transmission.

Thank you for providing me the opportunity to speak to you today, and I'll be pleased to answer any questions you may have.

DRAFT OUTLINE OF "GLOBAL CLIMATE RESPONSE ACT OF 2007"

Recognizing that addressing global climate change could require a fundamental shift in the way America makes and uses energy, this Act establishes a three-phased program of responses through 2050 to allow the U.S. economy to transition away from the use of greenhouse gas-emitting fossil fuels: Phase I (2007-2019) emphasizes incentives, mandates and technology development. Phase II (2020-2029) establishes generation performance standards for power plants and economy-wide carbon intensity targets that are, in turn, applied to the transportation and industrial sectors as well as to the federal government. Phase III (2030-2050) establishes an enforcement mechanism to achieve a 25% reduction of U.S. greenhouse gas emissions from 2000 levels by 2030, with the expectation of dramatic reductions thereafter as a result of domestic and international technology deployment.

I. FINDINGS OF CONGRESS

A. There is a growing consensus among scientists that greenhouse gas emissions from human activities are altering the composition of the Earth's atmosphere in ways that are having an impact on the climate and posing risks that may prove significant for society and ecosystems.
B. These risks justify taking actions now to reduce those emissions, but the selection of actions must take into account scientific and technological uncertainties as well as balance energy, economic, and environmental policies.
C. Global climate change solutions should preserve a secure, economic and diverse supply of energy for the United States by encouraging investments that maintain adequate reserve margins, support economic growth, and meet customers' needs for affordable and reliable energy.
D. Global climate change solutions should be designed to encourage greater deployment of cost-effective energy efficiency programs; economically feasible renewable energy production; and adequate funding for research, development, and deployment of a broad spectrum of innovative technologies targeting low or zero carbon emissions and carbon sequestration at reasonable costs.
E. A time frame for implementation of greenhouse gas emission reductions must take into account technology availability, reliability and economic feasibility in order to avoid unacceptable impacts on residential consumers and small businesses.
F. A greenhouse gas reduction program should be phased in over a reasonable period of time to provide a balanced and effective transition for the electricity sector, although flexible interim benchmarks must be developed to ensure progress and to accommodate developments in scientific knowledge and accelerated technology development opportunities.
G. Given the enormous transitional effects a greenhouse gas reduction program will have on the electricity sector, regulated utilities should be authorized to recover

all costs necessary to achieve the greenhouse gas emission reduction levels mandated by this Act.

H. Climate change is a global phenomenon that requires comprehensive, long-term and worldwide responses that address all greenhouse gas sources in all economic sectors.

I. A U.S. greenhouse gas emissions reduction program will be effective only if it is part of an international approach that includes all major emitting sectors in both developed and developing countries.

J. If international greenhouse gas emissions control regimes emerging after the first commitment period of the Kyoto Protocol in 2012 are not compatible with this Act or if major developed and developing countries fail to participate in such international regimes, self-implementing "off ramps" shall become effective.

II. PHASE I PROGRAM (2007 – 2019)

1. ELECTRIC POWER SECTOR

    a. Research and development program:
        i. Industry-funded program to cover cost effective:
            1. Integrated gasification combined cycle technology;
            2. Carbon sequestration and other carbon capture technologies;
            3. Next-generation nuclear plants;
            4. Transmission and distribution efficiency;
            5. Energy efficiency and demand-side management;
            6. Renewable energy technologies; and
            7. Other innovative technologies that will reduce greenhouse gas emissions at affordable costs.
        ii. Research and development program to be funded by a ten-year, non-bypassable wires fee of 1 mill per kilowatt hour (or alternative funding mechanism).
        iii. Provision for U.S. government research and development funding:
            1. Industry program to be matched by the federal government on a 2-to-1 basis; or
            2. Separate U.S. government (and national laboratory) research and development programs in these fields.

    b. Federal renewable portfolio standard:
        i. 12% renewable portfolio standard by 2025 with credit trading:
            1. Applied across the board to all load-serving entities, including:
                a. Investor-owned utilities;
                b. Municipal-owned utilities;
                c. Rural electric cooperatives; and
                d. Federal power marketing agencies.

2. Sets a percentage floor, not a ceiling, so as not to preempt state programs that have higher percentage requirements.
3. Includes a mechanism to pay for the above-market cost of the program, such as:
    a. Cost recovery with reasonable rates of return; and/or
    b. A long-term extension of the Section 45 production tax credit (see below).
4. Defines "renewable energy resources" to include:
    a. Wind
    b. Solar (photovoltaic and concentrated solar power)
    c. Geothermal
    d. Closed loop biomass
    e. Open loop biomass
    f. Incremental hydropower facilities
    g. Small irrigation power
    h. Landfill gas
    i. Trash combustion facilities
    j. Wave and tidal
5. [Note: Bill will need a provision to resolve different state definitions of what qualifies as a "renewable" resource.]
6. Establishes nationwide renewable energy credits trading market.

ii. Provisions to earn credits under the renewable portfolio standard program through investments in quantifiable energy efficiency and demand reduction programs.

iii. Provisions to earn up to 20% of renewable portfolio standard credits through investments in emissions-free or emissions-neutral technologies such as advanced nuclear, integrated gasification combined cycle technology, and/or carbon-capture ready coal.

iv. 20% federal renewable purchase requirement by 2030.

c. Extension of the Section 45 production tax credit for the production of renewable energy:
    i. Ten-year extension of Section 45 production tax credit, with the amount of the production tax credit phased down to 1.5 cents/kilowatt hour by 2018.
    ii. Alternative provision: Five-year extension of Section 45 production tax credit with provisions to add a flexibility mechanism to enable baseload renewable resources to utilize the credit:
        1. Establish a "deemed" placed-in-service date for qualified facilities if, prior to the "reference" placed-in-service date, the taxpayer has entered into a binding contract for construction of a facility designed and constructed so that at least 50% of the output is produced as baseload power.

2. Rather than receiving the full ten years of production tax credit, the taxpayer loses one year of credits for each year the facility is placed in service beyond the statute's reference placed-in-service date.
3. This provision would cover geothermal, incremental hydropower facilities, small irrigation power closed loop biomass, open loop biomass, landfill gas, and trash combustion facilities.

d. Energy efficiency incentives and mandates:
   i. Extend and enhance the energy efficiency tax incentives in the Energy Policy Act of 2005:
      1. New tax credits for home retrofits that save energy:
         a. Sliding scale from $800 for 20% energy savings up to $2,000 for 50% energy savings.
         b. Alternative: Tax credit for 10% of the cost of the retrofit equipment, up to a maximum of $1,000 annually.
      2. Extend the tax deduction for energy efficient property installed in commercial buildings:
         a. This covers:
            i. heating and cooling systems;
            ii. Interior lighting systems; and
            iii. Insulation.
         b. Increase the amount of the deduction from $1.25 per square foot to $2.25 per square foot.
      3. Extend the tax credit for the purchase of certain residential energy efficient equipment. The credits range from $50 to $300, depending on the equipment.
      4. Extend the $2,000 tax credit for a new owner-occupied home that is certified to have heating and cooling energy consumption at least 50% below such consumption for a comparable existing home.
   ii. Mandates for efficiency improvements in:
      1. Electricity transformers;
      2. New fossil electric generation plants;
      3. Appliances and other consumer products;
      4. Residential and commercial buildings.
   iii. Requirement that states review their regulatory procedures and report to the Department on Energy on measures to update ratemaking principles to encourage investments in energy efficiency.
   iv. Phase-out of SF_6 from electric breakers.

e. Provisions to advance zero-emission and low-emissions baseload technologies:

i. Requirement to issue uniform federal regulations related to sequestration and storage of carbon dioxide from electric generating plants.
ii. Requirement to issue federal regulations related to the interstate transportation of carbon dioxide through pipelines and establishment of federal siting authority over these pipelines.
iii. Federal "Price-Anderson"-type indemnification of approved carbon sequestration activities.
iv. Federal study of alternatives for 500-year (not 10,000-year) safe management or reprocessing of spent nuclear fuel with fast track presidential recommendation to Congress for action by 2012.
v. Consideration of benefits of hydropower with regard to climate change as part of hydro relicensing process.

2. TRANSPORTATION SECTOR

a. Fuels:
   i. Increase renewable fuel standard requirements to 50 billion gallons of ethanol and biodiesel per year by 2030.
   ii. Modifications to the volumetric ethanol tax credit to provide credits proportional to energy inputs in the ethanol refining process.
   iii. Phase-in requirements for fuel distributors or large oil companies to install E-85 capable pumps at their stations, increasing the number by 5% every year over the next decade based on facility sales volume.
   iv. Incorporate provisions of the "Coal-to-Liquid Fuel Promotion Act of 2007," including loan guarantee, tax credits, and other incentives for building coal-to-liquids plans that would use coal to make diesel fuels.

b. Vehicles:
   i. Increased mileage:
      1. Beginning in 2010, increase Corporate Average Fuel Economy (CAFE) requirements by requiring passenger cars to obtain an average of 40 miles per gallon by 2020, with Secretary of Transportation discretion to reduce or increase requirement by 10 percent based on analysis of vehicle safety, technology, national security and climate science considerations.
      2. Alternative concept: Establish "fee-bates" system for auto manufacturers whereby consumers receive rebates or pay premiums for vehicles based on a carbon-emission based fuel economy standard established by vehicle class.
   ii. Require that by 2020 all vehicles sold in the United States must be E-85 compatible, together with five-year benchmarks to achieve

this goal (either increase flexible fuel vehicle production by 10% annually starting in 2010 or achieve a 50% mark by 2015).

iii. Require that by 2012 all federal fleet vehicle purchases, except those used for military or law enforcement purposes, must:
    1. Exceed average CAFE standards by 25%; and
    2. Be E-85 compatible.

iv. Provide tax credits to manufacturers that retool their factories to make hybrids, plug-in hybrids, and flexible fuel vehicles.

v. Raise the cap on consumer tax credits for the purchase of hybrids and advanced diesel vehicles.

vi. Tax credit for using renewable electricity to charge plug-in hybrid electric vehicles.

c. Ground Freight – Rail and Truck Carriers:
    i. Mandate the Department of Transportation to establish a program to ensure that railroads and trucking companies (consisting of more than five vehicles) increase the fuel efficiency of locomotives and trucks and establish industry practices that significantly reduce greenhouse gas emissions. Such program shall include:
        1. Fuel efficiency standards;
        2. Engine efficiency standards;
        3. Improvement of environmental management systems and operations with an emphasis on reducing idling time for trucks and locomotives; and
        4. Recycling of oil and aluminum.
    ii. Establish a research and development program to further develop and implement existing and new technologies in a safe and cost-effective manner. Goals of this program shall include:
        1. Reduce greenhouse gas emissions from new trucks and locomotives;
        2. Provide power during idling conditions, allowing engines to be shut down; and
        3. Fuel saving and reduction of exhaust emissions.

d. Air Transportation:
    i. Findings: Aircraft-related greenhouse gas emissions are expected to increase by as much as 60 percent by 2030 and that the aviation industry will contribute between 6-9 percent of global greenhouse gas emissions by 2030.
    ii. Direct the Federal Aviation Administration to establish a program with the goal of improving energy efficiency by an average of greater than 1% annually through 2015, as measured by a three-year moving average, beginning with the three-year average of 2002-2003. Such program shall include:
        1. Fuel efficiency standards;
        2. Engine efficiency standards;

3. Ground support equipment efficiencies;
4. Traffic management improvements;
5. Deployment of low-emission technologies in airport operations; and
6. Changes to fleet average fuel economy for future aircraft.

iii. Establish a research and development program to further develop and implement existing and new technologies in a safe and cost-effective manner in the areas of:

1. Reduction of greenhouse gas emissions from future aircraft;
2. Efficient engine technologies, advanced aerodynamic shapes and structures, autonomous avionics, and low-emissions alternative power;
3. Congestion mitigation programs to reduce aviation-related emissions on the environment;
4. Alternatives to liquid fossil fuels for aviation fuel; and
5. Airport operations and ground support.

3. INDUSTRIAL SECTOR

a. Mandate the U.S. Environmental Protection Agency and the Department of Energy to develop a program for each of the major emitting manufacturing industries (chemicals, cement, metals, and oil), with the goal of further improving the energy efficiency of their operations as well as establish practices that significantly reduce the intensity per unit of output of their greenhouse gas emissions.
b. Establish a research and development program to further develop and implement existing and new technologies in a safe and cost-effective manner.

4. FEDERAL GOVERNMENT POLICY

a. Conduct a comprehensive review of all federal policies and programs including tax, transportation, resource, agriculture and housing to identify recommendations to slow, stop and reverse increases in greenhouse gas emissions.
b. Every U.S. government agency shall improve energy efficiency and reduce greenhouse gas emissions by 3% annually through the end of fiscal year 2015 or 30% by the end of fiscal year 2015 relative to a 2003 baseline.

III. PHASE II PROGRAM (2020 – 2029)

1. ESTABLISHMENT OF ECONOMY-WIDE CARBON INTENSITY TARGETS

a. Level and schedule of target carbon intensity targets.
b. Establish a safety valve allowance mechanism and price escalation schedule.
c. Require the President to issue reports every five years beginning in 2015 as to whether to reduce or increase carbon intensity targets by plus or minus 10% based on technology, national security, economic, international cooperation, and climate science considerations.

2. ESTABLISHMENT OF GENERATION EFFICIENCY PERFORMANCE STANDARDS FOR ELECTRIC GENERATION FACILITIES

a. Establish a federal generator efficiency standards program measured in terms of greenhouse gas intensity, applicable to all U.S. fossil fuel-based electricity and steam producers (when in conjunction with electricity production), both existing and proposed.
b. "Greenhouse gas intensity" means the measure of greenhouse efficiency as the emission rate of greenhouse gases from fuel burning expressed in pounds of carbon dioxide equivalents per megawatt-hour sent out. For cogeneration, this is discounted for steam/heat production.
c. Model the program after the successful Australian program (see http://www.greenhouse.gov.au/ges/index.html).
d. In 2015, the Secretary of Energy shall:
    i. Promulgate a minimum generation performance standard for all electric generation facilities based on fuel type at __% of efficiency of units in operation as of the date of enactment of this act.
    ii. Determine best practice greenhouse efficiency standards for existing and refurbished power and cogeneration plants;
    iii. Determine best practice greenhouse efficiency standards for new power and cogeneration plants;
    iv. Determine the actual greenhouse intensity for power plants based on total fuel burning over a twelve month period and the corresponding energy output as electricity, and steam if applicable.
e. The Secretary or Energy shall review and reassess these standards every five years.
f. These standards shall apply to all grid and off-grid generating plants that meet all of the following criteria:
    i. 25-megawatt electrical capacity or above;
    ii. 50-gigawatt per annum electrical output; and
    iii. Capacity factor of 5% or more in the last three years.
g. Beginning in 2020, require all electric generating facilities to meet minimum generation performance standards for fuel conversion efficiency based on fuel type.
h. Increase generation performance standards for fuel conversion by 10% for each succeeding five-year interval.

3. ESTABLISHMENT OF MILEAGE PERFORMANCE STANDARDS FOR PASSENGER VEHICLES

    a. Beginning in 2020, require all vehicles to meet minimum carbon-based mileage performance standards based on vehicle class.
    b. Increase generation performance standards for carbon-based fuel economy by 10% for each five-year interval.

4. ESTABLISHMENT OF ENERGY EFFICIENCY STANDARDS FOR COMMERCIAL AIRCRAFT – need placeholder

5. ESTABLISHMENT OF ENERGY EFFICIENCY STANDARDS FOR RAIL TRANSPORTATION – need placeholder

6. ESTABLISHMENT OF ENERGY EFFICIENCY STANDARDS FOR INDUSTRIAL SECTOR – need placeholder

7. FEDERAL GOVERNMENT REQUIREMENTS

    a. Beginning on January 1, 2020, the federal government is required to take physical title and assume all legal responsibility for spent commercial nuclear fuel.
    b. Should the federal government not meet the obligation to take physical title and assume all legal responsibility for spent commercial nuclear fuel, it shall make a lump-sum payment to utilities for all monies paid into the nuclear trust fund since its creation, plus interest.

IV. PHASE IV PROGRAM (2030 – 2050)

1. DETERMINATION OF APPROPRIATE METHODOLOGY FOR ACHIEVING MANDATORY REDUCTIONS IN U.S. GREENHOUSE GAS EMISSIONS

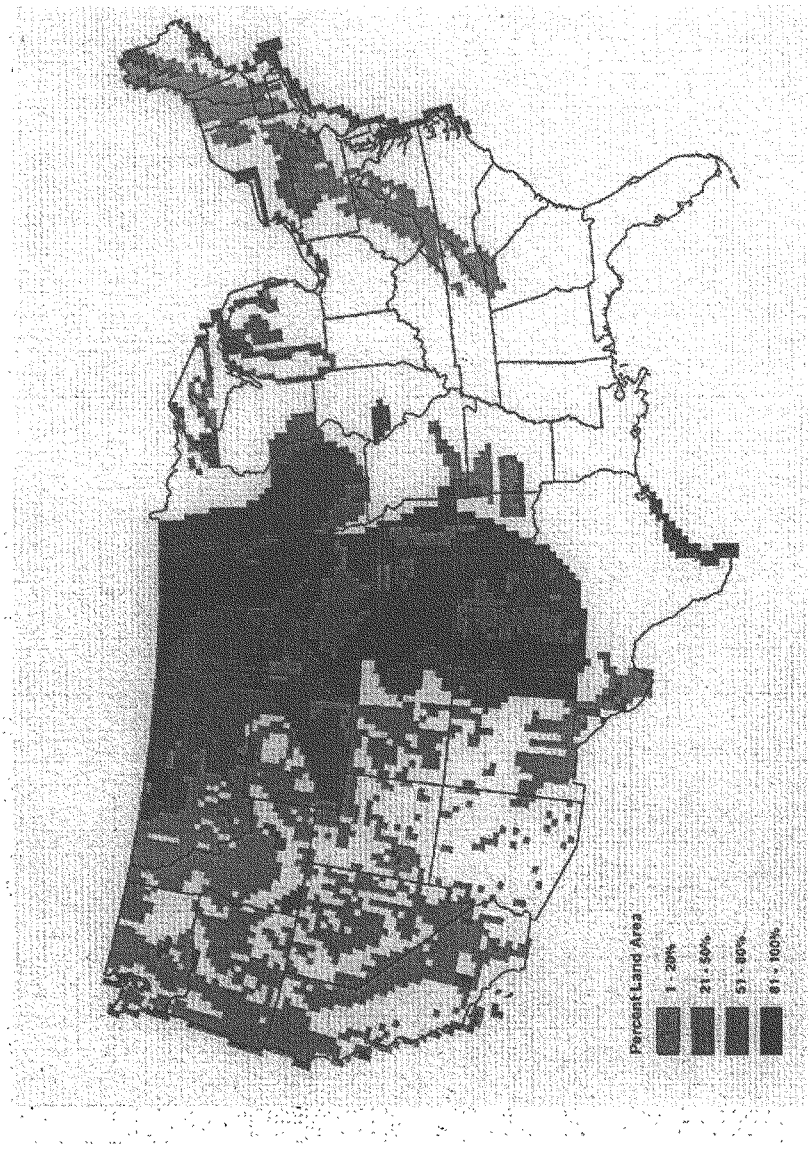
    a.. By July 1, 2025, the President shall submit a legislative recommendation to Congress on the enforcement mechanism to achieve a 25% reduction of U.S. greenhouse gas emissions from 2000 levels by 2030.
    b. The President's recommendation shall take into account technology availability, reliability and economic feasibility.
    c. Congress shall consider the President's recommendation under "fast track" legislative procedures within 90 days of the submittal of the recommendation.
    d. Through the enforcement mechanism, the United States shall achieve additional emissions reductions of 10% in each succeeding five-year period.

e. Authorize regulated electric utilities to recover all reasonable costs necessary to achieve the greenhouse gas emission reduction levels mandated by this Act.
    i. Options for recovery of cost could include:
        1. A non-bypassable wires charge;
        2. Mandatory "check off" program (similar to programs enacted for heating oil, propane and milk industries);
        3. Carbon tax; or
        4. Adoption of Public Utility Regulatory Policies Act's "avoided cost" requirement.
    ii. Non-bypassable wires charge:
        1. Adopt language from the Atomic Energy Act, which imposes fees to recover nuclear decommissioning costs.
        2. Cost recovery in rates to be approved by the Federal Energy Regulatory Commission for wholesale costs and states for retail costs.
        3. Funds, once collected, will be used by utilities to offset costs incurred in complying with federal mandates to reduce emissions through the use of:
            a. Carbon capture and sequestration;
            b. Integrated gasification combined cycle technology (IGCC) technologies and permitting costs; and
            c. Other technology deployment.
        4. A non-bypassable wires charge could be implemented in addition to a cap and trade system or a carbon tax to allow utilities to recover costs.
f. In 2025 and in each succeeding five-year period, the President may reduce or increase the carbon emissions reduction target by plus or minus 10% based on technology, national security, economic, international cooperation and climate science considerations.
g. Preemption versus grandfathering:
    i. Ideally, federal legislation in this area would preempt all state laws or regional regimes that regulate greenhouse gas emissions.
    ii. Politically, many legislators are attached to what their states have enacted, even if those programs go beyond what could likely be achieved through federal legislation.
    iii. Short of complete preemption, adopt a grandfathering provision:
        1. Grandfather in programs already adopted at the state level thus far, without permitting other states to adopt additional standards.
        2. Use as a model the provisions of the Energy Policy Act of 2005, which recognized state actions under Section 111(d) of the Public Utility Regulatory Policies Act if states had considered certain issues within a certain time frame.

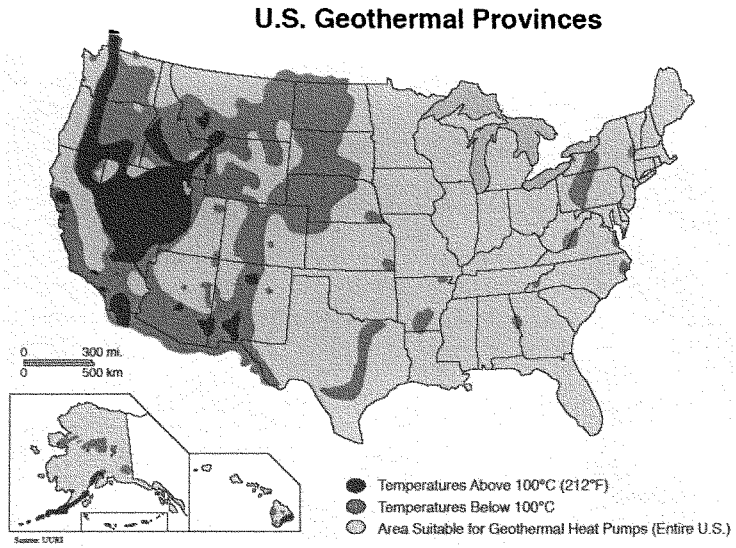
2. COORDINATION WITH INTERNATIONAL GREENHOUSE GAS EMISSIONS REDUCTIONS PROGRAMS

    a. The President shall take appropriate measures to ensure that any international greenhouse gas emissions control regime emerging after the first commitment period of the Kyoto Protocol in 2012 is compatible with this Act.
    b. If, by July 1, 2015, the President notifies Congress that major developed and developing countries have failed to participate in such an international greenhouse gas emissions control regime, this Act shall be null and void effective January 1, 2016.
    c. Alternative provision: Use the "soft linkage" in Senator Bingaman's climate bill:
        i. By 2016, and every five years thereafter, an interagency group appointed by the President shall study and make recommendations relating to all of the emission reductions programs established by this Act in light of a review of international greenhouse gas emission reduction actions and programs:
            1. For OECD countries, the reviewers shall determine whether actions taken were comparable to those taken in the United States.
            2. For rapidly developing countries, the reviewers would determine whether the actions taken were "significant, contemporaneous, and equitable" as compared with actions taken in the United States.
        ii. The review could culminate in a recommendation to modify the requirements imposed by this Act on U.S. greenhouse gas emitters.

Percent of the land area estimated to have Class 3 or higher wind power in the contiguous United States

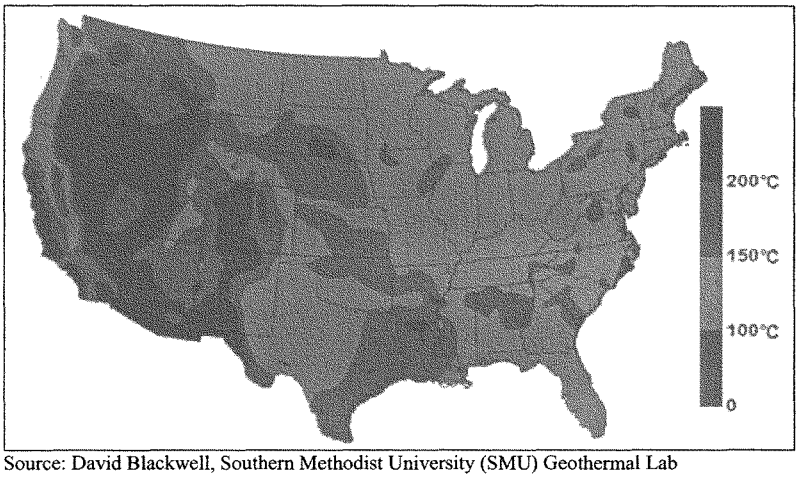


Estimated Subterranean Temperatures at 3 Kilometers Depth



Source: University of Utah Research Institute (UURI)

Estimated Subterranean Temperatures at 6 Kilometers Depth



Source: David Blackwell, Southern Methodist University (SMU) Geothermal Lab

TESTIMONY OF JOHAN VAN'T HOF BEFORE THE UNITED STATES SENATE COMMITTEE ON FINANCE
THURSDAY MARCH 29, 2007

"Tax Policy Can Help Build Green Highways"

Chairman Baucus and Members of the Committee,

I am Johan van't Hof, CEO of Tonbridge Power Inc., a publicly traded transmission development company that intends within the next several months to begin construction on a 210-mile 240 kV merchant power line between Lethbridge Alberta and Great Falls Montana.

Senator Baucus, I am especially pleased to be testifying before you because of your well-deserved reputation in Montana, in Canada, and internationally for promoting innovative and actionable solutions to tough problems. That is as good a description of the Montana Alberta Transmission Link - "MATL" - as I can imagine.

I also commend the State of Montana and Governor Schweitzer for a can-do approach to supporting good projects. I am pleased to report that, if you have a solid idea and the ability to execute, Montana is "open for business" and is a great partner to the private sector. After having developed energy infrastructure projects around the globe it is a pleasure to work in under the Big Sky.

MATL is unique:

- It is an international transmission line connecting a state and province that are otherwise unconnected.
- It is a merchant line that will provide a valuable complement to traditional utility lines.

- It is the enabling infrastructure that will allow renewable and increasingly essential energy to flow from Montana where it is generated to serve native Montana load, and meet demand in other areas.

The Senate Finance Committee is uniquely positioned to identify and adopt policies that make clean and renewable energy supplies feasible, as well as the policies that allow construction of the "transmission highway" on which "green energy" (and all other supply-side resources) depends. I note that as we speak the Governor Schweitzer and the Montana Legislature are considering highly complementary state policies.

GREEN HIGHWAYS

Our goal is to take MATL from initiation to completion in two years. This is nearly unprecedented for a transmission project, but is absolutely critical given North America's projected need for supply and transmission infrastructure. After its 2008 in-service date the MATL line will be able to transmit 300 MW either into or out of Montana. It will thus make a solid contribution to enhancing cross-border trade in energy and to providing additional sources of stability to our respective grids. Importantly, it also serves as a critical collection system for 600 MW in new wind farm projects in Montana. In fact *all of the generators which currently have capacity contracts with MATL are new wind projects.* It is not an overstatement to say that MATL is a "Green Highway."

As we have tackled the numerous issues associated with this project we have learned some lessons that are extremely germane to the issue facing us today: *How can transmission be developed optimally and congruently with the timelines for generation development, so that essential and environmentally friendly supply can be developed and reach customers?*

Almost every observer of the power sector today would concur that new transmission development has badly lagged the growth in generation, the growth in load and the need for transfers of energy between regional markets. We are like a continent of 2-lane roads with too few interstate highways. Many of the highways we do have fail to connect with one another. The lack of adequate investment in transmission has led to inefficient generation

investment decisions, regional power prices that are often too high, and reduced reliability – particularly at times of peak demand.

The United States Department of Energy has been sufficiently worried that it authorized a study of transmission congestion, which identified areas where wind generation would require new transmission investment.[1] Montana and the Northwest are one of five areas of critical congestion. North American Electric Reliability Council (NAERC) recently released an important study of the reliability of North America's power systems. Capacity margins are forecast to decline, while the need for new transmission will grow, including the need for transmission to support diverse supply sources.[2] In sum, congestion will only get worse and action is required to support investment in new transmission.

Transmission investment has lagged in part because linear projects are harder to permit and build than single-site facilities. (Here again, we have been very pleased by the approach taken by the Montana Department of Environmental Quality.) In addition, there are important challenges with factoring in positive externalities of transmission investment and coordinating transmission planning and investment among numerous parties. An important contributing factor has been the lack of commercial incentives in the sector. This is potentially true, although in somewhat different ways, both for utility-sponsored transmission and for merchant projects such as MATL. Few competitive generators today contemplate an investment that requires a decade to develop, yet timelines like that are now considered standard when it comes to developing the transmission projects which enable new generators. Were MATL on a ten year plan, my investors would wish me well and take their capital somewhere other a transmission project on the High Plains of North America. Their expectation is two years.

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[1] National Electric Transmission Study (August 8, 2006). The report identifies "Critical Congestion Areas" of most concern, "Congestion Areas of Concern," and "Conditional Congestion Areas." Conditional Congestion Areas include those where congestion could become acute if large amounts of new generation are built without associated transmission capacity, specifically including wind in Montana and other northern states.

[2] 2006 Long-Term Reliability Assessment: The Reliability of the Bulk Power System in North America (October 2006). The study concludes that the system "requires additional investment to address reliability issues and economic impacts" (p. 7); that "(w)ithout expanded transmission system investment, grid congestion will increase, making it more difficult for available supply to meet demands and to allow full utilization of capacity/demand diversity" (pp. 7-8); and that the "adequacy of electric supplies depends, in part, on the adequacy of fuel supply and delivery systems, not just the installed capacity of generators" (p.9).

I note that the need for investment is so great that there is plenty of room for both utility and merchant projects. It's not either/or, it's both/and. For example, we have a very positive relationship with NorthWestern Energy in Montana. We need to interconnect with them. In turn, we believe we will help NorthWestern solve problems with the generation and load on its system. The efforts are highly complementary.

LESSONS LEARNED AND POSSIBLE ACTIONS

Our views, and they continue to evolve as we learn more, are that this Committee might usefully consider acting to address three issues:

1. *The value of stimulating all kinds of transmission investments, particularly for renewable electricity projects;*

2. *Incentives for landowners to enhance the value of making rights-of-way available; and*

3. *The need for commercial solutions to the problems associated with integrating renewable generation into utility operating areas.*

Please allow me to speak to these three issues in order:

Stimulating Transmission Investment

The Problem:

As the demand for renewable energy, most notably wind and small run-of-river hydro grows, it becomes increasingly evident that the existing transmission grid was never built to connect wind and watersheds with markets. To effect the 'greening' of power will require not only many new environmentally-appropriate generation projects but also a significant new wave of transmission development. In addition, an alternative to building some of the generation that will otherwise be required is to interconnect more in order to share back-up capacity between systems.

Necessary Action:

I believe that the tax incentives granted to renewable energy projects should be extended also, on a *pro-rata* basis, to the investment in the transmission systems the renewable energy projects require.

Providing "Win-Win" Right-of-Way Incentives to Landowners

The Problem:

Transmission developments are often blocked or delayed by opposition to new rights-of-way. Unless right-of-way can be assured, transmission lines simply won't be built. Relying on condemnation, while effective, ultimately pits landowners against project developers. We believe it is important to seek ways for land owners to share in the benefits of transmission rather than perceive themselves as the victim. This can only happen if we develop concrete ways of sharing the value of these lines.

Necessary Action:

MATL works hard to address the concerns of as many landowners as possible. We pay landowners for the right-of-way on a per-pole basis. Thus, we have pledged to make annual pole rental payments that reflect the impact on land values and agricultural practices. We suggest that these payments should be made tax free to landowners and that their property taxes should be reduced to partially compensate them for the hindrances a line imposes. The new property taxes that new transmission lines will pay will more than make up the difference.

Integrating Renewable Generation on a Commercial Basis

The Problem:

Renewable energy generation and wind energy in particular suffers from uncontrollable variability. The wind doesn't always blow when demand rises and this causes considerable difficulty for those responsible for matching load and generation. There are several possible solutions.

In many jurisdictions the system operator buys ancillary services or additional generation to fill the gaps and smoothes the cost of that purchase over all users of the grid. I'll call this the "socialized solution." This may become more problematic as wind becomes a greater proportion of the supply on a system.

In Montana the system operator is asking new wind generators to firm their own wind generation profile, either by providing their own 'firming' capacity or by contracting for it. I'll call this the "privatized solution"

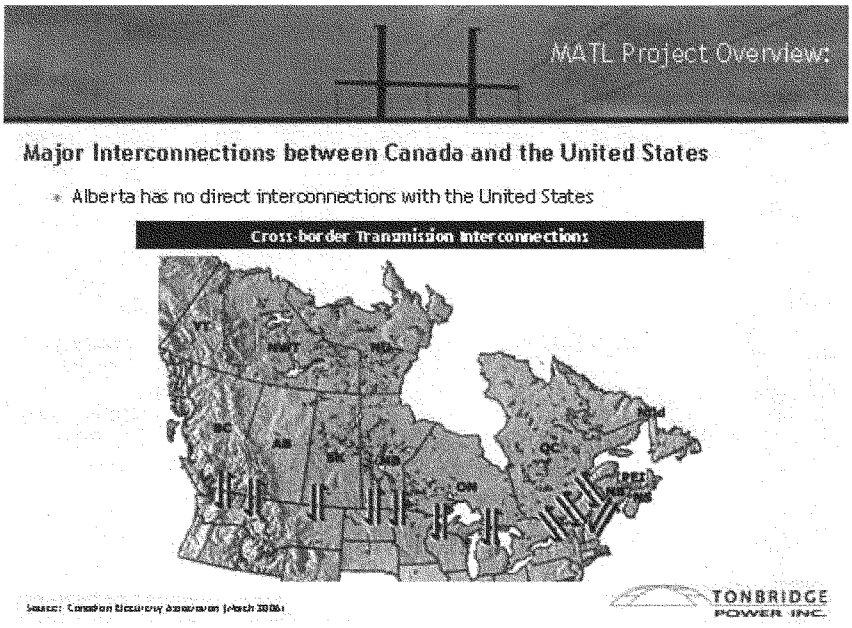
Necessary Action:

Neither the socialized nor the privatized solution is optimal in our view. It would be greatly preferable if all electricity generators and loads shared in the responsibility for matching their planned use of the grid with their real-time use. When imbalances or electric volatility occurs – as they inevitably will – both generators and loads should be encouraged to adjust their use of the grid through the development of spot markets for imbalances and ancillary services.

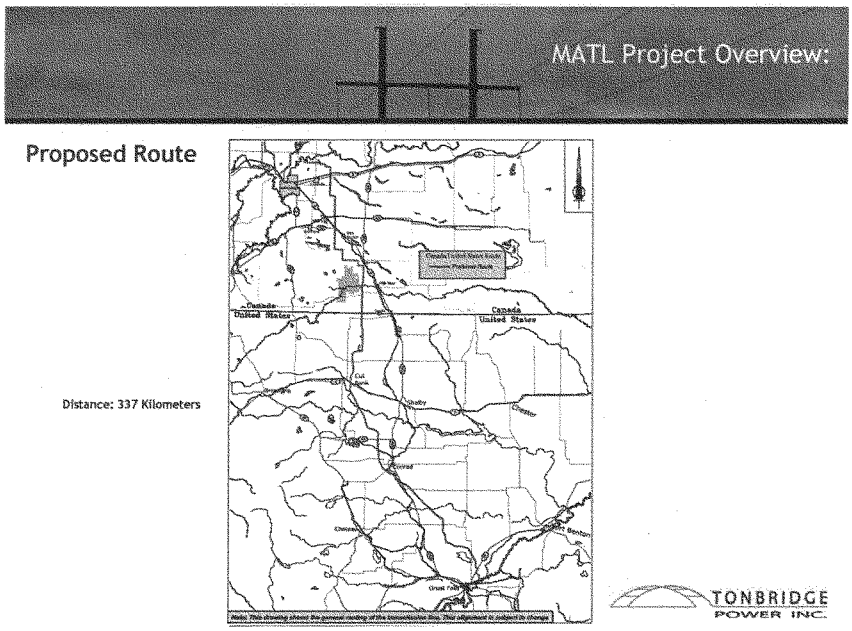
Only thus will the most efficient use of energy arise. Efficiency lies behind our need for renewables. We should not lose sight of that on the way to building a more renewable-based electricity sector.

Mr. Chairman, I hope that MATL will be a contributor to Montana's "Big Sky Country" for years to come. I thank you for your leadership, and look forward to the Committee's questions.

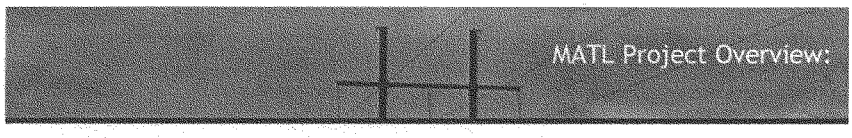
No Connections Between Alberta and Montana



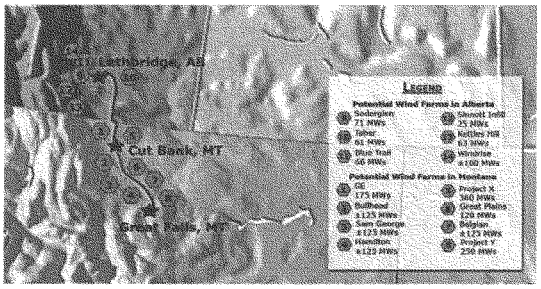
Proposed MATL Route



Proposed Wind Farms near MATL Line



New generators: Potential Wind Farms Near the Line



3,000 MWs of new wind generation stranded with no transmission

TONBRIDGE POWER INC.

Wind Power and the Production Tax Credit: An Overview of Research Results

Testimony Prepared for a Hearing on
"Clean Energy: From the Margins to the Mainstream"
Senate Finance Committee
Thursday, March 29, 2007, 10:00 AM

Dr. Ryan Wiser
Scientist, Lawrence Berkeley National Laboratory

Mr. Chairman and members of the Committee, thank you for inviting me to testify today. My name is Ryan Wiser, and I am a Scientist at Lawrence Berkeley National Laboratory (Berkeley Lab). Since 1995, I have conducted renewable energy research at Berkeley Lab; research that has been funded in large part by the U.S. Department of Energy. I am an author of over 200 research reports, articles, and book chapters, many of which can be found at: http://eetd.lbl.gov/ea/ems/. I am honored to be able to share with you my views as a researcher and as a private citizen.

I am here today to report on the findings of recent and ongoing work that I have helped manage and conduct that may inform your deliberations on the possible fate and extension of the Section 45 Production Tax Credit (PTC), especially as it pertains to wind power. These studies, many of which are still in progress, suggest that renewable electricity development is beginning to accelerate, that the potential for renewable electricity production in the U.S. is enormous, and that there may be significant benefits to both a longer-term extension of the PTC and to certain revisions to the PTC. That said, there are also very real costs to the Treasury of these changes that will need to be balanced against the potential benefits, and the benefits and costs of tax incentives for renewable energy might also be judged in comparison to the costs and benefits of providing tax incentives to other industries.

To be clear, I am here to report the results of my recent research and analysis, and though I hope that my remarks will help inform your deliberations, I am not here to take a specific policy position on the use of tax policy to support renewable energy. Let me also note that my remarks are my own, and do not necessarily represent those of Berkeley Lab or the U.S. Department of Energy. I am here on my own time, and neither my time nor my expenses are being charged to the Department of Energy.

The Nation's Renewable Electricity Resource Base

Renewable electricity, excluding hydropower, supplied just 2.7% of the Nation's electricity needs in 2006, and consisted of biomass and municipal waste (60%), wind (25%), geothermal (14%), and solar (0.5%). Including hydropower, the contribution of renewables increases to roughly 10% of U.S. retail electricity sales.

Despite this modest contribution, new renewable electricity investments have been accelerating in recent years, after a lull in the 1990s. Figure 1 illustrates the recent growth in renewable electricity capacity in the United States, excluding hydropower.

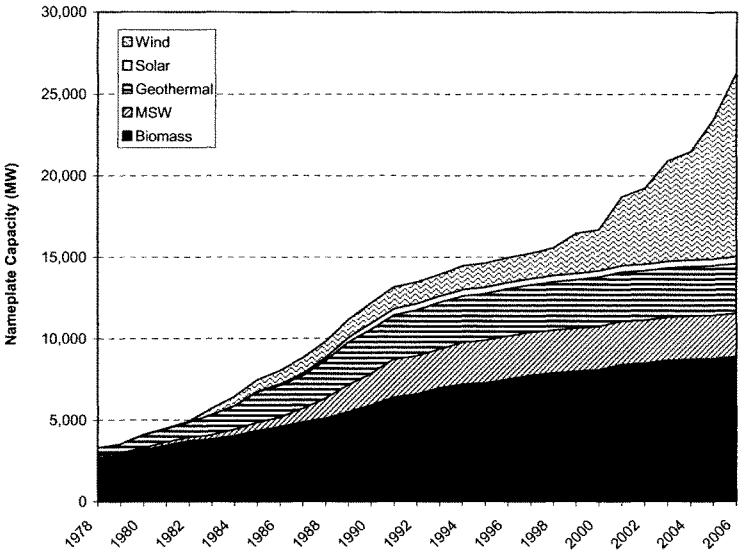


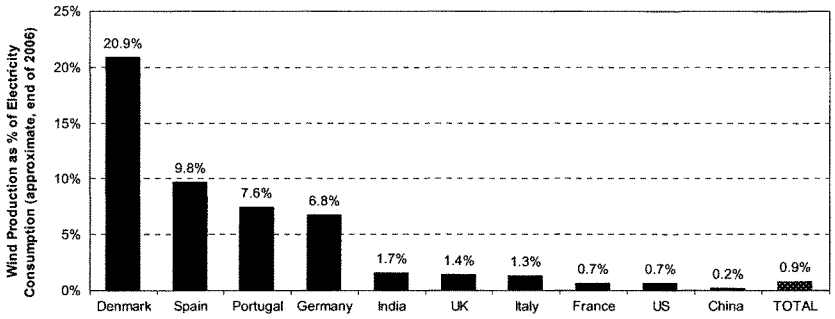
Figure 1. Cumulative U.S. Renewable Electricity Capacity, Excluding Hydropower
(Source: Black & Veatch 2007)

Figure 1 clearly shows that recent growth in the U.S. renewable electricity sector has been led by wind power. In fact, the year 2006 was the largest on record in the U.S. for wind power capacity additions, with over 2,400 MW of capacity added to the U.S. grid (see Figure 3, later). And, for the second consecutive year, this made wind power the second largest new resource added to the U.S. electrical grid in capacity terms, well behind new natural gas plants, but ahead of coal. New wind plants contributed roughly 19% of the new capacity added to the U.S. grid in 2006, compared to 12% in 2005. On a worldwide basis, 15,200 MW of wind capacity was added in 2006, up from 11,500 MW in 2005, for a cumulative total of 74,200 MW.

The recent growth in U.S. and worldwide use of renewable electricity is not restricted to wind power. Geothermal energy development in the Western U.S. has accelerated in recent years, and biomass power also has great potential. Solar power, though contributing relatively little to the Nation's electricity supply at present, holds substantial technological promise both through the use of photovoltaics and with solar-thermal electric facilities; the U.S. is currently the world's third largest market – behind Germany and Japan – for solar photovoltaics.

It is also undeniable that the United States is endowed with a very sizable renewable resource base, a resource base that is technically and physically able to meet the Nation's full energy needs. I won't go through the evidence in detail here, but suffice it to say that we have enormous physical resources to harness, including wind, solar, biomass, and geothermal energy, though of course not all of these resources will be cost effective.

Other countries, with far less attractive resource bases, have already made significant strides towards using substantial amounts of renewable energy. Denmark meets roughly 20% of its electricity needs with wind alone, while Spain is at 10% and Germany is at 7%. These countries have chosen to employ aggressive governmental policies to reach these levels of penetration. Despite having a much more robust wind resource, and despite recent growth, the U.S. currently meets less than 1% of its electricity needs with wind power (Figure 2).



Source: Berkeley Lab estimates based on data from Global Wind Energy Council, BTM Consult., and elsewhere

Figure 2. Wind Power as a Percentage of Total Electricity Sales for the Ten Top Wind Power Markets

Concerns have sometimes been expressed about the difficulty of accessing and using these resources; due, for example, to the complexity of integrating wind energy into electrical grids, and the cost of transmitting wind power from resource areas to load centers. These concerns are not entirely unfounded, but a growing number of sophisticated and credible research studies, as well as experience in Europe, show that not only is the integration of a substantial amount of wind power into electrical grids technically feasible, but that the costs of doing so are manageable. Similarly, while transmission availability is often a contractual or physical barrier to wind development, innovative tariff designs and growth in transmission infrastructure are possible and need not be overwhelmingly expensive. A common barrier is uncertainty over who will pay for new, large, and often multi-state transmission lines, the so-called "cost-allocation" issue. Solving this issue in not technical, but rather involves agreements being reached jointly by the affected states, as well as with FERC and state regulatory bodies. These barriers are not entirely unique to renewable energy; some of the same issues arise when accessing certain conventional sources of power, such as coal, which are also often located remote from load centers. Though there are surely very real barriers to the growth of the renewable electricity industries in the U.S., the opportunities are also great.

The Renewable Energy Industries Are Maturing but Policy Is Still Likely to Be Needed if Rapid Growth is Desired

The renewable energy industries are maturing. The wind power manufacturing sector, for example, now includes GE, Siemens, Vestas, and other major international firms. A number of large companies have recently entered the development side of the business as well, including AES, Goldman Sachs, Shell, BP, and John Deere, joining existing players such as FPL, PPM, Iberdrola, and others. The increased acceptance and maturity of the wind sector has also attracted interest by electric utilities to own wind assets, with 25% of the total U.S. wind additions in 2006 owned by local electrical utilities. Similar growth and industry development is occurring in other segments of the renewable energy sector.

Despite these advances, analyses funded by the Federal government, by non-profit organizations, and by the private sector consistently suggest that, if renewable resources are chosen to be harnessed at a significant scale in the United States (particularly at a rate faster than the normal multi-decades natural growth that will occur regardless as technology costs continue to decline), supportive policy will be needed.

The U.S. DOE's Energy Information Administration, for example, projects that existing Federal policies (assuming that existing tax policies, including the PTC, expire on schedule) will only be enough to increase the amount of non-hydro renewable electricity used in the U.S. to 3.9% of electricity supply by 2030. Work at Berkeley Lab, meanwhile, shows that if existing *state* renewable energy purchase standards are fully achieved, renewable electricity use would meet roughly 6% of the Nation's electricity supply by 2020. Recent and ongoing work by the DOE and the wind industry to evaluate the feasibility of achieving 20% of the Nation's electricity supply from wind has also found that policy actions are critical to the pursuit of such aggressive targets.

To be clear, it is not my role to argue that Federal or state policies are warranted on policy grounds – policymakers must consider both the potential costs and benefits of these policies, as well as the alternative uses of the funds required to support them. But, one point is evident based on the research, and that is that *if* deploying renewable energy on a significant scale in this Nation is desired (above the much slower rate of uptake that analysts predict will occur absent new/expanded policies), then policy efforts, in concert with private sector ingenuity and investment and R&D advancements, will likely be needed.

History of the Production Tax Credit

As you are all very much aware, the U.S. Congress has a long history of providing tax incentives for energy development, including renewable electricity. The PTC was established by the Energy Policy Act of 1992 to stimulate use of renewable technologies for power production. At the present time, the PTC provides a 10-year credit of 1.9¢/kWh (adjusted upwards, in future years, for inflation) for wind, "closed-loop" biomass, and geothermal power, and half that rate for traditional "open-loop" biomass, eligible hydropower, landfill gas, and municipal solid waste. Projects must be in service by the end of 2008 to be eligible for the current PTC. Presumably,

the PTC intends to support renewable energy due to the environmental, economic development, and energy security benefits that these sources provide, and perhaps as a way of compensating for the Federal incentives that have historically been offered to conventional energy sources.

Since 1999, the PTC has expired on three occasions, and has been extended on five occasions. Typically, the PTC has been reinstated for 1- to 2-year periods, with resource eligibility rules and other statutory details often also witnessing some change. Table 1 shows the legislative history of the PTC, along with its impact on wind project development.

Table 1. History of the PTC and Related Development Activity

Legislation	Date Enacted	PTC Eligibility Window	Effective Duration (considering lapses)	Wind Capacity Built in PTC Window (MW)
Section 1914, Energy Policy Act of 1992 (P.L. 102-486)	10/24/92	1994-June 1999	80 months	894
Section 507, Ticket to Work and Work Incentives Improvement Act of 1999 (P.L. 106-170)	12/19/99	July 1999-2001	24 months	1,764
Section 603, Job Creation and Worker Assistance Act (P.L. 107-147)	03/09/02	2002-2003	22 months	2,078
Section 313, The Working Families Tax Relief Act, (P.L. 108-311)	10/04/04	2004-2005	15 months	2,796
Section 1301, Energy Policy Act of 2005 (P.L. 109-58)	08/08/05	2006-2007	24 months	5,454*
Section 201, Tax Relief and Health Care Act of 2006 (P.L. 109-432)	12/20/06	2008	12 months	3,000**

*5,454 MW based on 2,454 MW installed in 2006, and AWEA projection of 3,000 MW to be installed in 2007.
**Estimate assuming AWEA's 3,000 MW 2007 projection holds throughout 2008.

Impact of the PTC on Wind Power Development to Date

The PTC reduces the cost of wind power by roughly one-third (~ 2 cents/kWh), thereby making wind more attractive to electric utilities and other investors. In fact, with the PTC, wind power is now economically attractive in some regions of the country relative to more-conventional electricity sources. The PTC, coupled with the rising cost of conventional fuels, R&D advances, and a variety of state policies, has stimulated significant growth in the use of wind power over the past 10 years, as shown in Figure 3. It is difficult to overstate the importance of the PTC to the wind industry over this timeframe, as well as the negative consequences of PTC expiration for the industry in 2000, 2002, and 2004.

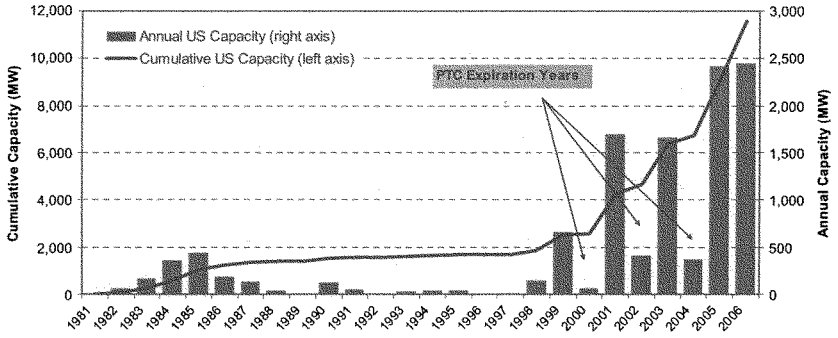


Figure 3. U.S. Wind Power Capacity (annual and cumulative)

In part as a direct result of the PTC, the U.S. has led the world in wind power additions for the last two years, with roughly 16% of the worldwide wind capacity installed in 2006 coming from the United States. Moreover, nearly $4 billion was invested in U.S.-based wind capital additions in 2006 alone. Since the PTC began in 1994, wind plant additions in the U.S. have resulted in an aggregate investment of roughly $13 billion.

As shown in Table 2, major state beneficiaries of the PTC are regionally diverse, and include Texas, Washington, California, Iowa, Minnesota, Oklahoma, New Mexico, and New York. A total of 20 states had more than 50 MW of wind power capacity at the end of 2006.

Table 2. Wind Power Capacity, by State

Cumulative Capacity (end of 2006, MW)		Incremental Capacity (2006, MW)	
Texas	2,768	Texas	774
California	2,361	Washington	428
Iowa	936	California	211
Minnesota	895	New York	185
Washington	818	Minnesota	150
Oklahoma	535	Oregon	101
New Mexico	497	Kansas	101
Oregon	439	Iowa	100
New York	370	New Mexico	90
Kansas	364	North Dakota	80

As evidence of the importance of the PTC to the U.S. wind sector, wind capacity additions have seen pronounced lulls in 2000, 2002, and 2004 (see Figure 3). In each of these years, the PTC expired for some period of time before being subsequently extended. Though some wind development will surely occur even without the Federal PTC, this historical experience suggests that the PTC, or some alternative policy, is crucial if significant near-term growth of the wind market in desired.

The Boom-and-Bust Cycle of Development

Though the historical impacts of the PTC are well known, somewhat less recognized is the fact that the frequent expiration/extension cycle that we have seen since 1999 has had several negative consequences for the growth of wind power. Due to the series of shorter-term, 1- to 2-year PTC extensions, growing demand for wind power has been compressed into tight and frenzied windows of development. This has led to boom and bust cycles in renewable energy development, under-investment in manufacturing capacity in the U.S., and variability in equipment and supply costs. Recent work at Berkeley Lab suggests that this boom-and-bust cycle has made the PTC less effective in stimulating low-cost wind development than might be the case if a longer term and more stable policy were established.

More specifically, some of the *potentially* negative impacts of the shorter-term, 1- to 2-year extensions of the PTC on the wind industry are as follows:

1. **Slowed Wind Development:** Data in Figure 3 demonstrate that the risk of PTC expiration can slow wind development in certain years. Even in years in which the PTC is secure, uncertainty in the future availability of the PTC may undermine rational industry planning, project development, and manufacturing investments, thereby leading to lower levels of new wind project capacity additions.

2. **Higher Costs:** Wind project costs in the U.S. decreased substantially from the early 1980s to the early 2000s, demonstrating the success of public and private R&D investments and the commercial success of the technology. Since 2002, however, costs have risen. Based on data collected by Berkeley Lab, the average installed cost of wind projects in the U.S. in 2006 was roughly $1,600/kW, up from roughly $1,300/kW in 2002. There is reason to believe that these increased prices have been caused, in part, by the erratic market cycle of frenzied investment alternated with market collapse that has been created by the 1- to 2-year extensions of the PTC in recent years.

3. **Greater Reliance on Foreign Manufacturing:** Uncertainty in the future scale of the U.S. wind power market has limited the interest of both U.S. and foreign firms in investing in wind turbine and component manufacturing infrastructure in the U.S. Instead, the U.S. remains reliant, to a significant degree, on wind turbines and components manufactured in Europe and, in the future, perhaps China and elsewhere, thereby reducing opportunities to grow the domestic manufacturing sector.

4. **Difficult to Rationally Plan Transmission Expansion:** Accessing substantial amounts of wind energy will require investments in the transmission grid, and most analysts believe that the U.S. has under-invested in transmission in recent years. Uncertainty in the future of the PTC makes transmission planning for wind particularly challenging because the economic attractiveness of wind projects (and therefore of expanding the transmission system for those projects) hinges in many cases on the PTC. In turn, since transmission projects take many years to plan, permit, finance, and construct, uncertain demand for the line itself may prevent needed transmission projects from taking place.

5. **Reduced Private R&D Expenditure:** Shorter-term PTC extensions may lower the willingness of private industry to engage and invest in long-term wind technology R&D that is unlikely to pay off within a 1- to 2-year PTC cycle, given uncertainty in the future domestic market demand for those advanced technologies.

Potential Benefits of a Longer-Term PTC Extension

Recent research at Berkeley Lab and elsewhere has sought to investigate, with more specificity, some of the possible benefits of a longer-term (5-10 year) PTC extension, or other more-stable form of promotional policy. Preliminary analysis in late 2006 by Berkeley Lab, for example, suggested that a longer-term PTC extension may be able to drive the installed cost of wind down by 5% to more than 15%, relative to a continuation of the present cycle of 1- to 2-year extensions. More recent analysis of historical wind capital costs also suggests the possibility of a capital cost premium of up to 12% as a result of the present boom-and-bust cycle.

Because these initial analyses were crude, and the resulting estimates uncertain, we also sought to confirm the results through a survey of wind industry members. Through the survey, we also hoped to develop a better understanding of some of the specific benefits of a longer-term PTC extension (or alternative policies that would bring more long-term certainty to the industry). Importantly, this was an industry survey, and did not seek to address other relevant perspectives on the benefits and drawbacks of longer-term PTC renewal. I therefore encourage you to think of the results as useful inputs to policy determination, but by no means a comprehensive analysis of the advantages and disadvantages of such an extension.

Survey respondents represent a diverse set of industry stakeholders, including two wind turbine manufacturers, three components suppliers, four developers/O&M providers, and one construction contractor. We may receive more responses in the weeks ahead, so the results presented here should be considered preliminary.

Some of the key findings of this work are provided below.

Finding #1: The Benefits to the Wind Industry of a 5- to 10-Year PTC Extension Are Expected to be Diverse

Survey respondents ranked a number of potential benefits from a 5- to 10-year PTC extension, relative to a continuation of the current 1- to 2-year extension cycle. Respondents were asked to respond to the question from an aggregate industry perspective.

Survey respondents view the most important benefit of a 5- to 10-year PTC extension to be the greater number of wind installations expected to result from that policy stability (Figure 4). Other major benefits include more rational transmission planning, reductions in installed project costs, and enhanced private R&D. Though expectations for reductions in project costs are not surprising, it is interesting to note the perceived importance of a 5- to 10-year PTC extension on transmission planning and private R&D investments. Neither of these potential benefits has typically been emphasized in discussions over PTC extension, at least to my knowledge.

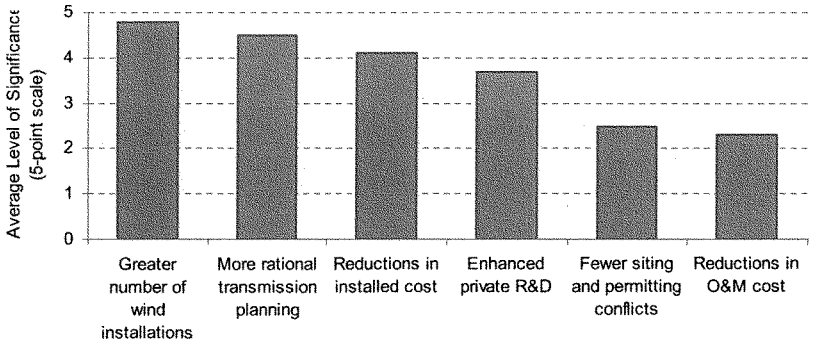


Figure 4. Potential Benefits to the Wind Industry of a 5- to 10-year PTC Extension

Finding #2: A 5- to 10-Year PTC Extension May Encourage Growth in Domestic Wind Turbine Manufacturing

U.S.-based manufacturing of wind turbines and components remains somewhat limited, in part because of the uncertain availability of the Federal PTC. This is true despite recent announcements and investments to increase local manufacturing of certain components by both domestic and international firms. In 2006, for example, new wind-related manufacturing plants were established in Iowa (Clipper Windpower), Minnesota (Suzlon), and Pennsylvania (Gamesa). And GE Energy, the Nation's most prominent wind turbine manufacturer, captured 47% of domestic wind turbine sales in 2006.

Industry members were asked to estimate the proportion of U.S. wind project costs currently sourced from or manufactured in the United States, as well as expected trends in domestic manufacturing in the coming ten years under both an uncertain PTC environment and under a 10-year PTC extension.

Though responses show a range of opinions on the magnitude of future domestic manufacturing, directional consistency is clear: a longer-term PTC extension is expected by industry to yield a sizable increase in domestic wind turbine and component manufacturing (Figure 5).

Under the present uncertain PTC extension path, domestic manufacturing is expected to remain largely constant over time, and not grow substantially from its current base of roughly 30%. As one point of reference, the nascent wind power market in China has already achieved a 70% local manufacturing share, with virtually all of the major turbine manufacturers (including GE) making substantial manufacturing investments in that market. A 10-year PTC extension, on the other hand, yields a median expected domestic manufacturing share of over 70%, on par with China's current share, bringing with it jobs and local economic development benefits.

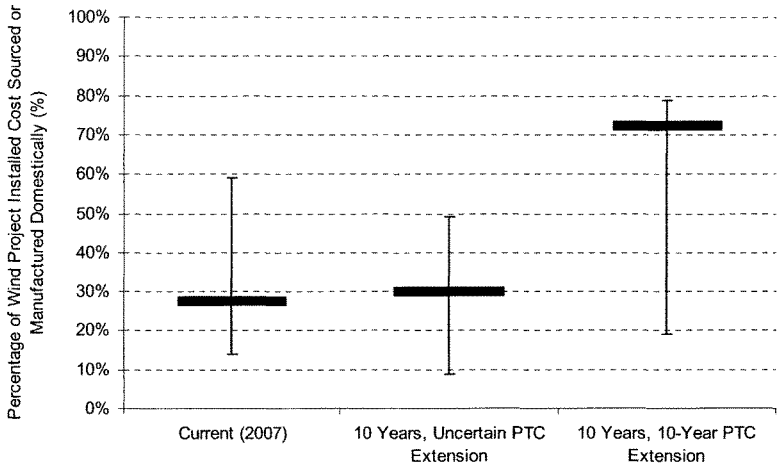


Figure 5. Domestic Manufacturing Expectations by Industry Under Longer-Term PTC Extension (median, min, max)

Finding #3: Installed Cost Reduction <u>Potential</u> Is Significant, at 8% (5-year extension) to 15% (10-year extension), on Average

All of the industry stakeholders that responded to the survey agreed that a longer term extension of the PTC could help reduce the installed cost of wind in the United States, but there is some disagreement on the magnitude of those possible cost reductions.

Almost universally, survey respondents believe that the potential cost reduction is greater under a 10-year extension than under a 5-year extension. Under a 10-year extension, projected cost reductions range from a low of 5-10% to as high as 20-25%; under a 5-year extension, cost reductions are projected to range from 0-5% to 10-15%. Averaged over all responses, a 5-year extension is projected to yield cost reductions in the 8% (~$135/kW) range, while a 10-year extension may result in ~15% reductions in installed wind project costs (~$255/kW). Other survey results, not presented here, suggest that these savings estimates might be considered a conservative lower bound. Either way, these results are reasonably consistent with those estimated earlier by Berkeley Lab.

Respondents believe that the most important cost-reducing influences that may come from a 5- to 10-year extension include:

1. More efficient labor deployment and greater investment in supply-chain capital; lower risk premiums for capital investment in the supply chain.
2. Enhanced private R&D expenditures that improve wind technology.

3. Cost savings from a de-linking of U.S. prices to the Euro-US dollar exchange rate, due to increased domestic manufacturing.
4. Transportation savings created by increased domestic manufacturing of turbines and components.
5. Reductions in other project development and financing costs that are driven higher by currently rushed development schedules

Summary of Findings

The findings reported above suggest that the benefits of a longer-term PTC renewal may be significant, and that the benefits of a 10-year extension are likely to be greater than those of a 5-year extension. I want to very clearly acknowledge, however, that these possible benefits must be judged against the costs to the Treasury of a longer-term PTC extension, as well as the alternative uses of the funds required to support such an extension. In addition, it should be understood that the above survey results derive from the views of wind industry participants, who have a natural self-interest in a PTC extension.

Production Tax Credit Design Considerations

Based my work, and the work of other colleagues at Berkeley Lab, I would also like to raise for your consideration several different elements of the design of the PTC. While, again, I take no formal position on the proper design of the PTC or whether it should be extended, I do hope this discussion will help identify several design elements that you may wish to consider.

Credit Offset Rules

First, Section 45 (b)(3) of the Internal Revenue Code contains what are commonly known as "credit offset" or "anti-double-dipping" provisions that reduce the amount of the PTC available to any eligible project that also benefits from certain types of government grants, tax-exempt bonds, subsidized energy financing, and other Federal tax credits. To date, most individual states that have offered financial incentives to encourage wind project development have structured their incentives so as not to trigger the PTC's credit offset provisions.

In contrast, the Federal government has, in recent years, offered grants to qualifying wind projects, through the USDA's "Section 9006" program, that do trigger the credit offset. Recent work by Berkeley Lab suggests that the percentage of a Section 9006 grant lost to both income tax payments (since the grant is considered to be taxable income) and the PTC's credit offset can range from 31% to 83% of the face value of the grant, with a base-case scenario falling in the middle of that range at a combined loss of 58% (37% due to income tax payments, and 21% due to the credit offset).

To the extent that this potential conflict in Federal policy goals is considered adverse, possible remedies might include eliminating the credit offset provisions altogether (the offset is currently capped at 50% of the value of the PTC), exempting certain smaller renewable energy projects (i.e., those targeted by the USDA program) from the offset provisions, or alternatively

restructuring the USDA Section 9006 incentives so that they do not trigger the PTC's credit offset provisions (by, for example, making the payment performance-based). Any of these "solutions" would increase the value of the Section 9006 grants available to smaller, community-owned renewable energy projects.

Investment Restrictions

The PTC has also sometimes been criticized as being too narrowly applicable, thereby restricting the types of investors that can efficiently make use of it. Most obviously, as a tax credit, the PTC is not available to entities that do not pay taxes (e.g., publicly owned electric utilities, rural electric cooperatives, government bodies, and non-profits), though due to several design features, the PTC is also not easily accessible by certain tax-paying entities as well.[1] These restrictions have led to a concentration of wind project ownership in the hands of relatively few entities with sufficient tax liabilities to make use of the credit. The result may be some inefficiency in the use of the PTC, and certainly some lack of parity in what types of entities can realistically participate in wind project ownership.

If so desired, Congress could expand the potential universe of wind project equity investors by making a few structural changes to the PTC. Alternatively, Congress could achieve some of the same goals by implementing or expanding parallel programs targeted at entities unable to directly benefit from the PTC. For example, the Clean Renewable Energy Bond (CREB) program created by the Energy Policy Act of 2005 and expanded by the Tax Relief and Health Care Act of 2006 is one attempt to level the playing field for non-taxable entities unable to use the PTC. The Renewable Energy Production Incentive (REPI) is another such policy with a longer, though marred, history: because REPI payments are subject to annual (and therefore uncertain, and often insufficient) Congressional appropriations, the REPI is widely considered to be relatively ineffective at stimulating new renewable generation. It is perhaps worth noting that both the REPI and CREB programs would be largely unnecessary if the PTC were made tradable. If the PTC is not made tradable, however, then Congress may wish to consider a longer-term renewal and allocation of funds to the CREB program, or revisions to the REPI to make it a truly predictable and more-effective incentive.

Treatment of Non-Wind Renewable Sources

Earlier in this testimony I discussed some of the possible negative consequences of the recent history of 1- to 2-year PTC extensions for wind power. The implications of this extension cycle are even more severe for eligible non-wind renewable energy technologies, such as biomass and geothermal. This is because the 12-24 month development window created by shorter-term PTC extensions does not appear to be long enough to directly and significantly spur the development of other PTC-eligible technologies, such as geothermal and biomass. Both of these technologies require longer development periods than does wind. As such, a longer-term extension of the

[1] For example, individuals who are passive investors in a PTC-eligible project will typically only be able to use the PTC if they have additional (other) forms of passive income (i.e., not wage or interest and dividend income) against which to take the credit. In addition, those individuals and corporations subject to the alternative minimum tax (AMT) will likely only be able to use the PTC during the project's first four years (during which time the PTC is exempt from AMT limitations).

PTC, in the range of 5 years, may well be necessary for the PTC to provide value to the biomass and geothermal industries that is equivalent to the value provided to the wind industry. It is also apparent that some renewable technologies – most notably solar, but also including smaller, residential wind systems – are better suited to investment-based support such as through the current investment tax credit. Of course, it is up to policymakers to determine whether an acceleration of the deployment of these renewable resources is desired.

Treasury Impacts

Finally, since many of the design and extension options discussed in this testimony would, if addressed, likely lead to increased renewable generation development and a correspondingly higher PTC budgetary impact, it is worth considering how to contain the cost of the policy within acceptable limits while still achieving as many policy goals as possible.

One way to potentially accomplish this goal is to gradually reduce the level of the PTC over the extension period, presumably in concert with renewable technologies becoming more mature and cost-competitive. For example, a 10-year PTC extension might start at current levels ($15/MWh not adjusted for inflation) for projects built during the first year of the extension, but then decline in value over the extension period, such that projects built later in the 10-year period would receive a reduced PTC. The long-term nature of such an extension would provide the industry with the certainty that it seeks, while the declining incentive level would help contain the cost to the Treasury. Though such an approach deserves consideration, one caution is that wind power costs have risen substantially in recent years, and care is therefore warranted so as not to reduce the PTC to a level that is unable to support new project development (assuming, again, that increased renewable energy development is the goal of the PTC).

Conclusion

Mr. Chairman and members of the Committee, to conclude I want to re-emphasize that I am not here to advocate for any particular policy outcome from this Committee. Instead, I hope that the data and analysis that I have presented today will be helpful as you consider the desirability of accelerating the use of renewable electricity in this Nation's energy supply, the possible benefits and costs of policies that provide greater certainty and stability to the renewable energy sector, and the advantages and disadvantages of certain policy design features.

Senate Finance Committee Hearing
"Clean Energy: From the Margins to the Mainstream"
Question for the Record for Ryan Wiser

Question:

Mr. Wiser, electricity from wind energy has grown from almost a science fair experiment to a significant contributor to the grid. As I said in my opening statement, I was the original sponsor of the wind production tax credit in the Energy Act of 1992. So I have been studying the wind industry for almost 20 years now. In your testimony you spoke of the common barrier of cost allocation on large multi-state transmission lines. Could you please discuss this further? (Senator Grassley)

Answer:

Though transmission is typically about only 10 percent of the cost of delivered electricity, who pays for new transmission lines that span multiple States can be a significant hurdle towards the development of large multi-State transmission lines. That is because the transmission line developer, to obtain financing, must be able to prove that there is a reasonable certainty that its investment can be recovered through transmission rates charged to the various users and beneficiaries of the transmission line.

There are a number of "cost-allocation" formulas used to allocate costs to various users and beneficiaries (ultimately the electricity customers who receive the electricity that the transmission line carries), each with its advantages and disadvantages. How costs of a new line are allocated ("cost-allocation") is subject to individual State approval, with any agreed-upon cost-allocation formula for a specific new multi-State line then submitted for ultimate approval to the Federal Energy Regulatory Commission.

The difficulty with large multi-State transmission lines is that the benefits of the new transmission line may vary for each State that the line crosses. A State that is in the middle of a new line's path but that receives little of the electricity from the line may object to having a transmission line cross its State, and nay particularly object to having its States electricity customers pay a share of the transmission line costs. Also, determining the exact electricity flows surrounding a transmission line, and thus those who receive the electricity and its benefits, is very difficult to do from an engineering standpoint. Additionally, as years go by, electricity flows over the transmission grid change in response to changes in electrical demand and the addition of new generation or transmission, and so likewise do the various beneficiaries. Thus, getting agreement among States on how the costs of a large multi-State transmission line should be divided among the various States and their electricity ratepayers can prove difficult and may prevent the construction of multi-State transmission lines.

Cost-allocation of new multi-State transmission lines must be agreed to by the involved States themselves, subject to FERC approval, before that new line can be built. As discussed above, getting that agreement among the involved States can be daunting and difficult.