GET SMART ON THE SMART GRID: HOW TECHNOLOGY CAN REVOLUTIONIZE EFFICIENCY AND RENEWABLE SOLUTIONS

HEARING

BEFORE THE

SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING HOUSE OF REPRESENTATIVES

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HEARING ON GET SMART ON THE SMART GRID: HOW TECHNOLOGY CAN REVOLUTIONIZE EFFICIENCY AND RENEWABLE SOLUTIONS

WEDNESDAY, FEBRUARY 25, 2009

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON ENERGY INDEPENDENCE
AND GLOBAL WARMING,
Washington, DC.

The Committee met, pursuant to call, at 9:30 a.m., in room 2247 Rayburn House Office Building, Hon. Edward Markey (chairman of the Committee) presiding.

Present: Representatives Markey, Blumenauer, Inslee, Hall, Sensenbrenner, Sullivan and Capito.

Staff present: Jonathan Phillips.

The CHAIRMAN. Over the past two years this Committee has explored key elements of our low-carbon energy future: renewable energy sources and improving efficiency. Today we focus on the next critical component: how the Internet and information technologies unleashed by the 1996 Telecommunications Act can enable us to take full advantage of renewable energy sources and efficiency. I think of this as the energy internet.

Today we will explore how the Internet can revolutionize the energy sector, just as it has transformed so many other parts of our economy. We all recognize that the energy backbone infrastructure needed to integrate wind and solar resources is an issue that needs to be addressed as we move away from carbon-producing fossil fuels towards new, clean, cost-effective renewable resources.

But the backbone infrastructure needed for renewables requires more than tall towers and wide rights-of-way. To do it right, it also requires smart grid internet protocol communications networks, open protocol smart meters, backbone sensors connected to radio spectrum, and sophisticated interactive control technologies.

The U.S. electric grid has been called the most significant engineering achievement of the Twentieth Century. It is the largest, most complex machine on the planet, with over a million megawatts of generating capacity and 300,000 miles of transmission lines ready for just-in-time delivery of energy to heat our homes and light our world almost wherever it is needed. However, this grid was designed for a different era.

Historically, environmentally unfriendly coal, natural gas, and nuclear generators have delivered electricity to passive consumers. These customers, both large industrial users and average consumers, lacked the information and incentives to change their consumption. Utilities also had limited information on grid conditions and limited ability to control and monitor demand-side resources or respond to changing grid conditions.

In the era when we have gone from black rotary phones to BlackBerries, from three TV stations on the large appliance in your living room to YouTube on the tiny device in your pocket, we need to do better.

The technology is available in 2009 to develop an energy internet and a smart grid. And today we will explore some of the potential technologies to accomplish that goal.

Smart grid technologies can alter the way we use electricity, allow distributed generation to be sold to the grid, help utilities to integrate intermittent renewable resources, allow us to reduce carbon emissions, and allow self-healing of the grid when the system goes awry. This is not just the right thing to do. Smart grid technologies also can save consumers money.

In discussing climate change legislation, we focus on the importance of putting a price on carbon to send price signals to businesses and consumers. On the electricity side, we need to ensure consumers, large and small, have good information to make wise decisions.

Home-level smart grid technologies allow consumers to reduce demand and see their carbon footprint through the use of advanced meters. Smart meters, such as those placed on thermostats, washer/dryers, and refrigerators, allow consumers to respond dynamically to prices by turning down appliances and thereby reducing consumption.

These end-user smart grid devices also can be adopted by utilities to control numerous electricity usages from street lighting to industrial customers willing to reduce consumption.

I am pleased that we have a panel of experts to explain the benefits and challenges facing us in the development of smart grid technologies and promoting an energy internet. I thank you all for being here.

That completes the opening statement of the Chair. We now turn to recognize the Ranking Member of the Committee, the gentleman from Wisconsin, Mr. Sensenbrenner.

[The prepared statement of Mr. Markey follows:]

THE SELECT COMMITTEE ON
ENERGY INDEPENDENCE AND GLOBAL WARMING

"Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions."

Opening Statement of Chairman Edward J. Markey
February 25, 2009

Over the past two years this Committee has explored key elements of our low carbon energy future – renewable energy sources and improving efficiency. Today, we focus on the next critical component – how the Internet and information technologies unleashed by the 1996 Telecommunications Act can enable us to take full advantage of renewable energy sources and efficiency. I think of this as the "energy Internet." Today we'll explore how the Internet can revolutionize the energy sector just as it has transformed so many other parts of our and economy.

We all recognize that the energy backbone infrastructure needed to integrate wind and solar resources is an issue that needs to be addressed as we move away from carbon producing fossil fuels towards new clean, cost effective renewable resources. But the backbone infrastructure needed for renewables requires more than tall towers and wide rights-of-way: to do it right, it also requires smart grid internet protocol communications networks, open protocol smart meters, backbone sensors connected by radio spectrum, and sophisticated interactive control technologies.

The U.S. electric grid has been called the most significant engineering achievement of the 20th Century. It is the largest, most complex machine on the planet with over a million megawatts of generating capacity and 300,000 miles of transmission lines ready for just-in-time delivery of energy to heat our homes and light out world almost wherever it is needed. However, this grid was designed for a different era. Historically, environmentally unfriendly coal, natural gas, and nuclear generators have delivered electricity to passive consumers. These customers, both large industrial users and average consumers, lacked the information and incentives to change their consumption. Utilities also had limited information on grid conditions and limited ability to control and monitor demand side resources or respond to changing grid conditions. In an era when we have gone from black rotary phones to BlackBerry's, from three TV stations on the large appliance in your living room to YouTube on the tiny device in your pocket, we need to do better. The technology is available in 2009 to develop an energy Internet and a smart grid, and today we'll explore some of the potential technologies to accomplish that goal.

Smart grid technologies can alter the way we use electricity, allow distributed generation to be sold to the grid, help utilities to integrate intermittent renewable resources, allow us to reduce carbon emissions, and allow self healing of the grid when the system goes awry. This is not just the right thing to do; smart grid technologies also can save consumers money.

In discussing climate change legislation, we focus on the importance of putting a price on carbon to send price signals to businesses and consumers. On the electricity side, we need to ensure consumers large and small have good information to make wise decisions. Home-level smart grid technologies allow consumers to reduce demand and see their carbon footprint through the use of advanced meters. Smart meters, such as placed on thermostats, washer/dryers and refrigerators, allow consumers to respond dynamically to prices by turning down appliances and thereby reducing consumption. These end-user smart grid devices also can be adopted by utilities to control numerous electricity usages from street lighting to industrial customers willing to reduce consumption.

There is also a huge opportunity for savings using Internet and wireless technologies in the energy backbone. Smart grid technologies allow utilities to send electricity more efficiently, integrate renewable resources which can be intermittent, increase system reliability and increase transmission capability. The amount of electricity produced by wind and other intermittent resources has been rapidly increasing. These new intermittent resources place additional strain on the grid in terms of balancing supply and demand. The wind won't blow and the sun won't always shine during peak demand hours. How to solve this problem of spike-y supply? Use smart grid technology to dynamically downscale demand in a way that the average consumer won't even notice. Home level smart grid meters and control devices provide utilities with numerous new distributed resources to provide these balancing functions.

These issues are critical to the goals of our committee – energy independence and climate change. These demand side resources are so significant that they can replace the need to build or keep online inefficient generation. In fact, one utility today is proposing to avoid building a 900 Megawatt plant by using advanced energy efficiency and demand side management to refocus the demand. These kinds of technologies and programs will allow utilities to build fewer generation plants needed to meet peak load and to balance the system which will lead to lower bills paid by consumers.

I am pleased that we have a panel of experts to explain the benefits and challenges facing us in the development of smart grid technologies and promoting an energy Internet. I thank them for being here and I look forward to hearing their ideas.

Mr. SENSENBRENNER. Thank you very much. Thank you. Thank you very much. Thank you very much. [Laughter.]

Okay. Reset the clock, please. Thank you very much, Mr. Chairman.

The CHAIRMAN. We have no clock. So we will be putting pieces of paper in front of people when there are 30 seconds.

Mr. SENSENBRENNER. Okay. Well, thank you very much, Mr. Chairman. I look forward to hearing about the advantage of smart grid technology and the need to update our national transmission system.

Technology and costs are not the only hurdles that we have to clear. Last week the Fourth Circuit ruled that the Federal Energy Regulatory Commission, FERC for short, lacked authority to locate high-voltage transmission lines. If we can't streamline the regulatory issues for siting new transmission lines, we will be doomed to legal battles and the same outdated grid.

In his written testimony, James Hoecker, counsel to the Working Group on Investment in Reliable and Economic Electric Systems, says that much of the infrastructure needed to increase our electrical transmission network will stretch over state lines.

Indeed, much of the nation's wind, solar, and geothermal resources are located in the interior of the country while many people who need that electricity live near the coasts. This will require new transmission lines, not just upgrades to the existing grid.

The states and the federal government must develop a streamlined system of approving rights-of-way for new electrical transmission lines. Since many of these lines will cross several states, the federal government must lead.

With regional electricity transmission networks serving numerous states, states will surely argue over the costs of these vital upgrades. Smart grid technology will encounter the same cost allocation and recovery problems that the transmission network now faces.

I am interested in hearing today about new electrical transmission technology that can make the network more efficient, but I am also interested in hearing about what new transmission is required and how we can improve the regulatory system that oversees this expanded network.

The states, the federal government, shareholders, consumers, and other stakeholders will all play a role in upgrading our energy infrastructure. These stakeholders must work together to ensure that this network can be built in a timely manner without unnecessary regulatory hold-ups.

Now, let me say that earlier this week energy/environment czar, poobah, or whatever she is in the White House, Carol Browner, talked about the need to upgrade the regulatory process in siting and building transmission lines.

I think that this is one issue where Republicans and the White House can agree. And I am looking forward to working to get together a piece of legislation that will update at least that part of the FERC law that gives FERC some power to deal with this issue.

I noticed in reading the newspaper last August that a utility in Indiana wished to build a 240-mile transmission line solely within that state and not crossing any state lines. They said in order to surmount the regulatory and litigation hurdles, they would not be able to begin construction until the year 2014.

Now, obviously that is unacceptable. And we in Congress are going to have to look at the FERC laws very closely to see what can be done to streamline the approval process for siting and construction of new transmission lines as well as upgrading the capacity of the grid. This is going to be a challenge with many conflicting stakeholders involved, but it is something that in my opinion has to be done.

So we can't let disputes between regulators and other stakeholders block better transmission and improve technologies that help address the energy challenges that we face. This hearing will deal with about half the issues. We had better be dealing with the other half to make sure that the package is complete.

Thank you.

The CHAIRMAN. The gentleman's time has expired. The Chair recognizes the gentleman from Oregon, Mr. Blumenauer.

Mr. BLUMENAUER. Thank you. Thank you for sharing your microphone, Mr. Chairman.

I find myself in substantial agreement with both statements from the ranking member and the chair. So I would like to forego an opening statement and add it to my question period if that is all right.

The CHAIRMAN. Excellent. The Chair——

Mr. BLUMENAUER. My apologies to the witness. Actually, Mr. Markey's influence is being felt in my Ways and Means Committee. We are having a hearing on global warming. I am just going to check in, tell them I am alive, and come right back.

The CHAIRMAN. Excellent. Thank you.

The Chair recognizes the gentleman from Washington State, Mr. Inslee.

Mr. INSLEE. I just want to make three quick points. First, you know, we have had a start on the smart grid, which was last Tuesday, when President Obama signed the economic recovery plan, which made very substantial investments in smart grid technology.

This is not an abstract exercise. We started last week creating green collar jobs associated with the smart grid with the signing of the economic recovery package.

I may note, too, that that package included what you might think of as the old-fashioned grid improvements as well. In my neck of the woods, the Northwest, it included $3.5 billion for laying wire with the Bonneville Power Administration. So the old backbone counts, too.

So, number one, we have made the first step down this road. Number two, we know that this works. One of the first experiments on consumer acceptance of smart grid technology with demand management so we can manage the amount of demand to level out peaks to reduce some of the stresses on the grid system was in Olympic Peninsula out in western Washington.

What the Pacific Northwest labs found is very high consumer acceptance on some strategies to reduce the demand in peak load periods, where consumers had the ability to determine when to do their drying and when to do their washing and when to do some of their thermostat and heating of their hot water systems, very,

very high consumer acceptance to find a way to do that demand management. We know this works.

And, third, we do know that we have to improve our siting, planning, and financing of grid improvements in general. I will be introducing in the next couple of weeks a bill that will make substantial improvements that will engage the offices of the federal government for siting, planning, and financing the very, very large improvements we need to the grid system, both as to timing, permitting, and a way to finance this plan.

I think the conditions are right for progress on this. I just note that the utility commissioners as recently as last week were moving forward to accept some more national effort in this regard. This is a very, very positive sign that the states are recognizing the necessity for a national movement in this regard. That is not always easy to do. And I think we should feel comforted that the states want to be partners with us in this effort. We even have the chamber on the other side of the U.S. Senate moving on these issues.

So it is time for action. And thanks for this hearing, Mr. Chair.

The CHAIRMAN. The gentleman's time has expired. The Chair recognizes the gentle lady from West Virginia, Mrs. Capito.

Mrs. CAPITO. Thank you, Mr. Chairman. I have no opening statement. I just want to say I am pleased. This is my first hearing as a new member of this Committee. And I am very honored.

I represent West Virginia, which obviously has a great interest in the direction that we are going to go as a nation. We have two. The TrAIL and the PATH are grids that are going right through our state right now and are trying to be sited. So I again appreciate the courtesy. And I will defer to the witnesses.

The CHAIRMAN. Great. The Chair recognizes the gentleman from New York State, Mr. Hall, for an opening statement.

Mr. HALL. Thank you, Mr. Chairman, for holding today's hearing. And thank you also to the distinguished panel of witnesses, whose testimony I look forward to.

I have long believed that modernizing our electric grid is critical, not only to achieving energy independence but also to coping with the looming climate crisis. So it is altogether appropriate for this Committee to be holding this hearing today.

As the testimony you have submitted indicates, due to the structure of the current grid, there are significant barriers to widespread use of renewable power, something that I think many of us here, if not most of us, would acknowledge as a worthwhile policy goal.

We need to have a grid that is flexible to accept power from a variety of intermittent sources, a grid that can handle power flowing in two directions, a grid that anticipates the widespread use of plug-in hybrid electric vehicles and electric cars, a grid that may be made of materials that are not 100-year-old technology but more modern technology that does not lose so much power in transmission due to the resistance, modern network that can carry the voltage without unduly marring our landscapes and harming local ecosystems.

Without those pieces in place, the investments we are making in renewable power, advanced battery technology, and electric cars will be for naught. But if we make the right decisions, we use wisely the resources provided by this Congress, then not only will we modernize our grid, but we will create good-paying jobs here at home.

There is a new growth industry in smart grid technology that is just beginning to develop. Before us today are some of the first of what I hope will be many smart grid technology companies, who not only find a market but also a workforce.

I have said before the only thing more foolish than continuing to import more oil from the Saudis would be to import more solar panels from the Chinese. Well, the same could be said for smart grid technology.

We cannot let the opportunity pass us by to harness the American and, indeed, the global market for this technology and create the industries and the jobs right here at home.

Now more than ever this is critical. Thanks to the economic recovery package signed by the President last week, the resources to begin work on the smart grid are available today. It is up to us here in this Congress and on this Committee to make sure that the resources are used wisely to create jobs and solve our energy and climate crises.

Again, thank you, Mr. Chairman, for holding the hearing. And I look forward to the testimony of our witnesses.

The CHAIRMAN. Great. I thank the gentleman. The gentleman's time has expired.

The Chair now with the permission of the other members will recognize the gentleman from New Mexico, Mr. Luján. He is a new member from the State of New Mexico and is an expert, actually, on these issues. And, without objection, I will recognize him to make an opening statement if he would like to do so.

Welcome.

Mr. LUJÁN. Thank you, Mr. Chairman. Thank you, Mr. Chairman and members of the Committee. I am honored to be part of this very important discussion today.

As our country moves forward toward creating a green economy and reducing our dependence on foreign oil, it is imperative that we not only prepare students for the jobs of the future. And in a growing renewable energy industry, we must build transmission that includes smart grid technology that will be critical for our future.

New Mexico has always been the leader in energy. And in my state, like many around the country, we have an enormous potential to grow renewable generation, like solar and wind.

While traveling to my district last week, I had the opportunity to visit the North American Wind Research and Training Center and Mesalands Community College in Tucumcari, New Mexico. There we also have the Northern New Mexico Solar Energy Research Park and Academy, which is growing every day. Students at the center train for the jobs of tomorrow, learn the mechanics of the wind turbines, the importance of solar generation, and have planned their skills on full-size generation built right on the campus.

As we train and prepare our young people for the jobs of the future and make investments of renewable energy, we are faced with the challenge that trends to minimize the gains we have made preparing our workforce for a clean energy economy.

We all know our current electric grid design does not accommodate new renewable energy resources. We are charged with the task of building new transmission while incorporating new technologies that will improve efficiency.

We must continue with fundamental research and development. And areas such as energy storage and solar generation have already taken place across the country in facilities like Los Alamos National Laboratories. We must develop technologies that have the ability to store millions of watts of electric energy that can be released back into our electric grid so we can take full advantage of the abundant renewable potential United States.

Smart grid is a complex system. And we need to accelerate the use of computer simulation and modeling to build an ideal electric grid, a grid that will support energy efficiency, reduce our use of fossil fuels, lower consumer energy costs, and support our growing renewable energy industry as it creates jobs for the future.

At Los Alamos National Laboratories, scientists are exploring the next generation of technologies needed to implement smart grid. Los Alamos has adapted the tools we use today for national security to analyze and develop solutions, as an example, resulting from renewable generation, from large-scale renewable facilities, and from distributed generation in homes or businesses.

To get these solutions into the workplace, we need to grow new partnerships between research and development organizations, like our national laboratories, our utilities, and industry aimed at accelerating the pace of discovery and commercialization.

As a former public utility commissioner with the New Mexico Public Regulation Commission, I understand the importance and the urgency and the need to improve our existing infrastructure and build a new, more efficient smart grid that will allow for the deliverability of new renewable generation and improve the reliability and security of our nation's power.

Deployment of smart grid technologies will create new jobs, facilitate a green economy, and change the way we generate and deliver power across America and around the world.

Investments in the modernization of our electric grid is the next critical step towards a clean energy future. And I look forward to working with my fellow members to develop and implement the smart grid systems of today and tomorrow.

Thank you, Mr. Chairman, the Committee, for allowing me the time to be able to be here today.

The CHAIRMAN. Thank you, Mr. Luján. Thank you for being here.

Now we are going to turn to our witnesses. Our first witness is a very distinguished one, Mr. Tom Casey. He is the CEO of CURRENT Group. He previously worked on telecommunications and global communications with Merrill Lynch and Skadden Arps. He was also the chief counsel of the Federal Communications Commission back in the 1970s, long ago and far away for both of us, Tom.

We welcome you. And whenever you are ready, please begin.

Mr. CASEY. Thank you, Mr. Chairman, Representative Sensenbrenner, members of the Committee.

STATEMENT OF TOM CASEY, CEO, CURRENT GROUP, LLC; ALLAN SCHURR, VICE PRESIDENT, IBM; ROBERT GILLIGAN, VICE PRESIDENT, GENERAL ELECTRIC; CHARLES ZIMMERMAN, VICE PRESIDENT, WAL-MART; SHIRLEY COATES BROSTMEYER, CEO, FLORIDA TURBINE AND TECHNOLOGIES, INC.; AND JAMES HOECKER, HOECKER ENERGY LAW & POLICY

STATEMENT OF TOM CASEY

Mr. CASEY. I am here, obviously, to talk about smart grid and to talk to explain the impact of a smart grid can do for energy efficiency, for energy independence, and for emission reduction.

As the Chairman mentioned, we can think about a smart grid as though it was an electric internet or the internet of the electricity. I completely agree with that analogy because it is a network that must be organized, monitored, managed for the distribution of electrons, as opposed to bits.

But the challenges and the operational considerations that go into running the grid are very similar to the considerations that go into running the internet or telecommunications networks generally.

And, in fact, much of the value of the internet, as with much of the value of the smart grid, will come from not only the performance and the efficiencies it creates itself but the fact that it enables other devices to attach to it and then to perform services on it; for example, computers on the internet, telephones on the telephone network.

We don't know what the iPod or Google of the electric sector will be, but if we have a true smart grid, we can have a great deal of confidence that there will be an iPod of electricity, there will be a Google of electricity, that consumers will be taking electricity as a service. And these changes are very, very significant.

If I could—and I know the Committee is well-aware of this, but, just for the record, I would put out some statistics on the stakes of what we are talking about today. The Department of Energy has estimated that 40 percent of all of the greenhouse gases emitted in the country are emitted from the electric sector, from the power sector.

EPRI, in turn, has forecast that if a smart grid were deployed, 25 percent of those emissions could be avoided or 10 percent of total greenhouse gas emissions globally could be avoided.

The Climate Group, a well-populated group filled with international companies, conducted a study by McKinsey. And they concluded that 2 gigatons a year of carbon dioxide or its equivalents could be avoided by the deployment of a smart grid. McKinsey said that the deployment of a smart grid is the largest single global technology contribution possible to reducing climate change.

So the stakes are very high. And the smart grid is an essential element to accomplishing those benefits. So let's talk about, then, what a smart grid is.

There has been a lot of discussion about smart grid. It is something of a generic term encompassing very large amounts of different technologies, different functions, different services. I would like to be a little bit more precise.

I believe that a smart grid is an electric grid; that is, the set of wires that distributes electricity that has had applied to it technology to do several specific things: first, to sense information on the performance and the operation of the grid. That is, is the electricity running on these wires? Is it at the proper voltage? Is it at the proper current? Is it in balance, all those sorts of operational things?

Once that information is discovered, it must be communicated somewhere for somebody to do something with it. So there needs to be a communications channel created. That communications channel delivers the information to some analysis capability, so a software system.

The software looks at the data that it has received and decides what is going on. Is this a problem? Is it normal? Do I have to do something? Do I have to change? Do I have to turn the power on or off, up or down? And then it concludes that an action should be taken.

It sends an instruction to take that action, either to a person or in sort of the next generation of smart grid to a device that is on the grid itself. And that device controls the various pieces of equipment that are on the grid to turn off or up or down or go on another path or whatever.

This sounds complicated, but this is what happens every minute of every day in the telecom world. Every network is managed in this way. The internet is managed in this way. The equipment exists to do it. The software exists to do it. And as consumers of telephony and as internet consumers, we don't even know that this is happening.

But the network itself is very dynamic. Messages are moving in various ways along various paths. And the network itself is organizing that. We believe that that is what a smart grid is.

I would say also that smart grid consists of many elements, as I said. It will have thermostats in it. Eventually appliances will have chips in them. And the appliance itself may be communicated with directly. The meter is going to be a part of the smart grid, as will the substation as will the renewable generation, as will the solar panel on our roofs or the windmill on our chimney.

All of these devices are elements of a smart grid, but they are not the smart grid itself, just like telephones and computers are elements of telecommunications or of the internet, but they are not the internet. The internet is the network of networks. And a smart grid is the underlying network that enables all these other devices to perform to their optimal potential.

I would say also smart grids are available today. CURRENT is a small company. We are headquartered in Germantown, Maryland, just outside of Washington. But we have smart grids operating in Dallas, Texas with Encore Electric and in Boulder, Colorado with Xcel Energy. These are fully equipped, operating commercially, functioning smart grid networks that work.

So this is not a concept. This is not a vision necessarily. It is a vision in the sense that the rest of the country and the rest of the world, in fact, needs to adopt a smart grid technology, needs to deploy it, which is a complex and an expensive undertaking that will be helped, we hoped, by the stimulus package that the member just referred to.

I would say the important point here is that smart grid exists today. It is commercial operation. And the effects that we have seen from smart grid operation we can categorize into four general categories.

System optimization. Electricity grid is a system. It starts at the generation. There are long distance lines, which are called transmission lines. Then there are local distribution lines, which are called distribution grid. Then there is the consumer.

All right. All of this network can be optimized. And by "optimized," we mean that the electricity that is traveling over it is the least that is necessary to perform the functions of the users at the end of the grid.

Your appliances in your home and in factories and in offices have certain requirements to have electricity of certain parameters: 120 volts. If the electricity is moving above or below 120 volts by too much or too little, it can have an effect.

An optimized network will make sure that the electricity flows exactly where it is needed or at least as close to where it is needed as possible, which will save generation because if we are not buying or generating energy that we are not using at the end of the day, then we are not emitting carbon equivalents. We are not spending money on generating plants. We are not siting them. We are not having any of those consequences.

The second and equally important contribution of a smart grid is it enables renewables and distributed generation. Renewables have certain characteristics. They are basically clean, which is why we as a nation are committed to trying to increase the deployment and the use of renewable energy, but they are also intermittent.

They have variability to their production of electricity. And that poses certain challenges for the grid because the grid right now is operated on the premise that there will be constancy of the electrons.

Electrons are produced at the coal plant or the natural gas plant or the nuclear plant, and they flow in one direction until they end up in your refrigerator or in your television. And that is it. There is no complexity to that.

Renewable, the sun doesn't always shine. The wind doesn't always blow. Clouds can come over. They are inherently variable. They are inherently intermittent. And, therefore, they are inconsistent with the way that the grid is designed to be operated now.

That inconsistency or that intermittency has to be dealt with. And it can be dealt with. One of the ways to deal with it is by making the grid smart so the grid can manage the ebbs and flows of the source by managing the ebbs and flows of demand, either on the grid itself or through end user equipment.

Another attribute of renewables, particularly on the distributed generation side, is if I have a solar panel on my rooftop or if I have a windmill or if I have some other form of distributed generation, the electric company doesn't know that I have that, I am producing that electricity.

And so several consequences occur from that. One, if they think the electricity is off on my line because a transformer has blown up and I am, in fact, generating electricity from my solar panel and they send a technician out to check, that technician thinks there is no electricity there. But there is because I am generating it. So that is obviously a safety issue.

If the substation has been designed or if all the equipment along the grid has been designed to receive certain amounts of energy coming from the generator and the utility knows how much energy that is but I am adding energy to it and the utility doesn't know that, then all their calculations are about balance and about loading and about all of the technical parameters of moving the electricity are wrong. And, therefore, that will affect performance.

These are problems that can be resolved, but they need to be resolved by having the technology that allows the utility to know what is going on on their grid and to manage it more accurately.

The CHAIRMAN. Mr. Casey, if I could? Because I think this is a great primer for all of the members, and I think they are all enjoying it a lot. But you have exceeded the five minutes. And if you could just make a kind of more cursory reference to points three and four, we will go to the other witnesses. Then we will come back to you during the question period if possible.

Mr. CASEY. Yes, Mr. Chairman. I am sorry about that.

The CHAIRMAN. Everyone is really benefitting from this overview.

Mr. CASEY. I would say, one, I made the point, just to close out, that the smart grid consists of multiple networks, some of which are in the home and some of which are on the grid.

There have been studies. The Climate Group in this McKinsey study I referred to estimated that 85 percent of the carbon emission reductions from a smart grid come from the network, the part I was talking about. And 15 percent of the carbon reduction, carbon emission reductions, can come from in-home energy management systems.

So we believe it is important when we talk about smart grid to actually have a set of priorities that allow change to be taken where it might have the most impact.

Thank you, Mr. Chairman.

[The prepared statement of Tom Casey follows:]

Testimony of Tom Casey
Chief Executive Officer
CURRENT Group, LLC
Before the House Select Committee on Energy Independence and Global Warming
"Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions."
February 25, 2009

Thank you, Chairman Markey, Ranking Member Sensenbrenner, and Members of the Committee, for the opportunity to testify on how a Smart Grid can revolutionize efficiency and increase the use of renewables. This issue is critical to this Committee and to the nation because electric generation is the largest source of greenhouse gases in the world, responsible for approximately 40% of CO2 emissions in the United States[i] and is expected to be responsible for 50% of growth in global energy related CO2 emissions from 2006 to 2030[ii]. Thus, substantial improvements in the way we produce and use electric power could have an immediate impact and must be a part of the path to energy independence.

CURRENT Group, LLC

CURRENT's Smart Grid solution is in commercial operation today combining advanced sensing technology with low latency IP based communications and enterprise analysis software and related services to provide location-specific, real-time actionable data that is easily integrated into a utility's existing IT infrastructure. Our technology is being used by utilities around the world including in several of the largest Smart Grid deployments. For example, President Obama highlighted a project that uses our technology as an example of a Smart Grid to be funded when he signed the ARRA stimulus bill last week.[iii] We are also a participant in several European Union-sponsored projects, including one led by Iberdrola, the world's 4th largest electric utility, to expand the use of Smart Grid technology to benefit electric utilities and residents of the European Union. Most recently we were honored by the World Economic Forum as a 2009 Technology Pioneer.[iv]

As Congress recognized in both the Energy Independence Act of 2007 and the American Recovery and Reinvestment Act of 2009 (ARRA), the application of technology to electric power is a key component of reducing carbon emissions. Here in the United States, the Electric Power Research Institute (EPRI) has estimated that a Smart Grid could reduce carbon from electric power by 25% or roughly 10% of overall U.S. CO2 emissions.[v] It is estimated this savings has the same impact as removing 140 million cars from the road.[vi] A recent Climate Group study concluded that deploying a Smart Grid is the largest single global information technology solution to climate change, more than investing in Smart Buildings, Smart transportation systems or improvements in motors and industrial processes. They projected a Smart Grid around the world could save over two Gigatons a year of carbon or roughly 5% of total global emissions.[vii]

<u>What is the Smart Grid?</u>

Today, the electric grid, especially the local distribution system, which is the part we usually see around our homes and offices, works much the way it did 50 or even 100 years ago. As Dr. Michael W. Howard of EPRI testified before the House Subcommittee on Energy and Air Quality, a Smart Grid combines millions of sensors throughout the grid and an "advanced communication and data acquisition system to provide real-time analysis by a distributed computing system that will enable predictive rather than reactive responses to blink-of-the-eye disruptions".[viii]

A Smart Grid, in many ways is like an Internet for Electricity, a network of devices that are monitored and managed with real-time communications and computer intelligence. A Smart Grid discovers grid performance and conditions using intelligent sensors capable of detecting problems and/or opportunities for improvement that are widely distributed on the electric grid. It makes adjustments locally or communicates back to the central control center where it is combined with information from other grid devices and utility systems. This information is further analyzed to create Actionable Intelligence that tells a person or a device on the grid to take a specific action. The information can come from any point on the electric grid, from the generation plant or renewable source through transmission to the substation to devices on the grid to devices within a home or business to the Plug-In Hybrid Electric Vehicles (PHEVs) and can require the control or action of any other device.

This is the same kind of monitoring and managing a network that has developed over the last 20 years and now happens routinely in the telecommunications and Internet networks around the world.

For example, Xcel Energy, the first utility in the United States to deploy a fully integrated Smart Grid in Boulder, Colorado, describes a Smart Grid as "the integration of the fuel source to the end-use consumer and all touch points in between. We believe that everything from a piece of coal or a breeze of wind to the thermostat has to be part of the smart grid and that it must include integration among all of the components."[ix]

It is important to note that certain of these actions require a complete loop from sensing of the initial situation to the completion of the Actionable Intelligence action in a matter of seconds or even milliseconds. As Smart Grids are further deployed, utilities will operate much more of a self-healing, self-optimizing electric grid with these actions occuring in the background in real-time like an autopilot system on the airplane or least cost routing in the Internet.

To achieve the Smart Grid vision, it is important that a network use real-time communications, as well as the open standards like Internet Protocol (IP) as required for funding under ARRA. The Smart Grid will provide the network platform for the distribution of electricity and also enable the attachment of currently unimagined numbers and kinds of devices and software applications to improve both the performance and the usefulness of electricity. For example, it is highly likely neither the "Google" nor the "iPod" of home energy management has been invented yet and it is just as likely that it will not be invented by a traditional vendor of utility equipment. If the Smart Grid network, the devices that attach to it and the software applications that run on them are not designed to a common open standard, the Smart Grid will be delayed or degraded and rate payers will have to pay to replace devices before the end of the their useful lives. Indeed, we believe that ultimately, in many cases, it may be appropriate to leverage existing IP public networks like the existing cable, DSL or wireless 3G or WIMAX networks.

How does the Smart Grid benefit us?

We believe there are four primary benefits to a Smart Grid:

- **System Optimization** – Delivering "least cost" power from the substation to the home
- **Increased use of Renewables** – Integrating renewables and distributed generation into the existing grid
- **Operation and Reliability Improvements** – Improving and automating the

operations of the electric distribution network

- **End-User Energy Management** - Enabling end users to modify their energy consumption behavior

While the fourth benefit of End-User Energy Management gets the most media attention and will certainly be part of the solution, the Climate Group estimates that 85% of the carbon reduction benefits of a Smart Grid come from the first two items (Optimization and Renewables) and only 15% will come from End-User Energy Management.[x]

Let me provide a little more detail on each of the areas:

System Optimization – Advanced sensing and controls are used to deliver only the power needed at any particular time while also minimizing any inefficiency in the operation of the grid itself. It is estimated such optimization can reduce electric generation requirements and related carbon by 3 to 5% without impacting on, or requiring any change in, customer behavior.

Integrating Renewables – Widespread renewables create several problems for the existing electric grid. First, as opposed to centralized power plants that send electricity one way from the plant to the home, renewables out on the grid itself (like a solar panel at a big box retailer) create a two-way power flow on a grid that is designed to go one way. This means that the utilities' assumptions about how the grid operates and typical loads are no longer valid and that increased monitoring is required. Second, utility practices today are presently, and rightly, designed to minimize variability. However, renewables are inherently variable or intermittent. The wind does not blow when the temperature is hot but thunderstorms do occur, both of which often happen when electric demand is at its highest, thus reducing the output of renewables such as wind or solar at a critical time. As electric grids have to be in balance, a sudden drop in generation from renewables requires the utility to adjust other generation, storage or the usage itself to keep the system in balance. For example, at one California utility, only 8 to 9% of the capacity of certain wind resources can be relied upon for peak capacity planning, thus requiring continued purchase and use of coal or gas based power plants or energy storage, whose availability in scale is limited. A Smart Grid's system optimization and demand response capabilities can be paired up with the renewable resources so that when the renewable source is varying, the overall load can be varied as well. This will reduce or eliminate the need for backup coal or gas based power generation plants. In turn, this will not only directly reduce emissions but will also free up utility capital to be shifted from purchasing conventional power sources to buying more clean renewable power. The MIT Technology Review recently stated "without a radically expanded and smarter electrical grid, wind and solar will remain niche power sources."[xi]

The use of PHEVs creates both opportunities and challenges. PHEVs have the potential to be a large contributor to reducing transportation emissions as well as to serve as a source of energy storage. At the same time, they represent the potential for a new type of electric usage – a device that can appear on the grid anywhere (i.e., home, work, shopping center or even vacation destination) and in large numbers, especially at peak hours when people arrive home from work. A Smart Grid will be required to manage the complexity of both the storage capability and the variable nature and location of the charging.

Operation and Reliability Improvements – Today, due to the lack of monitoring, many parts of the electric distribution grid are run until they fail. Such failure causes a blackout. This is very expensive to the U.S. economy as EPRI estimates that for every dollar spent on electricity in the United States (approximately $343 billion in 2007), the U.S. economy incurs $0.50 in lost productivity and other costs from outages.[xii] A Smart Grid can detect problems on the grid before they occur enabling utilities to move towards the more predictive maintenance model used in other industries. One of our customers that uses our Smart Grid technology has stated it "is able to monitor its electric delivery system, obtaining a steady stream of data that can be analyzed for potential problems. . . . Issues are often resolved before consumers even realize that there was a problem."[xiii] Another of our utility customers reported that it has shifted budgets from reactive to preventive maintenance as a result of our Smart Grid solutions providing them for the first time, the necessary information to detect potential faults and outages and allows it to fix the problem before the issue becomes an outage.

End-User Energy Management – This includes smart meters for both residential and commercial customers as well as a variety of building and in-home energy management devices like programmable thermostats. We believe that the case for using advanced meters, pricing and control systems for commercial and industrial customers who consume approximately 65% of overall electric power in the United States is strong, the approximate $40 billion required for residential metering may be better spent and produce significantly higher benefits by implementing a Smart Grid on the grid itself along with a more selective installation of advanced meters.

Some utilities are presently focused on "Smart Meter" projects for residential customers that will cost $325 or more per household and have a 20 year payback.[xiv] In most cases, approximately 55% of the 20 year benefit payback from Smart Meters comes from operating cost reductions, primarily as a result of laying off electrical workers[xv]. The remaining benefits depend on customers voluntarily shifting their usage based on pricing signals to reduce peak demand. Smart Meters themselves do not in any way "automatically" reduce customer electricity use.[xvi] They simply allow the utility to record not only how much but when the electricity is used and, in some cases to communicate that information to a display within the home. This in turn permits the utility to impose rate structures that penalize usage during peak periods by imposing higher charges on such usage. Consumers who are able to do so may respond to these higher prices by shifting the time of their usage to off-peak periods. They can do so in many ways, from choosing not to run certain appliances during the peak period, turning their thermostats up or down as the case may be, etc. Programmable thermostats and communicating thermostats may also be installed to automate the process, although the cost of doing so will be in the hundreds of dollars per household. It must be noted that 40% of American homes do not have central air conditioning and thus do not have a use for a programmable thermostat.[xvii] Additionally, many classes of customers, such as the elderly, night workers and families with young children at home may find it difficult to change their electric usage patterns and thus would be potentially penalized by higher time of use rates during peak periods.

Unfortunately, Smart Meters will not greatly reduce CO2 since the primary benefit is reducing load at the 50 or so peak hours of a year, not to eliminate the usage itself.[xviii] Ironically, this usage shift may be environmentally worse since it may move usage from a time at which the incremental power source is gas to a time when the incremental power source is coal with a resulting increase in CO2 emissions. Indeed, the Department of Energy (DOE) has recognized this and has warned state regulators and others that "policymakers should exercise caution in attributing environmental gains to demand response, because they are dependent on the emissions profiles and marginal operating costs of the generation plants in specific regions."[xix]

A Smart Grid benefits case developed with leading industry consultants and electric utilities projects over $3 billion of benefits enabled by CURRENT's technology for a representative one million home utility over 17 years with an IRR of greater than 25%. This IRR is 2 to 3 times the typical IRR required in a utility project and is before any benefits for reduced carbon emissions and greatly exceeds the returns of most Smart Meter business cases which barely break even. In addition, a number of the high impact Smart Grid applications can be deployed on a standalone basis and often exceed the cost of the applications in as little as 2 to 3 years.

What does our experience from operating Smart Grids show us?

We have learned a tremendous amount over the last six years deploying our technology with electric utilities and their customers. Several points stand out:

First, we believe the potential for system optimization is significant and a Smart Grid can help achieve this. We generate, transmit and distribute more power than is needed to the end customer. In historical terms, it make sense since utilities were penalized for low voltages, there was plenty of inexpensive power and no worries about carbon. In a carbon constrained world with tightening demand and difficulty in building new power generation facilities and transmission, utilities need a Smart Grid to reduce the amount of power delivered. However, as discussed below, they need an incentive to do so.

Second, while a part of the solution, changing customer behavior can not be the sole or primary measure to produce improvements in the way electricity is delivered and used. As discussed above, tens of millions of Americans do not have thermostat controlled cooling. Therefore, they have no reason to spend the additional hundreds to thousands of dollars on in-home energy management equipment when they get a smart meter installed. In addition, the average American household spends less than $0.15 per hour on electricity[xx]. With often quoted savings of 5 to 10% of peak demand, consumers who change their usage would expect to save only several pennies an hour.

Third, between the ARRA stimulus funding, cap and trade systems and renewable portfolio standards, we believe renewables (and similarly PHEVs) are going to have a bigger, quicker impact on the grid than most people expect. In one of our deployments, we have already identified residential solar panels which were feeding power back on to the grid without the utility's knowledge, creating a potential safety hazard for utility work crews. One customer has identified the need to have an accurate measure of the power being produced by various distributed renewables in order to better forecast load and schedule generation for its operating plan.[xxi]

Fourth, open standards are important as noted in the provisions of ARRA. We are already integrating our open standard technology with multiple grid device manufacturers, in-home energy management systems and with a variety of back office utility systems. If each interface must be custom developed, substantial delays and additional costs will result.

<u>What are the hurdles to more Smart Grid deployments?</u>

It is clear that utilities have to be incented to deploy Smart Grid technology. In general, under traditional regulatory models, a utility's cost is largely fixed and its revenue is the product of the number of kilowatt hours sold multiplied by the price per kilowatt hour. There is thus no reason to believe that a for-profit entity will (or should) spend money in order to earn less. As a result, utilities have strong regulatory and financial incentives to spend money on more traditional items, such as new power generation plants, rather than acquiring new technology to make more efficient use of existing power. An added aspect of such disincentives is that because a utility can earn a much higher rate of return on new generation plants than on conservation, it will spend more on such traditional assets. Xcel Energy pointed out that "the real risk in a true coal-to-cool-air, wind-to-light implementation of the smart grid is that these technologies that transform conservation and efficiency efforts can lead to degradation of the regulated return and uncompensated demand destruction."[xxii]

Additionally, utilities are subject to regulator review of their investment decisions and regulators, consumer advocates and the utilities themselves are still learning about Smart Grid. Utilities often anticipate that their discretionary adoption of new technology may be politically challenged or that cost recovery will be denied after the fact. Finally, as an integrated end to end solution, Smart Grid creates value all along the utility and the customers, including to society in the form of lower outages and less carbon. Regulatory policy has to be structured to assure that the entire value creation is included in the benefit case so that utilities can be assured appropriate rate recovery.

Summary

Smart Grid is the largest single information technology investment that can be made to reduce CO2 emissions in the world. A Smart Grid is an end to end integration of management and control from the power plant or renewable to the grid to the home, business, thermostat or PHEV. The highest potential CO2 reductions come from focusing on the grid itself. The technology exists and presently is delivering real benefits in the field to utilities. Regulatory policy needs to be aligned to encourage the deployment of the Smart Grid and to assure the utility a fair rate of return. Finally, encouraging a Smart Grid also will help American companies gain and preserve market leadership in what is fast becoming a worldwide market. Countries all over the world need a modernized electric grid, and companies from the United States can be leaders in this global market. Indeed, CURRENT and other American companies already are pursuing such international opportunities, which will create high tech jobs here at home.

End Notes

[i] U.S. Department of Energy (DOE), *Emissions of Greenhouse Gases in the United States 2007*, December 2008 pg 1, 14.

[ii] International Energy Administration, *World Energy Outlook 2008*, pg 391.

[iii] President Obama's remarks upon signing the American Recovery and Reinvestment Act of 2009, February 17, 2009. "The investment we are making today will create a newer, smarter electric grid that will allow for the broader use of alternative energy. We will build on the work that's being done in places like Boulder, Colorado." (*Xcel Energy SmartGridCity™ project)*

[iv] Further information about CURRENT is available at http://www.currentgroup.com

[v] Electric Power Research Institute. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation*' Available at: http://www.epri.com., pg 42.

[vi] Energy Future Coalition, '*National Clean Energy Smart Grid Facts*' Available at http://www.energyfuturecoalition.org/files/webfmuploads/Smart%20Grid%20Docs/Smart_Grid_Fact_Sheet.pdf., 2009.

[vii] The Climate Group '*SMART 2020: Enabling the low carbon economy in the information age*', 2008 available at http://www.theclimategroup.org/assets/resources//publications/Smart2020Report.pdf pg 9, 12.

[viii] *See* Testimony of Michael W. Howard, Ph.D., P.E., Senior Vice President, R&D Group, Electric Power Research Institute, "*Facilitating the Transition to a Smart Electric Grid*," Before the House Subcommittee on Energy and Air Quality, May 3, 2007.

[ix] Xcel Energy. 2008. '*Xcel Energy Smart Grid A White Paper*' Accessed 01 Oct 2008. Available from http://birdcam.xcelenergy.com/sgc/media/pdf/SmartGridWhitePaper.pdf.

[x] The Climate Group '*SMART 2020: Enabling the low carbon economy in the information age*', 2008 available at http://www.theclimategroup.org/assets/resources//publications/Smart2020Report.pdf pg 70.

[xi] Talbot, David "*Lifeline for Renewable Power*", MIT Technology Review, January/February 2009

[xii] Electric Power Research Institute. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation*' Available at: http://www.epri.com., pg 40.

[xiii] Oncor Press Release quoting Jim Greer - Senior VP of Asset Management and Engineering (Sept 19, 2007).

[xiv] For example, Southern California Edison is spending $1.981 billion to replace approximately 5.3 million meters ($373 per meter). Over a 20 year useful life, the project is expected to result in benefits of $1.990 billion or a net present value of $9 million. (See SCE Decision at http://www.sce.com/NR/rdonlyres/6DC13EB1-0AFA-40A8-B9E3-93546F24015C/0/081114_A0707026Final_Decision.pdf.)

[xv] Brockway, Nancy, National Regulatory Research Institute, '*Advanced Metering Infrastructure: What Regulators Need to Know About Its Value to Residential Customers*', February 2008 pg 18 highlights two different utility regulatory filings where between 53 and 60% of the operational benefits related to eliminating manual meter reading costs

[xvi] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 7 (July 2008)

[xvii] U. S. DOE Energy Information Administration (EIA), Office of Energy Markets and End Use, "*2005 Residential Energy Consumption Survey*". The same survey indicates of the people who have central air conditioning. According to data from the same study and EIA total sales data, electric heat represents less than 1% of overall electric sales.

[xviii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 13 (July 2008)

[xix] U.S. DOE Report to Congress, Feb 2006 "*Benefits of Demand Response and Recommendations*" pg 29

[xx] U. S. DOE Energy Information Administration, "*Electric Sales, Revenue, and Average Price 2007, Table 5 U.S. Average Monthly Bill By Sector, Census Division and State*" January 2009.

[xxi] While many people suggest that net metering (the ability to track the net between the usage of the home or business) and the solar panel is enough, our customer believes it needs to have each number at the gross value to assure adequate reserves.

[xxii] Xcel Energy. 2008. '*Xcel Energy Smart Grid A White Paper*' Accessed 01 Oct 2008. Available from http://birdcam.xcelenergy.com/sgc/media/pdf/SmartGridWhitePaper.pdf.

The CHAIRMAN. Thank you, Mr. Casey, very much.

Our next witness, Mr. Robert Gilligan, is the Vice President and corporate officer for GE Energy transmission and distribution business. We welcome you, sir. Whenever you are ready, please begin.

Mr. GILLIGAN. Thank you very much.

STATEMENT OF ROBERT GILLIGAN

Mr. GILLIGAN. Good morning, Mr. Chairman and members of the Committee. Thank you for the invitation to testify on the smart grid and the tremendous opportunities it presents for our nation. Smart grid is essentially the marriage of information technology and process automation technology with our existing electrical infrastructure. It is the energy internet, as the Chairman referenced, delivering real-time energy information and knowledge to grid operators and to consumers, enabling smarter energy choices.

As you know, the energy challenges that we face are significant. Transmission and distribution have been under-invested in comparison with new generation in this country for more than 25 years, resulting in an aging and stressed infrastructure. By 2030, it is estimated that U.S. electrical consumption will increase at least 30 percent, putting more stress on this aged infrastructure.

Power outage and power disturbances in the grid are estimated to cost the U.S. economy over $100 billion a year. And the reliability of the grid is deteriorating.

America spends more than $200,000 per minute importing foreign oil, putting our energy security in jeopardy. And, as was referenced by Mr. Casey, climate change has become a major concern in this country and around the world. And 40 percent of the U.S. carbon footprint is related to power generation.

Considering these factors, we must find a way to support greener sources of energy, improved efficiency, and enable conservation. These are the three primary objectives of a smarter grid: first, to enable the integration and optimization of more renewable sources of energy and eventually plug in hybrid electric vehicles; second, to drive significant increases in the efficiency and reliability of our network; and, third, to empower consumers to manage their energy usage and save money without compromising their lifestyles. These key benefits are clearly deliverable today and are shovel-ready to help foster energy independence and lower carbon emissions.

We need to drive delivery optimization, increasing grid efficiency through network intelligence and more sophisticated controls of our transmission and distribution system.

We need to drive demand optimization, empowering consumers with information to manage their usage and save up to 10 percent on their power bills by cutting their peak usage by 15 percent and their total usage by up to 8 percent. This has been demonstrated in studies conducted by the Department of Energy.

Renewable integration, reducing our nation's dependence on foreign oil by enabling seamless integration of greener, cleaner energy technology into our network, being able to deal with the complexity of intermittent power-generating sources, and enabling plug-in hybrid electric vehicles to be of benefit to the grid, as opposed to an additional burden on the grid.

In addition to giving consumers power and choice, perhaps one of the most critical deliverables of the smart grid is the optimization and integration of renewable energy. GE is actively engaged with Maui Electric Power Company and the Department of Energy to solve the challenge of integrating very high penetrations of renewable energy, particularly variable sources of energy, like wind and solar.

A smarter grid provides utilities with levers they can pull to address changes in renewable energy production. For example, if the wind suddenly drops, utilities can quickly compensate for this variability by shedding load or finding other sources of energy that they can bring on the grid in time to maintain that support.

Stimulus funding dedicated to smart grid gives us the opportunity to transform today's grid into a smarter automated system so we can start realizing many benefits that we have talked about. This technology is available now.

We believe it is in the long-term national interest to take a broad, all-encompassing view of the smart grid. To realize full benefits, funding must be focused on demonstrating solutions, not just spent on infrastructure. The inclusion of software solutions alongside infrastructure will be critical to delivering the ultimate promise of a smarter grid.

A logical approach might be funding full-scale, city-scale smart grid solutions, including back office solutions, where advanced metering infrastructure deployments have been independently funded and approved.

In addition to the efficiency, environmental, and productivity benefits delivered by smarter grid, large-scale investment will also result in jobs. In a study done by KEMA, an energy consulting company, for the Department of Energy, the stimulus is believed to create over 150,000 new jobs within the first year and over 250,000 jobs over the next several years alone. These jobs will span factories to utilities to construction to engineering firms.

By using the funding to demonstrate real benefits, we can ensure that the investment will continue after the stimulus money is spent. This will ensure that these jobs continue into the future.

The CHAIRMAN. If you could summarize, sir?

Mr. GILLIGAN. Another great benefit of the stimulus is that it creates the opportunity for the U.S. to lead and to create a market for these sophisticated and advanced solutions globally. We have the opportunity to be a leader in smart grid technology, just as we did for the internet.

Thank you.

[The prepared statement of Robert Gilligan follows:]

House Select Committee on
Energy Independence and Global Warming

Hearing on "Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions"

Wednesday, February 25, 2009

Written Testimony of
Robert Gilligan
Vice President
Transmission and Distribution
GE Energy Infrastructure

Good morning Mr. Chairman and members of the Committee, I am Bob Gilligan, Vice President, Transmission and Distribution at GE Energy Infrastructure. Thank you for the invitation to testify today on the Smart Grid, and the tremendous opportunities it presents for our nation.

As the hearing's title suggests, technology can revolutionize efficiency and renewable solutions, and, in the process, the electrical power grid that remains little changed since its inception. While the grid is a marvel in engineering design and may, indeed, be one of mankind's greatest achievements, it has yet to be transformed into a modern grid, a sustainable grid, a truly smart grid that takes advantage of proven, cleaner, cost effective technologies that are available or in development today. GE believes that the Smart Grid is an essential component to addressing the energy demand, security and environmental challenges we face. We applaud the Obama Administration and Congress for embracing the Smart Grid in the recently signed American Recovery and Reinvestment Act of 2009.

Today, we will share our vision for the Smart Grid, provide information about how our technology solutions enable the Smart Grid, and introduce our perspective on the policies and activities necessary to make the Smart Grid a welcome reality.

GE Energy

GE Energy Infrastructure is one of the world's leading suppliers of power generation and energy delivery technologies with businesses focused on fossil power, gasification, nuclear, renewable energy – including wind, solar and biomass, oil and gas, water, as well as transmission and distribution. We have more than 100 years of industry experience, and our team of 65,000 employees operates in more than 140 countries.

GE Transmission and Distribution (T&D)

GE T&D provides technology solutions that enable grid management and optimization for electric utilities worldwide. These solutions encompass hardware, software and services supporting the entire electricity delivery value chain, from power transformers at the generation switchyard to smart meters at the customer premises. They help utilities boost their productivity and reliability, while at the same time reducing their environmental footprint, and they empower consumers to monitor and control their electricity usage.

GE has been in transmission and distribution almost as long as it has been in energy - some 80 years, and our business consists of four divisions focused on power delivery, automation, smart metering and asset management. We have a strong North American presence, with headquarters in Atlanta, GA, and facilities in Melbourne and Bradenton, FL, Shreveport, LA, Somersworth, NH, Denver, CO, along with Mexico, Canada and the United Kingdom.

The breadth and scope of our portfolio differentiates us from others in the industry. We provide network, sensor and control, and monitoring and diagnostic equipment, smart meters, and a suite of asset management and grid management applications, in addition to project management expertise and a Smart Grid solutions focus. We strive to help utilities safely and efficiently design, automate, operate and manage their critical transmission and distribution assets.

The business has experienced significant growth over the past few years, and we expect this trend to continue as electric utilities prepare their networks for increasing population and energy demand, while addressing security and environmental concerns with an aging infrastructure and workforce.

The Transmission and Distribution Industry in the US

The customer base we serve is both large and diverse. There are over 3,100 investor owned utilities, municipals, cooperatives and federal and state agencies that deliver electric power across 50 states, 3 interconnections and 8 reliability entity regions. They keep the lights on and the systems running for over 142 million residential, commercial, industrial and governmental customer premises. (EIA)

The network itself is vast and intricate, and accounts for some 40% of industry asset value. There are over 160,000 miles of high voltage transmission lines, millions of miles of distribution lines and over 60,000 transmission and distribution substations. (DOE OE, IEEE, Newton-Evans)

The enormity and complexity of this network, coupled with its social, economic, regulatory and political operating environments, directly impact the understanding, acceptance and ultimate promotion of the Smart Grid.

It may be helpful to reflect on the following that further influence the dialogue on Smart Grid ...

- Annual electricity use in the typical home and average retail price per kilowatt hour continue to trend up year over year (EIA)
- Our nation's transformer fleet is aging, and the load on each transformer is continuing to rise; when frequency and severity of loss are taken into consideration, electric utilities face the highest risk (Hartford Steam Boiler)
- Transmission and distribution losses amount to almost 6% of net generation (EIA)
- There has been a 3% per year increase in outage duration and a 4% per year increase in outage frequency over the past five years (DOE)

- Power outages and power quality disruptions cost U.S. businesses $100+ billion per year (EPRI)
- There has been a well documented decline in U.S. energy R&D spending and the underinvestment by both the public and private sector has become a focus of policy debate (Harvard)
- By 2030, given the points noted above and the fact that electricity consumption is expected to increase at least 30 percent (EIA), almost $1 trillion of investment is projected to be needed ... $298 billion in transmission, $582 billion in distribution and $85 billion in advanced metering infrastructure and demand response (EEI/Brattle Group)

So, the time for significant change is now. Fortunately, over the past few years, we have found common ground in the Smart Grid concept as a way to move the industry forward and into the future. GE T&D is working across the entire General Electric Company, as well as with our utility customers and other technology providers. We are also actively engaged with the Department of Energy Electricity Advisory Council, the GridWise Alliance, the Smart Energy Alliance, IEEE Smart Grid Coordinating Committee, EPRI Intelligrid and Open AMI, among others, to continue advancing the conversation. Furthermore, GE's Global Research Center has been actively collaborating with the Department of Energy Office of Electricity on several Smart Grid technologies that will demonstrate capability early. Today, we add perhaps the most critical audience to the mix and gratefully acknowledge the Congress' interest and increasingly active involvement.

The Smart Grid ... at GE

The Smart Grid is a framework for solutions. It is both revolutionary and evolutionary in nature, because it can significantly change and improve the way we operate the electrical system today, while providing for ongoing enhancements in the future.

The Smart Grid is defined differently by and provides different benefits to the various audiences it serves.

It is both a bigger, stronger network – like our interstate highway system, and it is a digitized, smarter network – like the Internet.

It represents technology solutions that optimize the value chain, allowing us to squeeze more performance out of the infrastructure we have and to better plan for the infrastructure we will be adding.

It requires collaboration among a growing number of interested and invested parties, in order to achieve significant, systems level change.

At GE, our perspective is that the Smart Grid is the integration of electrical and communication infrastructures, and the incorporation of process automation and information technologies with our existing electrical network. Smart Grid is essentially modernizing the 20th century grid for 21st century society.

Of utmost importance are the tangible, quantifiable and meaningful results:

- Optimizing renewable energy integration and enabling broader penetration
- Empowering consumers to manage their energy usage and save money without compromising their lifestyle
- Delivering increases in energy efficiencies and decreases in carbon emissions
- Improving the utility's power reliability, operational performance and overall productivity

Smart Grid empowers smarter energy choices, as real or near real time data, information and insight are transferred directly to utility operators and consumers.

The American Recovery and Reinvestment Act, and the direction being provided by various federal and state regulatory agencies, give the industry a tremendous opportunity to noticeably begin transforming our grid into a more automated, interactive and intuitive power delivery system.

GE Smart Grid Solutions

The following examples should help you better understand how our utility customers use GE's Smart Grid solutions in their daily operations.

- Advanced planning and visualization systems - enhance grid modeling and management
- Sophisticated control systems - facilitate centralized management of the distribution system, with modular advanced applications for continued enhanced services
- Voltage control using regulators, capacitor banks, and advanced control solutions - improve grid operation by reducing losses
- Automatic fault detection, isolation and restoration - improve grid operation and enhance reliability
- Online monitoring and protection, including predictive maintenance - improve asset reliability and extend operation
- Smart meters with two-way communication - offer power quality monitoring, remote connect/disconnect, and real time price communication

As utilities begin to cope with the effects of higher penetrations of renewable energy resources in their network, Smart Grid technologies will help with their integration and management.

- Better coordination of central generation, with the new addition of controllable loads, to compensate for renewable energy variability
- Better coordination and control of the distributed resources themselves, such as utility access to advanced grid integration functions in the power converters for wind and solar energy resources

And, we envision the following examples of consumer usage of GE solutions as we build out the smart home of the future:

- A "Home Energy Manager," available both via in-home display and via Internet-enabled devices, that empowers consumers to monitor, control and optimize their electricity consumption
- Smart appliances with 2-way utility communications, capable of shedding significant load at peak times, while keeping the consumer in control of their operation
- Other variable load control devices, such as programmable communicating thermostats and pool pump controls
- Distributed energy generation systems, such as solar photovoltaic, supported by net metering programs
- A smart charging interface for plug-in hybrid electric vehicles

As proof of concept and commitment, GE is developing a suite of Demand Responsive appliances that interact with a smarter grid. A demonstration project is currently underway between GE and Louisville Gas and Electric Company (LG&E), a subsidiary of E.ON U.S. A full suite of smart consumer appliances, including washers, dryers, ranges, refrigerators, dishwashers and microwave ovens, are installed and active in consumer homes in Louisville, Kentucky. These units are receiving time of use pricing, and critical peak signals from LG&E's smart meters. In response to these signals, the units reduce their power draw, they delay the start of cycles, and they shift temperatures all in a consumer friendly fashion. These changes in appliance behavior serve to not only reduce the peak load on LG&E's network, but also reduce consumer energy costs by performing optional tasks during periods of lower billing rates.

With respect to GE's promotion of energy efficiency, we would like to highlight our continuing partnership with Energy Star™ and our highly successful Ecomagination business initiative. With approximately 80 certified products across all sectors of the economy, Ecomagination addresses customer demand for more energy efficient products and services. And, it reflects GE's commitment to invest in innovative solutions to environmental challenges, while generating profitable growth for the company and its investors.

GE T&D has two Ecomagination certified products.

- The highly efficient transformer (amorphous): If all 1.1 million distribution transformers that are installed each year in the U.S. and Mexico were to use GE's amorphous metal core technology, rather than high efficiency silicon steel, the annual energy savings would be approximately 750 million kWh, which could avoid more than 465,000 tons of CO_2 emissions – equivalent to the impact of removing nearly 90,000 cars from U.S. roads for one year.
- Grid efficiency software (coordinated volt-VAR control): If installed on 10% of the distribution feeders in the U.S., GE's voltage control technology is designed to reduce electricity consumption by approximately 9.3 billion kWh per year, avoiding annual CO_2 emissions equivalent to those of 1.1 million cars on U.S. roads.

GE T&D also offers capacitor banks and series compensation that reduce grid congestion and improve efficiency.

GE Activity in Research, Development and Demonstration

GE is investing significant internal resources into developing the technologies for the Smart Grid that our utility customers want and need. We are a most active and visible provider of Smart Grid solutions, due to the strength of our existing portfolio and this focus on continued research, development and demonstration.

GE smart meters with Internet-based protocols have been deployed at American Electric Power, Oklahoma Gas & Electric and Pacific Gas & Electric, among others. We have a comprehensive Smart Grid pilot with American Electric Power that is in the final phases of completion. This initiative includes smart meters with time of use rates and near real-time information being shared with consumers, as well as outage and distribution management systems to improve reliability and efficiency. This initiative also provides monitoring and diagnostics of critical transformer assets. Furthermore, there will be R&D projects to achieve energy efficiencies from the distribution grid. We have recently joined Austin Energy's "Pecan Street Project" to make the City of Austin and its partners a local clean energy laboratory and hub for the emerging cleantech sector.

GE has also been collaborating with the Department of Energy Office of Electricity Delivery and Energy Reliability, as well as with the Office of Energy Efficiency and Renewable Energy. A great example of this collaboration is in the area of integration of both centralized and distributed renewables, with key programs addressing the challenges of high penetration wind energy and solar energy currently underway. These programs are designed to culminate with real-world demonstrations that prove the value of this advanced technology. Our Power Conversion Systems team, based in the GE Global Research Center, our Energy Applications and Systems Engineering team, our Renewables team and our T&D Smart Grid team work closely together to turn theory into reality for wind, solar, geothermal, plug-in hybrid electric vehicle and battery integration.

To highlight one initiative, we are actively working with the Maui Electric Company and the Department of Energy to solve the challenge of integrating very high penetrations of renewable energy. Over the past decade, Maui has seen huge growth in its energy needs. Although the island is rich in renewable energy resources, including wind and solar energy, until recently these sources have serviced only a small portion of the island's electric power, meaning that energy has primarily come from imported oil. Maui Electric Company is committed to reduce its dependence on imported fossil fuel and replace it with local, clean, renewable energy resources.

That is why GE supplied 20 1.5 MW wind turbines to the Kaheawa Wind Farm on Maui. The energy they generate can power 11,000 homes, reduce greenhouse gas emissions by 160 million pounds and save 163,000 barrels of oil ... every single year.

When you compare 30 MW of wind energy from this one farm to the peak island load of 200 MW, Maui very quickly leaps to the forefront of the definition of high penetration, wherever you look around the globe. This year, Maui will get approximately 10% of its energy from wind and there are plans for even more wind energy on Maui. Due to this high penetration and the daily variability of wind production, Maui is an excellent example of a system that can benefit from the features of Smart Grid technology. GE is working closely with the Maui Electric Company and the Department of Energy to develop Smart Grid technologies that can help compensate for this variability, and may eventually help Hawaii reach its goal of having 70% of its energy from clean sources.

We hope this gives you more insight on how we are currently working with our utility customers to address our collective Smart Grid future. The value we provide comes through our history and brand, longevity in the market, continued financial strength, recognized domain expertise and relevant portfolio. Our consultative approach, our quality products, projects and processes and our ability to rapidly deploy at scale are what make us a Smart Grid leader.

Hurdles to the Smart Grid

Whether one views the Smart Grid as the deployment of smart meters and advanced metering infrastructure that will facilitate time of use pricing signals and enable demand response ... or the further automation and remote management of the distribution network ... or transmission build-out with accompanying deployment of phasor measurement units and wide area monitoring and control systems, there are hurdles that must be overcome.

The following is a representative rather than exhaustive list of key challenges and areas of concern. Note that these closely resemble Chapter 3 of the Department of Energy Electricity Advisory Committee report entitled "Smart Grid: Enabler of the New Energy Economy."

- Lack of a comprehensive Smart Grid strategy and roadmap required for systems level change, compounded by the overall complexity of systems integration
- Substantial capital investment required up front, made even more difficult with the current crisis in the capital and credit markets
- Regulatory structures that consistently recognize and capture the full range of benefits of Smart Grid technology and provide assurance of appropriate cost recovery (particularly important given that the regulatory approval process varies by state, and may result in vastly different outcomes for a utility operating across state lines)
- Utility business model that minimizes risk and ties returns to electricity sales, which can slow down the adoption of technology, as well as energy efficiency and demand response initiatives
- Interoperability, and the need for faster, more comprehensive development of standards, in conjunction with faster, larger scale demonstrations
- Policies, applications, compliance, etc. with respect to physical and cyber security, data integrity and/or privacy
- Availability and overall capability of Smart Grid educational tools for policymakers, regulators and consumers to shift attitudes and behavior

Smart Grid Recommendations

The time is now for making headway with the Smart Grid, and the American Recovery and Reinvestment Act provides some much needed impetus for the industry.

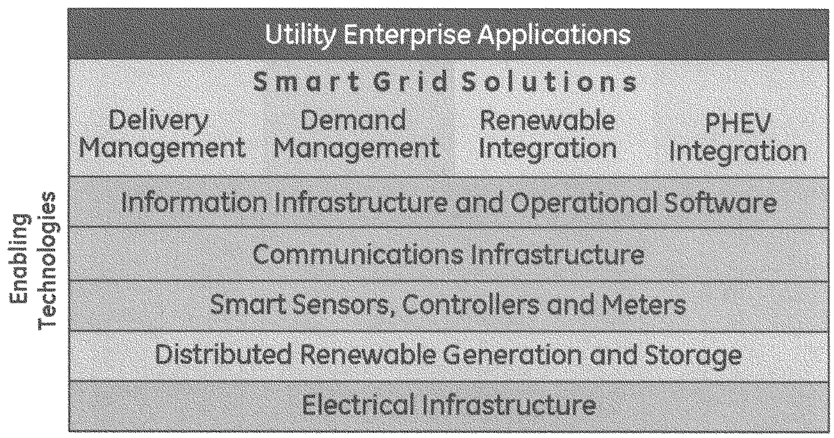
With respect to implementation, we believe it is in the long-term national interest to take a broad, all encompassing view of the Smart Grid to ensure that societal benefits will be fully realized as they pertain to our economy, environment and energy security ... growth in GDP, creation of jobs, reduction in carbon emissions, expansion of renewable energy and distributed energy resources that minimize our dependence on imported oil. We believe the solutions approach as it proves in societal benefits will also instill confidence in the marketplace and drive continued investment in the future.

To achieve a more rapid deployment of Smart Grid technologies and related recognition of benefits, GE recommends funding solutions around delivery management, demand management, renewables integration and electric and plug-in hybrid electric vehicle integration.

- Delivery management - involves improving grid efficiency through solutions that monitor power flow in real time, improving voltage control to optimize delivery efficiency and eliminate waste and over-supply ... thus, reducing overall energy consumption and related emissions, while conserving finite resources and possibly lowering the overall cost of electricity
- Demand management - empowers consumers with energy choice and control ... encouraging them to become smart consumers in smart homes, by giving them access to time of use rates and real time pricing signals that will help them to save 10% on power bills and cut their power use 15% during peak hours (DOE/PNL GridWise)
- Renewables integration - enables the seamless inclusion of cleaner, greener energy technologies into the grid from localized and distributed resources including rooftop solar and CHP ... thereby reducing our nation's dependence on coal and foreign oil and promoting a sustainable energy future
- Electric and plug-in hybrid electric vehicle integration - brings another distributed resource to market, but one at scale - with supporting rates and billing mechanisms, that can help flatten the

load profile and reduce the need for additional peaking plants and transmission lines ... potentially reducing the carbon footprint and fostering our energy security and independence

The figure below shows how enabling technologies such as smart devices, communications and information infrastructures and operational software are instrumental in the development and delivery of such Smart Grid solutions. As each utility customer begins the Smart Grid journey from a different place, based upon past actions and investments, present needs and future expectations, the solutions approach provides not only the necessary focus on societal and operational benefits, but also the flexibility for where and how to get started.



The development of new capabilities, the inclusion of related applications, services and project management with the enabling technologies and systems integration will be critical to actually fulfilling the grand promise of the Smart Grid. Thus, stimulus funding should be directed toward holistic Smart Grid solutions. For example, a logical approach might be funding city-scale Smart Grid solutions, where advanced metering infrastructure deployments have been independently funded and approved.

In addition, it seems while there is no difference in job creation in the short term, there is a significant one in the long term when choosing to focus on Smart Grid solutions over infrastructure alone. Findings from a recent KEMA study conducted for the GridWise Alliance indicate that disbursement of $16+ billion in smart grid incentives could result in the creation of up to 280,000 new jobs, with 150,000 being created in the first year alone. It is also expected that half of these jobs would continue beyond deployments as permanent, on-going high-value positions. Notably, many of these jobs will be with utility suppliers, as well as with utilities, the utility supply chain and new utility / energy service companies.

And with respect to carbon reduction, an EPRI study on 21st century transformation claimed that Smart Grid implementation could slash U.S. total carbon emissions output up to 25 percent.

So, it is the advanced, sophisticated solutions that include, but are not limited to, enabling technologies that will foster the Smart Grid in both the short and long term, differentiating our country and demonstrating leadership that may open up new markets for our solutions around the world.

Related Recommendations

In addition to much needed funding for Smart Grid initiatives, the American Recovery and Reinvestment Act included significant resources to spur wider broadband availability. This presents an important opportunity to leverage broadband/Smart Grid synergy.

The deployment of Smart Grid is dependent on a communications technology to connect the electrical infrastructure. The enablement of broadband to rural America, a priority initiative for this Administration, is also dependent on a communications technology that can be cost effectively deployed. GE has had insight into this synergy for some time, and we have worked with technology partners to develop next generation communication technologies that can support both Smart Grid and broadband. This emerging 4G technology, WiMAX, can be deployed with smart meters such that it provides consumers with information they need to make better energy usage decisions, as well as the broadband connectivity that, to date, has not been available to them.

GE suggests that funding be made available for projects that demonstrate the combined benefits of Smart Grid and broadband via 4G technology, the most advanced communications technology in the marketplace. Leveraging the resources available for Smart Grid and broadband programs would speed the realization of benefits and reduce development and build out cost.

Concluding Remarks

This is an unprecedented time in the energy industry. And, with respect to Smart Grid, this is definitely the time to be innovative, agile and willing to make bold moves. We are energized by the focus and momentum now surrounding Smart Grid and the solutions that enable energy efficiency, consumer empowerment and the integration of more renewable energy ... solutions that in turn provide economic, environmental and energy security benefits to our nation.

We thank you, in advance, for your careful consideration and thoughtfulness in how the stimulus will be awarded and spent. While there are many infrastructure investments in advanced metering infrastructure underway or in the process of being evaluated / approved, let us not miss this opportunity to accelerate deployment of additional applications and more comprehensive solutions that will provide those much "talked about" benefits and encourage much needed additional investment.

Once again, we commend Chairman Markey for his leadership on these issues, and we appreciate the Committee's time and look forward to its questions.

The CHAIRMAN. Thank you, Mr. Gilligan.

Our next witness is Mr. Allan Schurr. He is the Vice President of Strategy and Development for IBM Global Energy and Utilities Industry. We welcome you, sir.

STATEMENT OF ALLAN SCHURR

Mr. SCHURR. Mr. Chairman and members of the Committee, thank you for this opportunity to testify before you today about how a smart grid can enable a sustainable energy system with greater energy efficiency, improved reliability, and enhanced energy security.

I am Allan Schurr, and I am Vice President of Strategy and Development, as the Chairman mentioned. And IBM is proud of its global leadership role in smart grids as it reflects IBM's commitment to a smarter planet that is more instrumented, interconnected, and intelligent in diverse areas such as transportation systems; water supplies; health care; and, of course, energy.

We believe that the application of advanced information technology and communications technology to an already digitizing equipment domain in the energy field will revolutionize the way electricity is generated, delivered, and consumed across all sectors of the economy.

There are four key benefit areas for smart grids: more efficient use of energy by consumers, lower cost application of renewable energy supplies, operational and asset efficiency by utilities, and improved reliability and quality of electrical service. As requested by the Committee, I am going to focus on the first two mostly: consumer energy efficiency and renewables.

As I mentioned, smart grids encompass a mix of instrumentation, interconnectedness, and intelligence and are key to ensuring we meet our environmental and energy security goals and do so cost-effectively. Let me describe some examples where smart grids help achieve energy efficiency and incorporate renewables at the lowest possible cost.

Energy efficiency is widely viewed as the lowest impact and most cost-effective resource. Many large enterprises, like IBM, have made substantial progress in reducing energy consumed per unit of output over the past 30 years.

These enterprises had the scale to support detailed engineering analysis needed to identify waste in their operations and equipment, and they made investments accordingly to improve efficiency.

But consumers and small businesses have not had the same opportunity. Smart grid technologies will allow improvements for all customer classes. Smart grid technologies can help track, analyze, and control energy consumption at the whole premise level and on specific appliances, such as connected thermostats for a home air conditioner. Think of this as an intelligent home automation system but utilizing internet technology and in some cases utility-scale economies to dramatically reduce the cost and effectiveness.

Next, renewable energy technology is a growing part of a generating portfolio that can reduce environmental impacts. Whether in a utility-scale configuration or in wholly distributed installations, the integration of renewables with traditional grid operations requires special consideration. And smart grids can reduce this cost of assimilation.

For example, smart grid technologies can simplify the interconnection process of distributed renewables through business process automation, communication standards, and system discovery and monitoring, just like the way the internet itself manages devices that are constantly connected and disconnected.

The variability of renewable energy output is often cited as a significant objection to growing the portion of renewable energy sources. And smart grid can address this supply/demand imbalance by connecting the current and forecasted renewable output to dispatchable load.

Just today IBM announced that we are undertaking related efforts to integrate wind generation to the smart charging of plug-in vehicles so that on-board battery storage can absorb excess wind energy during controlled charge cycles.

All of this is possible with the smart grid, even without new inventions. We do require new thinking, new business models, new regulatory approaches, and new applications. For us to get there, we firstly need scale deployments. They depend on both solid program management and on technology blueprints that leverage standards and interoperability for the lowest total cost.

Interoperability is a necessary foundation for smart grid. And good progress is being made there. Within the electric system, interoperability means the seamless end-to-end connectivity of hardware and software from customers' appliance domain all the way up through the transmission distribution system to the power supply domain, enhancing the coordination of energy flows with real-time flows of information and analysis.

The markets driving toward interoperability in many states accurately see this issue as a means to ensure lower-risk technology investments, but there are challenges that need to be addressed, including current business model challenges in the utility industry, a lack of a coherent national smart grid strategy, and the lack of smart rate-making, all of which result in the fact that while there have been many pre-deployment pilots, there have been few full-scale projects.

The CHAIRMAN. Could you please summarize, Mr. Schurr?

Mr. SCHURR. Smart grid has become a topic of keen interest to parties across the technology, energy, and regulatory spectrum. And its benefits to energy efficiency and renewables are well-documented alongside reliability and operating efficiencies. But the hurdles really are the institutional inertia of the existing regulatory models and utility businesses. Necessary technologies and solutions are available, awaiting only the orders for scale deployments to drive costs out and benefits up.

Thank you very much. I look forward to answering your questions.

[The prepared statement of Allan Schurr follows:]

Testimony of Allan Schurr

Vice President of Strategy and Development

IBM Global Energy and Utilities

Before the Select Committee on Energy Independence and Global Warming

Hearing on Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions

February 25, 2009

Mr. Chairman and Members of the Committee, thank you for this opportunity to testify before you today on how a smart grid can enable a sustainable energy system with greater energy efficiency, improved reliability, and energy security.

My name is Allan Schurr and I am Vice President of Strategy and Development for IBM's Energy and Utility Business. IBM is proud of its global leadership role in smart grids as it reflects IBM's commitment to a smarter planet that is more instrumented, interconnected, and intelligent – in diverse areas such as transportation systems, water supplies, health care, and, of course, energy. We believe that the application of advanced information and communication technology to energy will revolutionize the way electricity is generated, delivered and consumed across all sectors of the economy.

Opportunities of a Smart Grid

Many begin the discussion of a smart grid with a definition. This approach often focuses on technologies from line sensors to advanced meters, and wireless communication to in-home displays. Unfortunately, this focus frequently omits the primary reasons for investing in an array of smart grid technologies. Namely, the four key interrelated benefits of smart grids:

- More efficient use of energy by consumers
- Lower cost use of renewable energy supplies
- Operational and asset efficiency by utilities
- Improved reliability and quality of electrical service

So let me instead begin with a vision of what providers and consumers alike would experience under a smart grid, with a particular focus on the first two: energy efficiency and renewables.

Imagine a system that helps consumers reduce waste by identifying where and when they use energy; that can automatically manage energy on behalf of consumers based on their lifestyle and economic preferences; that attaches the cost of energy to specific energy consumption patterns or appliances; that facilitates recommendations for deploying best practices and for buying equipment like lighting motion sensors, process control systems, and heating ventilation and cooling; and that enables the use of more efficient electric transportation like plug in cars through consumer-friendly recharging systems.

Or imagine that prices for both central and distributed renewable energy are driven down because the installation and interconnection is faster and cheaper. In this world, the cost and environmental impact of large scale plant transmission interconnection is reduced due to more dynamic loading on existing lines; the process of connecting new rooftop solar systems to the utility grid is as simple as ordering a mobile phone on-line; and the variability of wind, solar and other resources is managed through tighter integration of these supplies with similarly variable loads like dispatchable appliances, grid connected storage, and the timing of plug-in vehicle charging.

Imagine a system that continuously monitors the state of the network, looking for approaching equipment failures by analyzing such things as transient voltage data and transformer oil temperature to predict when equipment may fail so it can be maintained or replaced just in time. Imagine a system that automatically manages maintenance and construction work so that the right crews are sent to the right job with the right materials, thereby reducing costs and repair time for consumers.

Imagine a system that detects an outage, and automatically isolates the problem by rerouting power to affected customers, while simultaneously diagnosing the cause and dispatching the nearest repair crew that has the replacement parts on the truck. Or imagine a system where the utility calls you when there is an outage, rather than the other way around – and even gives you an accurate estimate of when power will be restored so consumers and business can plan accordingly.

Sound far fetched? This world is on our door step and requires no new invention, though it does require new thinking, new business models, new regulatory approaches, and new applications of available technology.

Is It Worth It?

Smart grids encompass a mix of instrumentation, interconnectedness, and intelligence. They are key to ensuring we meet our environmental and energy security goals, and do so cost effectively. Without a coherent approach to leveraging smart grid solutions, the costs to achieve our Nation's goals will unnecessarily divert resources from other productive uses. Let me describe some examples where smart grids help achieve energy efficiency and renewables at the lowest possible cost.

Energy efficiency is widely viewed as the lowest impact and most cost effective resource. In the past, its improvement has relied on efficient equipment selection, improved building shells, and industrial and building control systems. Smart grid technologies will allow improvements in cost and functionality for all customer classes. For example:

- It is not surprising that large enterprises have made substantial progress in reducing energy consumed per unit of output over the past 30 years. Energy price shocks of the 1970's and 1980's fundamentally impacted the profitability of companies, and adversely impacted governments budgets. These enterprises had the scale to support detailed engineering analysis needed to identify waste in their operations and equipment, and they made investments accordingly to improve efficiency. At IBM, we have reduced our operational energy costs by over $310M and reduced CO2 emissions 45% from 1990 levels. But consumers and small businesses cannot afford this level of detailed analysis. However, smart grid technologies in the form of advanced metering infrastructure, data analytics on energy consumption and price data, and peer to peer systems that offer advice and standardized solution delivered over the internet are all facilitated through the smart grid.

Installing energy efficient equipment, however, is only the start of the process. Again, large enterprises know that continuous monitoring and control of energy systems is key to realizing the benefits of energy efficiency. If the lighting runs on an empty shop floor, or office occupants change the temperature, or a pump operates at a higher pressure than specified, even highly efficient equipment is wasteful. Once again, consumers and small businesses have not been afforded the same opportunity to be as aware and effective at reducing unnecessary energy consumption. Smart grid technologies can also help track, analyze, and control energy consumption at the whole premise level, and on specific appliances, such as connected thermostats for a home air conditioner. Think of this as an intelligent home automation system, but utilizing internet technology and in some cases utility scale economies, to dramatically reduce costs.

- Finally, electric transportation offers a substantial opportunity to simultaneously improve energy efficiency and energy security. And as ubiquitous as the electric grid is, its role as a seamless and user friendly electric refueling network will require investment and coordination between drivers, automakers, utilities, and public charging providers. Especially for the emerging area of plug-in vehicles, smart grid technologies are critical to ensuring interoperability and off peak charging – whether at the system level or to avoid local distribution feeder overloads.

Renewable energy technology is a growing part of a portfolio of generating technologies that can reduce environmental impacts. Whether in a utility scale configuration or in wholly distributed installations, the integration of renewables with traditional grid operations requires special consideration and smart grids can reduce this cost of assimilation. For example:

- Transmission access is often cited as a constraint to more renewable energy development. This constraint is a combination of the lack of transmission lines to interconnect the utility scale wind or solar plant, as well as lack of available capacity on the existing transmission assets downstream of the interconnection point. If smart grid technologies can allow transmission operators to capture additional capacity through more dynamic loading, asset risk assessments, new market designs, and reduced spinning reserve that is otherwise contracting for transmission capacity, the costs and lead time of constructing new capacity can be reduced.

- To achieve the maximum penetration of renewable energy sources, utility scale systems must be supplemented with distributed systems located at the point of energy consumption. In addition to roof top solar, micro-wind and combined heat and power (CHP) systems need to be encouraged. Systems to provision these technologies through automation also are needed to reduce the cost and time of contracting for interconnection, ensuring safe operation, and monitoring the network. Smart grid technologies can simplify these processes through business process automation, communication standards, and system discovery and monitoring – much like the way the internet itself manages devices that constantly are connected and disconnected.
- The variability or intermittency of renewable energy output is often cited as a significant objection to growing the portion of renewable energy sources. To the degree that variable supply can be matched in time, quantity and location to variable loads, this concern is significantly mitigated. Smart grid technology can address this supply/demand imbalance by connecting

the current and forecasted renewable output to available variable load. Such load control has been available for years. Utilizing these same techniques to modulate loads, as well as dispatching charge and discharge cycles is one strategy for reducing the need for spinning reserve to support renewables. IBM is currently involved in related efforts in Europe to integrate wind generation to the smart charging of plug-in vehicles so that the on-board battery storage can absorb excess wind energy during controlled charge cycles.

Can We Do It?

The Desire for the Smart Grid

One important actor in the future I am describing here today is the consumer. Many industry leaders openly wonder if consumers are ready for this new world. Two recent IBM surveys demonstrate that consumers do want more control over their energy usage. The historical view of residential and small commercial customers as uniform and like-minded is not sustainable in the long run and is already outdated in most places. As utilities prepare for a period of major new infrastructure investments, consumers worldwide are reconsidering their role in the electric power value chain because of a combination of environmental, economic, and technology-driven factors. New consumer behaviors are emerging based on discretionary income, desire for control, ability to take control, and how successfully these new investments can be leveraged.

Furthermore, utility pricing and demand response studies demonstrate that consumers respond proactively to increased energy information and feedback that results from advanced metering and in-home displays. In short, consumers save money as they learn when and where their energy spending goes.

Innovation that matters to the world – is paraphrased from part of IBM's core values. As one measure of innovation, the Cleantech category has attracted substantial investment from the venture community covering everything from biofuels to solar to energy efficiency. But while biofuel and solar investing has stabilized, smart grid related investments have been growing. For example, the third quarter of 2008 saw venture capital investments in energy efficiency and smart grid grow to $272 million, overtaking biofuels' $150 million to capture second-place behind solar power companies in green technology VC investment rankings.

In addition, IBM's experience with both our own investments in smart grid and our work with technology partners of all sizes is that the modernization of the grid and grid connected systems is attracting substantial innovation: innovation through the application of technologies originally developed for other industries, innovation with new business models, and innovation of new vendor to vendor integration through specialization. The resulting landscape is dynamic, to say the least, and utilities are modifying their risk tolerance in some cases to be more comfortable acquiring less than fully mature technologies and solutions, through the insistence on standards and integration platforms. Today, we see new technologies emerging that are supported by both strong corporate balance sheets as well as venture funded startups.

Interoperability

Historically, progress occurs when many entities communicate, share information, and together create something that no one entity could do alone. When people talk about the smart grid, interoperability is a necessary foundation of that concept, and good progress is being made. Within the electricity system, interoperability means the seamless, end-to-end connectivity of hardware and software from the customers' appliances all the way through the transmission and distribution system to the power source, enhancing the coordination of energy flows with real-time flows of information and analysis.

There are three types of interoperability, and all are relevant to our objective. Technical interoperability covers the physical and communications connections between and among devices or systems (e.g., 120V power plugs and USB ports on a PC). Informational interoperability covers the content, semantics and format for data or instructions flows (such as the accepted meanings of human or computer languages and common symbols). Organizational interoperability covers the relationships between organizations and individuals and their parts of the system, including business relationships (such as contracts, ownership, and market structures) and legal relationships (e.g., regulatory structures and requirements, and protection of physical and intellectual property). All three types must be addressed to achieve effective interoperability in any system.

Privacy

One of the perceived hurdles to smart grids has to do with consumer privacy -- particularly voiced by consumer groups about the privacy of real-time meter data that is identifiable with household activities (such as that which could be associated with smart appliances). IBM has just completed a global utility consumer survey in late 2008 in which we asked people in twelve countries a variety of questions about their energy usage and goals for managing energy in the future. In anticipation of such concerns, our question set included several that dealt with consumers' desire for more information about their usage of energy and how they would use personally use that data, as well as some specific questions about making data available to outside parties and trusted privacy models for such data.

In the US, 65% of consumers we surveyed stated that they would be willing to make their usage data available to energy providers if it could be used to identify better deals for them. Only 9% said they would not (the remainder were unsure or neutral). These numbers are virtually identical to the global averages, and were consistent across all age and income levels. Most of those customers also want to leverage that data themselves; 54% in the US (58% globally) said that they want to obtain more information about their usage, such as its cost at any given time or its environmental impact.

To get a sense for what a privacy structure that would provide consumers with the most confidence that their data was being handled securely, we also asked about other industry models for handling sensitive personal data. Two industry models emerged with a majority of customers being comfortable: banking and medical offices (doctors, hospitals, and pharmacies). Given the somewhat unique nature of the privacy regulations and laws around medical records in the United States, we believe that providing a data security and privacy infrastructure along the lines of the consumer banking system would make the most sense to give people confidence that their data was being handled securely.

Challenges

Despite the many benefits that a smart grid offers, business model challenges still exist in making a fully integrated smart grid a reality. Today's utility business models are based upon the utility earning an authorized rate of return on capital investments. Utilities responsible for making these investments focus on minimizing risk and consequently, utilities are often slow to adopt new technologies that have not been extensively proven on a large installed-base. In addition, the many faceted value of smart grid technologies has been difficult to quantify in a simple cost-benefit analysis, thus making comparative financial metrics difficult to achieve. Existing electric rate structures create further complications since state public utility commissions (PUCs) are responsible for ensuring that electric utilities under their jurisdiction provide service at a cost effective price. Investments are often evaluated based upon actual and realizable benefits, and while societal benefits may be considered, they must be evaluated appropriately.

Another challenge is the lack of a coherent national smart grid strategy. The efficient evolution to a smart grid will require a coordinated strategy that relies upon building an appropriate electric infrastructure foundation to maximize utilization of the existing system. A smart grid is a new integrated operational and conceptual model for utilities. Among other things, it envisions the real-time monitoring of utility transformers, transmission and distribution line segments, generation units, and consumer usage, along with the ability to change the performance of each monitored device. This will require significant planning for implementing a system-wide network of monitoring devices (including monitoring devices at the consumer level), and for installing the equipment necessary to enable parts of the system to "talk" with other components and reroute power, self-heal configurations, and take other actions automatically. Developing such an integrated system requires a multi-year, phased installation of smart grid devices and upgraded computer and communication capabilities.

The lack of smart rates is also an issue. Per the Brattle Group, a smart rate provides "cost-based, forward looking information on the price of electricity that allows consumers to make wise decisions about how much electricity to purchase and when to purchase it. A review of default rate designs across North America reveals that prices paid by customers do not reflect the scarcity of capacity to produce energy at various times of day.

There is a lack of recognition that the default rates embody a hedging or risk premium which insulates customers from price volatility and eliminates any incentive that they would otherwise have for moving to dynamic pricing tariffs. In addition, customers lack the information to become smart shoppers. Policy makers have bought into a viewpoint espoused by defenders of the status quo that customers are averse to being placed on dynamic pricing tariffs, since not only will they face price volatility but they may also pay higher bills. This is contradicted by evidence from fifteen recent pilots with dynamic pricing, which clearly showed that once customers experienced a dynamic tariff, not only did they understand and respond to the price signals, they also overwhelming preferred dynamic tariffs to their conventional hedged rate form. The experiments also showed that a well-thought out customer education program is needed to sustain customer response.

To achieve the benefits of smart grids, industry must embark on and complete scale deployments of their selected solutions. While there are numerous, and sometimes overlapping pre-deployment pilots being conducted on various elements of the smart grid architecture, there have been few full scale projects.

However, things are changing and projects are beginning, and they are utilizing proven methodologies for managing similar large scale projects to define, design, develop and launch complex smart grid. IBM's extensive experience in complex projects has allowed us to apply skills, tools, and technologies to ensure that program functional and budget objectives are met and all constituencies are addressed. Installing technology is of course necessary, but insufficient for a successful outcome. Rather, significant technology integration, process redesign, and change management are all elements that ensure success. This proven approach is one way to reduce the hurdles of getting smart grid projects off the ground. As both utility executives and regulators see a disciplined, risk based program management approach, many of the concerns of this new frontier are alleviated.

This undertaking also will require significant investment and access to capital is a major hurdle to making these investments. A smart grid is a complex, comprehensive, and orchestrated utility operating system; it will provide publicly observable benefits only after substantial investments have been made in upgrading the infrastructure of the nation's utilities. Investing in equipment and personnel training, for which there are few short-term benefits, creates operating costs that may be difficult to justify without policy direction and support from government agencies

Conclusion

Smart grid has become a topic of keen interest to parties across the technology, energy, and regulatory spectrum. Its benefits to energy efficiency and renewables are well documented alongside reliability and operating efficiencies. So what is the hurdle to achieving these benefits? We believe smart grid advancement is now dependent on overcoming the institutional inertia of the existing regulatory models and utility business. Necessary technologies and solutions are available today, awaiting only the orders for scale deployments to drive costs out and benefits up. We believe our nation is ready to break out from this inertia and, to dramatically alter the energy value chain. By doing so we will help the US achieve its energy efficiency and energy security goals.

Thank you very much and I look forward to answering your questions.

The CHAIRMAN. Thank you, Mr. Schurr, very much.

Our next witness is Mr. Charles Zimmerman. He is the Vice President of Design and Construction for the International Division of Wal-Mart. Welcome, sir.

Mr. ZIMMERMAN. Thank you.

STATEMENT OF CHARLES ZIMMERMAN

Mr. ZIMMERMAN. Chairman Markey, Ranking Member Sensenbrenner, and distinguished members of the Committee, my name is Charles Zimmerman. I am the Vice President of International Design and Construction for Wal-Mart Stores, Incorporated. In my current role, I am responsible for coordinating the architectural and engineering system design for all of our international retail facilities.

Prior to joining Wal-Mart's International Division earlier this month, I was the U.S. Vice President of New Prototype Development and the captain of the sustainable buildings network. Here I oversaw our company's efforts to make our buildings more energy and water-efficient and lower their overall environmental impact.

On behalf of Wal-Mart and our 2.2 million associates around the world, I would like to thank the Committee for its work on this important issue and for holding this hearing today and for inviting us to appear. While I will focus primarily on our energy efficiency efforts, I will also explain the role smart grid plays in those efforts.

Our company holds the unique position in the world of energy. While there are no firm statistics, it is widely understood that Wal-Mart is one of the largest private purchasers of electricity in the world. In fact, the only entity thought to purchase more energy in the U.S. is the U.S. government.

Since energy is also Wal-Mart's second largest operating expense, it should be no surprise that we have been focused on energy efficiency and control technologies practically since the day we were founded. We have always recognized what many others have not, and that is that energy truly is a controllable expense.

Because nearly one-third of Wal-Mart's energy consumption is in the form of lighting, we have developed one of the most efficient lighting systems in the world. In fact, the installed lighting load in one of our newer stores is nearly 50 percent less than the baseline requirements established in the Energy Policy Act of 2005.

This truly innovative system results in the fact that during daylight hours, our sales floor lighting is either off or significantly dimmed. This is possible thanks to a sophisticated daylight harvesting system comprised of hundreds of skylights per store that are connected to sensors and state-of-the-art control technologies. This allows our sales floor lighting system to continually modulate the amount of energy needed based on the natural light available. This system is so dynamic that it even gradually ramps the light levels up and down as clouds pass over the store.

In our non-sales floor areas, such as offices, break rooms, and restrooms, lighting is controlled by occupancy sensors that turn off lights when no one is in the space. Even our freezer case lighting has now evolved to display an advanced digital technology as it is now comprised of LEDs, or light-emitting diodes.

The result is a building where most of the lighting is dynamic and only on to the degree conditions warrant. And this is just lighting. Similar efforts are underway with HVAC and refrigeration.

Recently, at the request of Wal-Mart, Lennox International has developed a new rooftop heating and air conditioning unit that it has marketed as being—and I quote—"the most efficient unit of its kind." Lennox also states that this equipment is up to 66 percent more efficient than U.S. Department of Energy regulations.

Today every rooftop unit purchased in the U.S. and Canada for all of our new stores and retrofits is this Lennox super high efficiency unit. This has been one of our many investments in green jobs.

Of course, as efficient as all of this equipment is, without proper control technology, it will never meet expectations. That is why every Wal-Mart store in the U.S. includes a sophisticated energy management system that allows us to monitor and control the lighting, temperature, humidity, and refrigeration in each and every one of our stores from our home office in Bentonville, Arkansas. Mr. Chairman, this is our version of a smart grid, simply awaiting arrival of a true smart grid described by Mr. Casey and others today.

If an associate in Sacramento leaves the door to a walk-in Coke cooler open, we know it in Arkansas. If a store manager in Chicago overrides their daylight harvesting system, we know it in Arkansas. And if a freezer in Miami is icing up and needs to be defrosted, we know it in Arkansas. And, in fact, we can correct the situation from Arkansas.

In 2001, when Governor Davis asked for all businesses to curtail lighting energy use during the 2001 brownouts, we were able to do that from Bentonville, Arkansas.

As efficient——

The CHAIRMAN. Do you think you could summarize, please?

Mr. ZIMMERMAN. As proud as we are of these accomplishments and innovations, we are even more proud to share what we are learning with everyone, including our competitors.

We at Wal-Mart applaud Congress in its efforts to communicate the necessity and the benefits of energy efficiency. Thank you for your time in allowing me to speak on behalf of Wal-Mart on this very important topic. We look forward to working with you to effectively and constructively address these issues. Thank you.

[The prepared statement of Charles Zimmerman follows:]

Testimony of Charles Zimmerman
Vice President, International Design and Construction
Wal-Mart Stores, Inc.

Before the House Select Committee on Energy Independence and Global Warming

February 25, 2009

Chairman Markey, Ranking Member Sensenbrenner and distinguished Members of the Committee:

My name is Charles Zimmerman, and I'm Vice President of International Design and Construction for Wal-Mart Stores, Inc. In my current role, I'm responsible for coordinating the Architectural and Engineering System Design for all of our international retail facilities.

Prior to joining Wal-Mart's international division earlier this month, I was the U.S. Vice President of New Prototype Development and the captain of the Sustainable Buildings Network, where I oversaw our company's efforts to make our buildings more energy and water efficient, and lower their overall environmental impact. In that role, I led a team of architects and engineers to experiment, pilot, and deploy a range of clean technologies in our buildings. I helped design Wal-Mart's most recent two experimental stores—where we test a range of emerging technologies in real world applications; and then develop our fleet of High Efficiency stores across the country where we pilot promising technologies from our experimental stores to see how they succeed in different climatic regions; and finally deploy the most successful technologies across all our new store prototypes and into our retrofit of existing stores.

On behalf of Wal-Mart and our 2.2 million associates around the world I would like to thank the Committee for its work on this important issue and for holding this hearing today. Wal-Mart appreciates the opportunity to participate in this critical discussion.

Our company holds a unique position in the world of energy. While there are no firm statistics, it is widely understood that Wal-Mart is one of the largest "private" purchasers of electricity in the United States. In fact, the only entity thought to purchase more energy in the U.S. than Wal-Mart is the U.S. Government. Since energy is also Wal-Mart's second largest operating expense, it should be no surprise that we have been focused on energy efficiency practically since the day we were founded.

Fortunately, our global presence gives us a great opportunity for energy efficiency comparisons. As Wal-Mart has continued to expand into other countries, our primary mode of expansion has been to acquire existing stores in those countries. Therefore, it is interesting to note that the stores we have built in the US are actually more energy efficient than those we have acquired in any other country thus far. This is even true for stores in countries with much more stringent energy regulation and much higher utility rates than the US; such as the UK and Japan. In fact, our stores in the UK actually use twice the energy per square foot, and our stores in Japan one and a half times as much energy per square foot as our stores in the US.

We have always recognized what many others have not: energy is a controllable expense.

Because nearly one-third of Wal-Mart's energy consumption is in the form of lighting, we have developed during the last decade, what we feel, is one of the most efficient lighting systems in the world. In fact, the installed lighting load in one of our newer stores is nearly 50% less than the baseline requirements established in the Energy Policy Act of 2005.

This truly innovative system results in the fact that during daylight hours, our sales floor lighting is either off (or at the very least) significantly dimmed. This is possible thanks to a sophisticated daylight harvesting system comprised of hundreds of skylights per store that are connected to a sensor and state of the art control technology. This allows our sales floor lighting system to continually modulate the amount of energy needed, based on the natural light available. This system is so dynamic that it even gradually ramps the lighting levels up and down as clouds pass over the store. In our non-sales floor areas such as offices, break rooms and restrooms, lighting is controlled by occupancy sensors that turn off the lights when no one is in the space. Even our freezer case lighting has now evolved into a display of advanced technology as it is now comprised of "LEDs" or "Light Emitting Diodes". The result is a building where most of the lighting is dynamic and only "on" to the degree that conditions warrant.

And this is just lighting; similar efforts are underway with HVAC and refrigeration.

At the request of Wal-Mart, Lennox Industries has developed a new rooftop heating and air-conditioning unit that it marketed as "the most efficient unit of its kind". Lennox also states that this equipment is "up to 66% more efficient than U.S. Dept. of Energy regulations". EVERY roof top unit purchased in the US for all of our new stores and retrofits for over the past year has been this unit.

Of course as efficient as all of this equipment is, without proper control technology it will never meet expectations. That is why every Wal-Mart store in the US includes a sophisticated energy management system that allows us to monitor and control the lighting, temperature, humidity and refrigeration in each and every one of our stores from our home office in Bentonville, Arkansas.

If an associate in Sacramento leaves the door to a walk-in cooler open, we know it. If a store manager in Chicago over-rides her daylight harvesting system, we know it. And if a freezer in Miami is icing up and needs to be defrosted, we know it. And we can correct the situation from Bentonville.

As efficient and forward-thinking as our energy practices have always been, we have very aggressive goals in our sustainability and energy efficiency efforts for the future.

In October of 2005, we announced plans to reduce the greenhouse gas emissions in our already energy-efficient existing buildings by another 20% by 2012. We also announced plans to develop a new store prototype that will increase efficiency another 25% - 30% by October of 2009.

So, how are we doing in achieving these goals?

With regards to our existing stores we recently approved capital for more than 1,200 energy related retrofit projects in our existing 4,000 US stores. This is on top of a similar program last year, and more than likely a similar program next year. A majority of these projects have paybacks between two and three years. And remember, these are in already efficient stores that have daylight harvesting systems, heat reclaim systems, energy management systems, etc.

When it comes to our new store program, we have opened in the last two years 8 of what we refer to as our "higher efficiency" prototypes. These stores are predicted to be up to 20-40% more efficient than our earlier prototypes, depending upon the climate zone. We are now in the midst of a 6 month strenuous audit of these facilities until the end of July in order to quantify exactly what the savings are prior to rolling them out to our entire program.

As proud as we are of these accomplishments and innovations, we are even more proud to share what we are learning with everyone, including our competitors.

In the past two years or so we have shared the details on our energy initiatives and their related paybacks with the Environmental Protection Agency, the US Department of Energy, the Defense Science Board, the Office of Management and Budget and with our retail competitors, Office Depot and Best Buy. We have even shared our story with the Pentagon and with the National Academy of Science. We have also taken representatives from Food Lion, Target, Publix, Costco and many others on tours of our recently opened stores that featured some of our newer energy efficient technologies. The best thing about the information we are sharing is that it is not theory; it is the proven result of real initiatives with real paybacks.

I am often told by others that until there are new technologies or until there is additional legislation, energy efficiency will never achieve mainstream attractiveness. Believe me, the technology exists, we are proof of that, and while Wal-Mart is not waiting for legislation to cause us to act proactively in the area of energy efficiency, we would encourage Congress to continue to look at new incentives that will help others to act as well, whether it be expanding the penetration of "smart metering" and "smart grid" technologies that would allow utilities, businesses and individuals to enjoy the kind of energy saving information management abilities that we have adopted; or adopting energy efficient building codes which set a floor for building performance to ensure that the lowest hanging fruit of efficiency upgrade benefits are met at a broader range of buildings. We hope that our experience proves insightful and helpful and stand ready to assist you in any way we can.

Finally, as you contemplate energy policy, we encourage you to remember the kinds of everyday Americans like the roughly 150 million shoppers who pass through our U.S. stores every week. More than ever before, we see these consumers struggling to make ends meet—we see them choosing between healthy food or their prescription medication; we see them leaving the toys out of the cart to make room for baby formula and diapers. At Wal-Mart, our energy efficiency practices not only help us save energy and protect the environment, they also help us keep costs low for our consumers.

And by making sure we have everyday low prices on products like energy efficient light bulbs, home winterization kits, and cold-water laundry detergent, we are helping Americans save money on energy costs, and live better.

In conclusion, I'm very proud to work for a company that has committed to, and is actively moving towards, a goal of eventually being supplied by 100% renewable energy; I am proud to work for a company that is demonstrating its commitment to environmental sustainability while saving consumers money; and I am proud that the company encourages me to pro-actively share our innovations with the world.

We at Wal-Mart applaud Congress in its efforts to communicate the necessity and the benefits of energy efficiency.

Thank you for your time in allowing me to speak on behalf of Wal-Mart on this very important topic. We look forward to working with you to effectively and constructively address these issues.

The CHAIRMAN. Thank you, Mr. Zimmerman, very much.

You sound like my mother used to say, "If you ride your bicycle outside your zone, your mother will know." [Laughter.]

I remember that lecture, but now it is coming from Wal-Mart.

We have another special guest today, Congressman Ron Klein from the State of Florida, who is also not a member of this Committee. This is a very special morning here for us in the Committee. We have so many members not on the Committee who are interested in the subject.

We welcome you, sir. Whenever you are ready, please begin.

Mr. KLEIN. Thank you, Mr. Chairman. And thank you, all of you on this Committee, for holding this and for the participants today.

This is something that many of us have been interested in for a very, very long time. It isn't just about energy alternatives. It is also about conservation and so many other things. So I appreciate your leadership.

Mr. Chairman, I have the opportunity today to introduce Shirley Brostmeyer. Shirley is CEO of Florida Turbine Technologies. She is a constituent.

In these difficult economic times, she is a great example of leadership in our business community in understanding the importance of how energy conservation can lead to great-paying jobs.

She employs over 185 well-paid employees at her company that work on the development, manufacturing, and testing of turbo machinery components and systems for aircraft engines, space propulsion, and industrial gas turbines. It sounds like a big, complicated thing, but, actually, it is an incredibly important part of our whole energy conservation that we are having.

When we think of energy independence, we always think about those alternative energies, which I know Mr. Hall and many others have been leading the fight on. But it is equally important to focus on energy conservation, something Ms. Brostmeyer and her company have been working on for many years.

I think you will be very impressed with the specifics that she is going to give us this morning. And don't let her be bashful because over the last ten years, her company is very proud of the fact that their improvements to aircraft, industrial turbines have led to 25,000 gigawatts of green energy, which is equivalent to all of the wind turbine farms in the United States.

Thank you for being here, Shirley. We appreciate your leadership in the community and nationally in your bringing this important advancement to the Committee.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Welcome, Ms. Brostmeyer. Whenever you are ready, please begin.

Ms. BROSTMEYER. Thank you.

STATEMENT OF SHIRLEY BROSTMEYER

Ms. BROSTMEYER. Mr. Chairman and members of the Committee, thank you for this opportunity to address you today. As you heard, I am Shirley Brostmeyer, CEO of Florida Turbine Technologies, a 185-person small business in Jupiter, Florida.

We develop next-generation turbine technologies for the Air Force, the Department of Energy, and aircraft and industrial engine manufacturers. We are fortunate enough to employ many of the world's foremost experts in turbine technology.

While my topic is not specific to transmission today, turbine efficiency technologies should be an integral part of the discussion regarding how technology can revolutionize efficiency.

In the ten years that FTT has been in business, we have already had a huge beneficial impact on the environment, eliminating the equivalent of emissions from 8 coal-fired plants, or 30 million tons, of carbon dioxide annually. Such a huge environmental impact was possible because turbines provide 97 percent of the electric power generated in our country.

We hear lots of talk today about improving the efficiency on the consumption side of electricity, such as our dishwashers, our clothes dryers, but just as important are changes that can be made on the production side of electricity or improving the efficiency of turbines.

I am here to tell you that turbine efficiency technology is the most cost-effective and near-term means to increase our energy independence and reduce CO_2 emissions.

I have a figure here on the wall if you can see that that shows the sources and uses of electric power in our country. I think it is probably difficult to see, but you should have it in your packet as well.

On the left, you can see that fossil fuels make up a large portion of our electric power generation. Renewable energy, which is small down there—this is a few years old—it will increase. It is increasing. But since demand is also increasing, fossil fuels will, by necessarily, remain a significant part of our energy picture for many years to come.

Why are high-efficiency turbines important? High-efficiency is important because more power can be generated with the same existing equipment because less fuel is needed to generate the same amount of power and because fewer carbon dioxide emissions result because less fuel has been burned.

I should start by saying that we have focused our efficiency advancements on natural gas-fired combined cycle plants since they are the most efficient way to make power with fossil fuels. Their efficiency is close to 60 percent. And they produce approximately one-third of the carbon dioxide for the same amount of power relative to a coal plant. And also because they are available 24/7, they make an excellent complement to most renewable sources.

My company has developed an exciting new technology called Spar-Shell Blade for combined cycle power plants. This next figure shows a schematic of how such a blade would be constructed.

Most turbine blades have to spray cooling air out from the inside of them to keep them from melting in their hot environment. That cooling air creates efficiency losses.

Spar-shell technology allows one to reduce that cooling flow by 75 percent. That savings in cooling air leads to a three and a half percent efficiency improvement for the plant.

Some other promising technologies to improve combined cycle efficiency are reducing the clearances between the rotating and the non-rotating parts or reducing the cooling leakage air. And these can be combined with Spar-Shell technology to make an upgrade kit that can be retrofit into today's turbines. This retrofitting would eliminate 60 tons of carbon dioxide every year.

Okay. We can go to the next. The final chart shows the effect of incorporating this Spar-Shell upgrade kit into half of today's combined cycle plants, or about 60 gigawatts worth of power, in the United States.

With the addition of these upgrade kits, we would end up with nine gigawatts of additional power. Three of those would be completely fuel-free and carbon dioxide-free.

With worldwide application, this additional power could reach 36 gigawatts and remove the equivalent emissions of 16 coal-fired plants. And my assumption is that we would only put these upgrade kits in about half of our existing power today.

The Spar-Shell kit would cost approximately $400 a kilowatt, which is half the price of putting in new combined cycle plants and one-quarter of the price of any other alternative.

The CHAIRMAN. If you could try to summarize, Ms. Brostmeyer, please?

Ms. BROSTMEYER. Okay. One additional point is that because it allows higher temperatures, Spar-Shell technology is an enabler for efficient, clean coal cycles. And the clean coal initiative at the Department of Energy is currently funding this.

So I would like to thank you, Mr. Chairman and members of the Committee, for taking time to hear about turbine efficiency technologies. And I encourage you to include power plant efficiency improvements as part of your energy independence plan.

The CHAIRMAN. Thank you.

Ms. BROSTMEYER. Thanks.

[The prepared statement of Shirley Brostmeyer follows:]

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Turbine Efficiency Improvements for Existing Power Plants

"How Technology Can Revolutionize Efficiency"

Ms. Shirley Coates Brostmeyer
Chief Executive Officer, Florida Turbine Technologies, Inc.

Testimony before the Select Committee on Energy Independence and Global Warming
US House of Representatives

February 25, 2009

Summary:

- Natural gas-fired turbines currently account for over 40% of the US electrical generation capacity. Existing turbines can be made more efficient by the incorporation of known and new technologies. Increasing turbine efficiency benefits consumers by reducing the amount of CO2 emissions, by reducing the fuel required to generate the same amount of electricity, and by providing additional capacity beyond that caused by the efficiency improvement.
- FTT has invented technologies that can be retrofit into natural gas-fired turbine power plants worldwide to create up to 15% more power from the same plants. Much of that power is completely carbon-free and requires no additional fuel. Application of this technology to existing US gas turbine power plants can generate an additional 9GW of power replacing the equivalent of 13 coal plants.
- The incorporation of Spar-Shell Blade into gas turbine plants account for two-thirds of the 15% total capacity improvement and will help put our nation at the forefront of a technology that will have world-wide implications. Efficiency improvements such as these can have a world-wide impact in CO2 emissions and fuel usage and so should be included in our nation's renewable energy policy and plans.

Testimony:

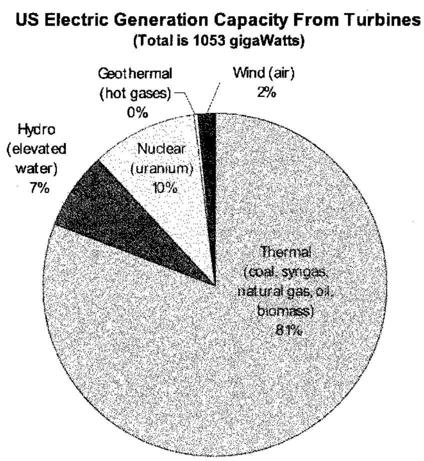
Mr. Chairman and Members of the Committee, thank you for this opportunity to address you today. I am Shirley Brostmeyer, Chief Executive Officer of Florida Turbine Technologies—a 185 person small business in Jupiter, Florida, specializing in turbine design and manufacturing. My company develops next-generation turbomachinery for the Air Force, Army, NASA, Department of Energy, and as a second-source supplier to aircraft and industrial turbine manufacturers. Florida Turbine Technologies, or FTT as it is often called, employs many of the world's foremost experts in turbine technology.

While FTT has been in business for only ten years, we have already made major contributions to our nation's environment. The turbine efficiency improvements of my small company have helped to eliminate 30 million tons of CO2 from the atmosphere every year[1]. This is the equivalent of eliminating eight coal plants from US soil. Such dramatic improvements are possible because almost all of our power today is generated from turbines. Even a small improvement to the efficiency of these machines results in a huge reduction in the amount of fuel burned and in CO2 emissions. For that reason, turbine efficiency improvement technologies offer the most near-term and cost effective means for energy independence. In my testimony today, I'd like to share the importance of a technology that FTT is developing, called the "Spar-Shell Blade", and other technologies that will increase turbine efficiency. I would like to show why turbine technology should be an integral part of the discussion regarding "*How Technology Can Revolutionize Efficiency*".

Why is Turbine Efficiency So Important?

A turbine is a machine that extracts energy from the flow of a fluid. The fluid could be air (in the case of wind turbines), steam (as in coal -powered turbines and turbines in nuclear plants), water (as in hydraulic turbines), or combustion products (as in natural gas turbines or aerospace jet engines).

Turbines provide 97% of the current US electric power and are used in almost all power plants: gas-turbine combined-cycle, coal-powered steam plants, nuclear plants, hydroelectric plants, and even solar-thermal plants. The breakdown by type of turbine,[2] shown in Figure 1, reveals that over 80% of the US electric power generation capacity is from thermal turbines, in which at least one form of fuel (for example: coal, natural gas, oil, syngas or biomass) is burned to create the hot gas or working fluid which rotate the turbines. Natural gas-fired turbines make up 53% of all thermal turbines, which means that approximately 41% of all US electrical generation capacity is by natural-gas fired turbines.



Ref: Electric Power Annual 2007, Energy Information Administration, Dept of Energy, 2008.

Figure 1: US Electric Generation Capacity from Turbines

According to the DOE's Energy Information Administration[3], the net generation of electricity from all energy cor
This means that nearly two-thirds of all power generation is lost in the energy conversion process (see Figure 2). In other words, today's electrical generation is, on the whole,

[1] Based on replacement of coal-burning power plants.

[2] Electric Power Annual 2007, Energy Information Administration, US Dept of Energy, 2008, page 25.

[3] Annual Energy Review 2001, Energy Information Administration, US Dept of Energy, 2002, page 219.

only 34.5% efficient. Because conversion losses are so large, relatively small reductions in losses (or improvements in efficiency) can yield substantial increases in the energy output. In other words, for every one per cent improvement in efficiency, the available energy is increased by 2.5%. Since turbines make up nearly all of the world's electric generation capacity, incremental turbine efficiency improvements can have extremely large impacts on the bottom line of energy production and fuel consumption.

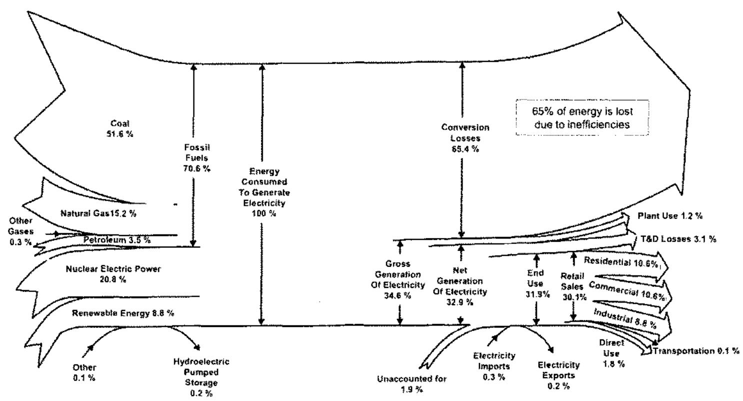


Figure 2: Conversion Losses Account for Two-Thirds of Energy Consumption (Ref: Annual Energy Review 2001, EIA, page 219, with percentage converted from absolute values by FTT).

The modern power-generating turbine has been undergoing efficiency improvements since its first production. Combined cycle plants, in which exhaust heat from a gas turbine is used to make steam to power a separate turbine also producing electricity, are the most efficient and have been in use since 1968. Many of today's operating power-generating turbines were designed based on technology that is 10 to 50 years old. The latest technologies would make them run cleaner and more efficiently. A typical large older gas turbine used in combined cycle applications produces 100 to 250 megawatts of power at 48-52% thermal efficiency; new combined-cycle power plants (designed within the last ten years) can see efficiencies as high as 59%.

The importance of turbine efficiency is rooted in the following points. When efficiency is increased:

1. Less fuel is required for the same amount of energy produced.
2. Less CO_2 emissions are generated for the same amount of energy produced because less fuel is used.

While combined cycle turbine plants are highly efficient, they are expensive to build and take many years from initial conception to completion. As our world energy requirements continue to increase at alarming rates, our society will need to keep older plants in use longer and longer in order to keep up with demand. For all of these reasons, the importance of near-term improvements to existing power plants can not be overemphasized.

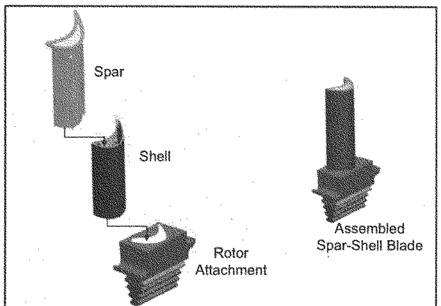
One very promising efficiency technology is called the "Spar-Shell Blade", currently being developed by FTT under a Small Business Innovative Research grant from the Department of Energy. The Spar-Shell Blade represents a promising leap in gas turbine technology that can be applied to over 60 GW of the US natural-gas generator nameplate capacity[4] (7% of total US power generation capacity). This program should be accelerated immediately to minimize CO2 emissions and reduce fuel consumption. In addition, other turbine efficiency programs should be an integral part of our energy independence strategy.

What is Spar-Shell Technology?

The simplest turbines have one rotor assembly which is a shaft with blades attached. The moving fluid acts on the blades so that they rotate and impart energy to the rotor. In the case of natural gas turbines, the hotter the working fluid (the gas), the more energy can be extracted from the turbine, and the more efficient the turbine is.

Currently, the efficiency of natural gas turbines is limited by the temperature that the turbine materials can withstand. Significant investment has already been made to achieve higher and higher turbine temperatures – through high temperature nickel superalloys, cooling air, thermal barrier coatings, film cooling, and other technologies developed in the last century. However, any further improvements in these technologies will serve only to incrementally increase the temperature above where standard operating temperatures are today.

The Spar-Shell technology allows the turbine operator to achieve significantly greater temperature increases because the turbine blade material is no longer the nickel alloy that is currently used, but a higher temperature metal of the refractory type. Refractory materials are a class of metals that are extraordinarily resistant to heat and wear. Examples of refractory metals include Niobium, Molybdenum, Tungsten, and Tantalum. Refractory materials have been in use in gas turbines for simple geometries, but not for complex blade shapes due to difficulties associated with their manufacture.



The Spar-Shell Blade is an assembly of three components, and can be a direct replacement for existing blades in natural gas turbines.

Figure 3: Spar-Shell Blade Assembly

[4] According to the Electric Power Annual 2007, EIA, the net generation of natural gas-fired turbines in 2007 was 102 GW (equivalent full-time operation). FTT assumes it is economically viable to apply this Spar-Shell Blade to 50% of this net generation on capacity operating at 85% of the time, or 60 GW of the US installed capacity.

FTT's Spar-Shell technology leverages the excellent heat resistance of the refractory metal and combines it with an advanced design approach – the Spar-Shell Blade – in which the external surface of the blade exposed to the turbine's hot gas, "the Shell", is composed of a refractory metal while an internal structure "the Spar" (composed of more conventional materials) provides support. The Shell protects the Spar's conventional materials from the hot working fluid of the operating engine, as illustrated in Figure 3.

The Spar-Shell Blade allows the metal temperature of the turbine blade to increase by 100 degrees F, saving 50 - 75% of the air required to keep the blades "cool". These changes allow for the overall turbine to operate 3.5% more efficiently. In other words, if all the industrial gas turbines in the US were retrofitted with Spar-Shell blades, we would reduce the fuel required by our power producing plants by 3.5% - essentially 12 days of energy consumption for free. The Department Of Energy has supported the Spar-Shell Blade with Small Business Innovative Research grants.

What Other Efficiency Technologies Does FTT Work On?

FTT is also actively developing other technologies for improving the efficiency of modern gas turbine power plants. While a wind turbine is open to the environment, gas, steam, and water turbines are constructed with cases around the blades to contain and control the working fluid. Every molecule of working fluid that the blade does not extract work from as it passes by, is called "leakage" which also reduces turbine efficiency. FTT is currently working on methods to control and limit the amount of leakages in turbines through advanced clearance control schemes and sealing technologies.

There are other ways to increase turbine efficiency. Improvements in the surface finish of blades and cases help to minimize losses in efficiency. FTT is working on methods to improve the surface finish such as better blade coatings, improved wear resistance, and other surface treatments.

The combination of all these technologies will help power producers get the most from their investments. Combined, these technologies contribute to a total of 5% efficiency improvements, with the Spar-Shell Blade making up 70% of the total, as shown in Figure 4

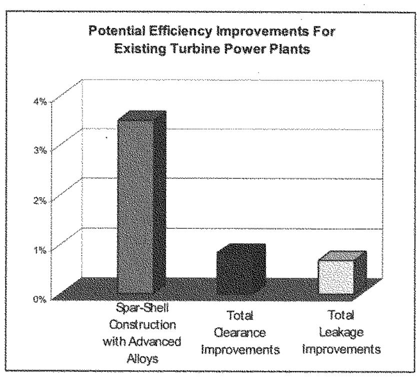


Figure 4: Efficiency Improvements Of Up To 5% Have Been Identified

How Do Technologies Lead to Natural Gas Savings, Higher Plant Capacity, and Lower Emissions?

The efficiency improvement technologies described above can be incorporated into existing combined cycle gas turbine power plants to generate additional electrical capacity. This capacity stems from two sources:

1. Air previously required for cooling the turbine blades is now combusted with fuel, to give additional power output ("upgraded power capability")
2. The ratio of conversion of electricity from fuel is higher ("turbine efficiency")

The Spar-Shell blade and associated efficiency improvements not only yield additional electricity for the same amount of fuel, these improvements allow the power plant to increase the rated generating capacity. For every 100 MW of electricity generated before the implementation of Spar-Shell and other efficient technologies, 5 MW of additional electricity is generated by the increase in efficiency (no additional fuel is required and no emissions are generated). Further, because of the increase in air through the combustion process, an additional 10 MW of clean natural gas combined cycle power is generated to result in a total of 15 MW additional power (or 15% increase).

This is illustrated in Figure 5. For the US natural gas installed capacity viable for Spar-Shell Blade, 60 GW of US turbine capacity becomes 69 GW of capacity. This additional capacity is enough to power 4.5 million homes and is equivalent to the production of 13 coal-fired plants. Further, the efficiency improvements can be applied on a world-wide basis, which translates 240 GW total world-wide natural gas electrical capacity[5] to 276 GW.

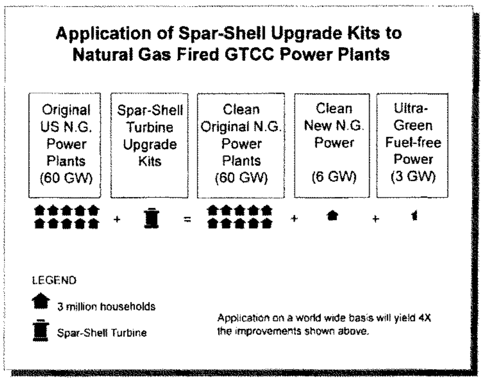


Figure 5: Efficiency Improvements Can Result in 15% Increase in Power

How does this efficiency improvement convert to reductions in CO2 emissions? As mentioned in the previous section, when the turbine is more efficient, less fuel is required to generate the same amount of energy, and less CO2 emissions are generated for the same amount of energy because less fuel is used. The calculated 5% plant efficiency improvement applied to the 60 GW of US turbine capacity saves 15 million tons in US CO2 production annually due to Spar-Shell and related technologies, relative to the original power plant (and 60 million tons of CO2 saved per year world-wide).

How does this efficiency improvement convert to savings in oil? Measured in millions of barrels of oil equivalent (mboe) per year, the natural gas savings due to efficiency improvements is 25 mboe on a US basis and 100 mboe world-wide.

When comparing these striking numbers to other recovery policy options, the importance of turbine efficiency truly stands out. Development rig and engine verification will cost an estimated $25 million. Implementation to generate 9GW of additional US power will cost $3-$5 billion which is a cost of $300-$500 per kilowatt. One-

[5] 2005: Energy Information Administration (EIA), *International Energy Annual 2005* (June-October 2007).

third of this power (3 GW) is fuel-free and pollution free at a cost less than 20% of the cost of alternative fuel-free, pollution-free technologies.

Turbine efficiencies will continue to be important as electrical power generation from natural gas is not expected to decrease, but rather will increase with increases in electricity demand. Figure 6 shows the predicted world electricity generation by fuel to the year 2030[6]. These predictions show that natural gas turbine power generation will continue to be a predominant source of energy for many years to come.

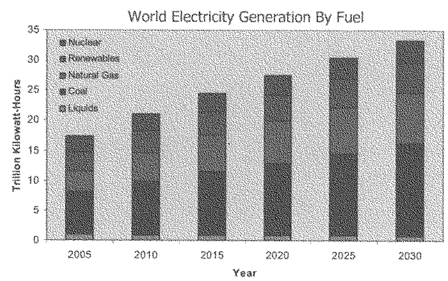


Figure 6: World Electricity Generation By Fuel By Year

What Hurdles Exist to Obtaining The Benefits of Spar-Shell Technologies?

"Renewable" should include "Efficiency":
The Spar Shell program and other technology programs that focus on efficiency need to be included as an integral part of our "renewable energy" plan. Since power outages can cost millions of dollars per day, utilities are extremely conservative with respect to the introduction of new technologies. They want to avoid a failure at all cost.

For that reason, efficiency technologies need to be tested on "turbine rigs" which simulate turbine conditions at a fraction of the cost of operating engines. Only after many hours of successful rig testing followed by engine testing, will a utility incorporate new energy-saving technologies. Engine testing is expensive for several reasons. New hardware must be secured and fuel costs incurred. But more importantly, the cost of insuring the testing due to the risk of potential outages and hardware replacement is high. Failures during the validation phase can cost a utility $5 to $10 million. Although the typical test program of these technologies is in the millions of dollars, such an investment is well worth the investment when considering our nation's energy security.

In summary, natural gas-fired turbines currently account for approximately 50% of the US electrical generation capacity. Existing turbines can be made more efficient by the incorporation of known and new technologies. Increasing turbine efficiency benefits consumers by reducing the amount of CO_2 emissions, by reducing the fuel required to generate the same amount of electricity, and by providing additional capacity beyond that caused by the efficiency improvement.

FTT has invented technologies that can be retrofit into natural gas-fired turbine power plants worldwide to create essentially "free power"— or up to 15% more power from the same plants. Much of that "free power" is completely carbon-free and requires no additional fuel.

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[6] 2005: Energy Information Administration (EIA), *International Energy Annual 2005* (June-October 2007), Projections: EIA, System for the Analysis of Global Energy Markets/Global Energy Module (2008).

The incorporation of Spar-Shell Blade into gas turbine plants will help put our nation at the forefront of a technology that will have world-wide implications. Efficiency improvements such as these can have a world-wide impact in CO_2 emissions and fuel usage and so should be included in our nation's renewable energy policy and plans.

FLORIDA TURBINE
TECHNOLOGIES, INC.™
Providing Innovations That Work™

10 YEARS

Turbine Efficiency Improvements for Existing Power Plants

"Turbine Efficiency IS Green Energy"

Ms. Shirley Coates Brostmeyer
Chief Executive Officer
Florida Turbine Technologies, Inc.

June 10, 2009

Florida Turbine Technologies, Inc.
1701 Military Trail Suite 110
Jupiter, FL 33458-7887
www.fttinc.com

FTT At A Glance

FTT Is:

- An energy and defense company employing more than 180 employees with an average of >19 years of experience
- Specializing in development of next-generation turbomachinery

2007 (Actual)	2008 (Actual)	2009 (Estimated)
149 employees	187 employees	200 employees
$23.2 million	$30 million	$33 million

- Headquarters: Jupiter, Florida
- Incorporated: October 1998

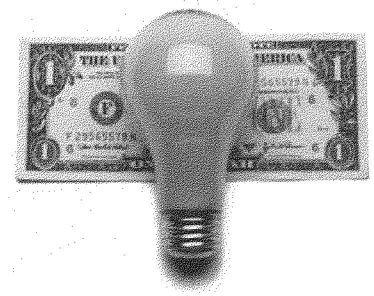
Our Contribution:

- Turbine efficiency improvements designed by FTT for aircraft and industrial power are saving 28 million tons of CO_2 per year and 181 million barrels of oil per year

Leader in innovation and technical excellence

Turbine Efficiency Is Important

$$Efficiency = \frac{Power\ Output}{Fuel\ Input}$$



Goal:

✓ Improve the efficiency of existing power plants to get more power for the same amount of fuel

Result:

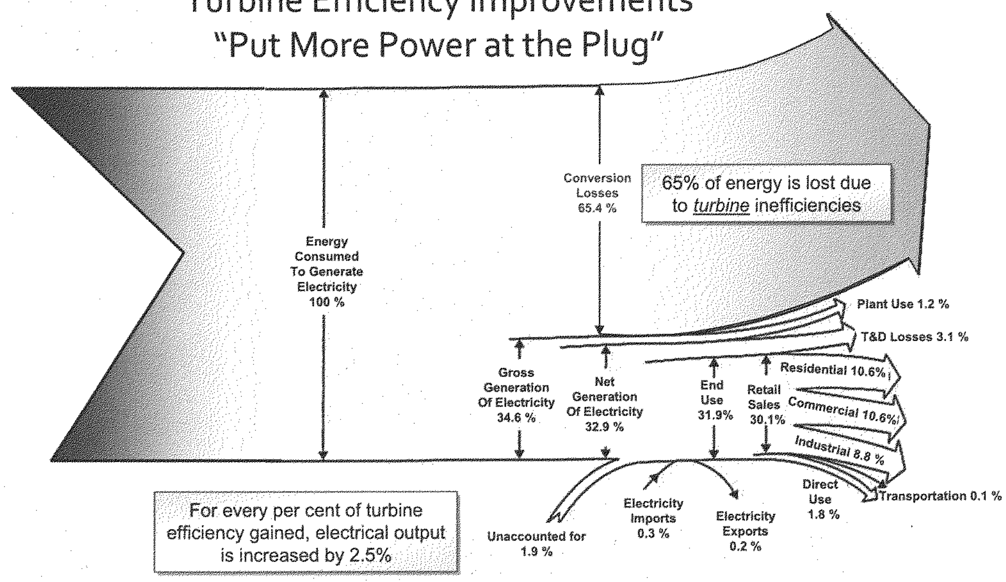
✓ Fewer power plants will need to built

✓ Less CO_2 released to environment

✓ Less dependence on foreign fuel

Turbine Efficiency Is Important

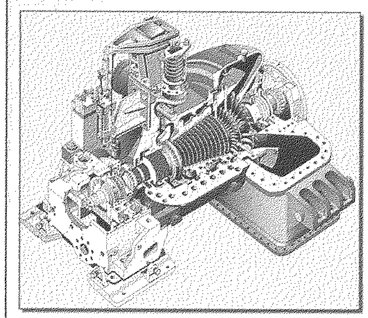
Turbine Efficiency Improvements
"Put More Power at the Plug"



Reference: Annual Energy Review 2001, EIA, US Dept of Energy, 2002, page 219, conversion to percentages by FTT.

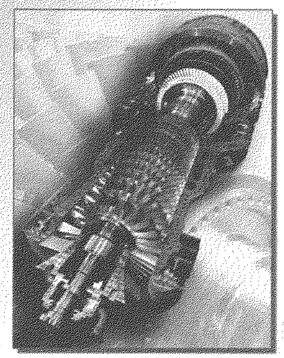
Turbines Create 97% of World's Power

Steam Turbines



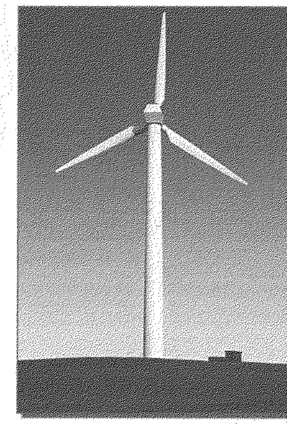
- Typical Cost of Electricity: \$0.03-0.07/kilowatt-hour
- Used by **Coal Powered Plants**
- Turn Industrial Waste heat to power

Gas Turbines



- Typical Cost of Electricity: \$0.04-0.08/kilowatt-hour
- Cleanest fossil-fuel burning turbines: Used in Combined Cycle Plants
- Burn Natural Gas, Biofuel, Hydrogen
- Waste heat used to power Steam Turbines

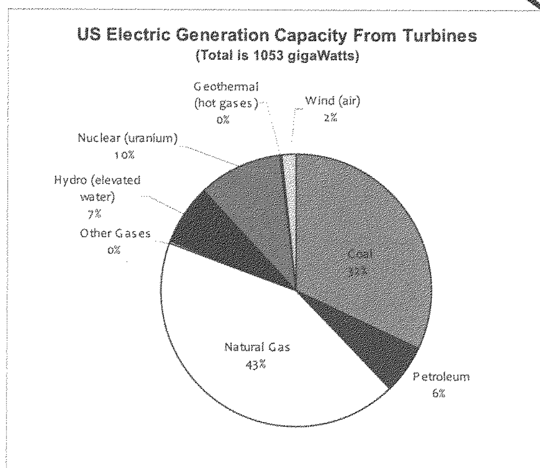
Wind Turbines



- Typical Cost of Electricity: \$0.07-0.13/kilowatt-hour
- Clean, Intermittent Power Producer

Turbine Efficiency Is Important

	Gas Turbine Combined Cycle	Coal Fired Steam
Pounds CO_2/kilowatt	0.65	2.1
Efficiency %	58	35



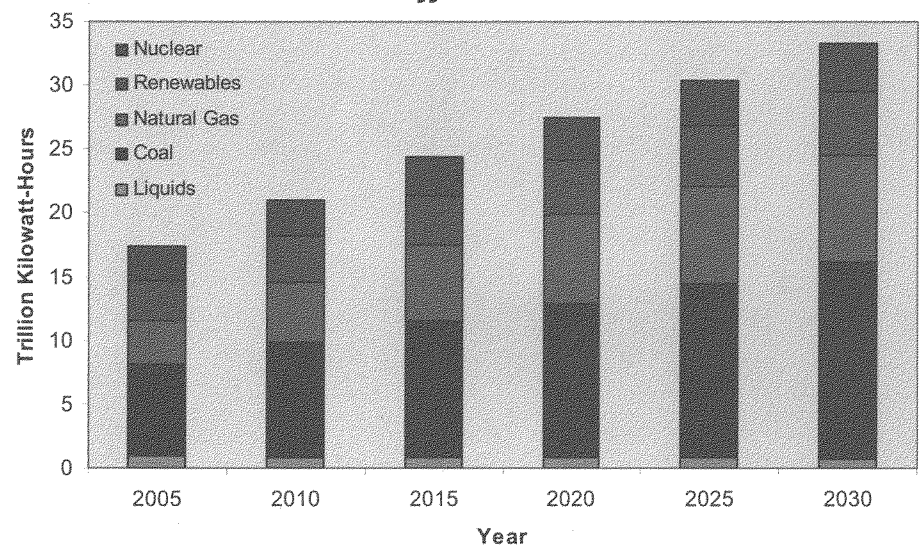
Ref: Electric Power Annual 2007, Energy Information Administration, Dept of Energy, 2008.

Natural Gas Turbine Combined Cycle Plants Are The Most Efficient Fuel-Burning Power Producer In Use Today

World Electric Generation by Fuel

Demand is Increasing –

Fossil Fuel Plant Efficiencies Must be Addressed



Ref: 2005: Energy Information Administration (EIA), International Energy Annual 2005 (June-October 2007), Projections: EIA, System for the Analysis of Global Energy Markets/Global Energy Module (2008).

FTT's Spar-Shell Upgrade Kit

FTT's Spar-Shell Upgrade Kit Can Be Retrofit into Existing Gas Turbines to Improve Efficiency by 5% and Deliver 15% More Power

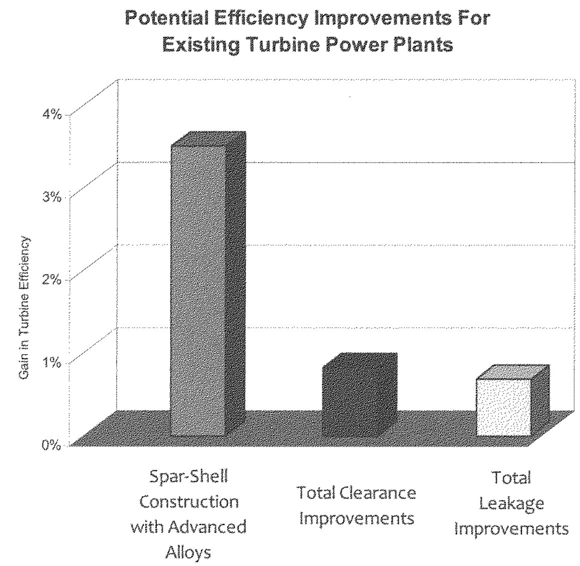
Spar-Shell Upgrade Kit Includes:

--Spar Shell Blade

--Leakage Improvements

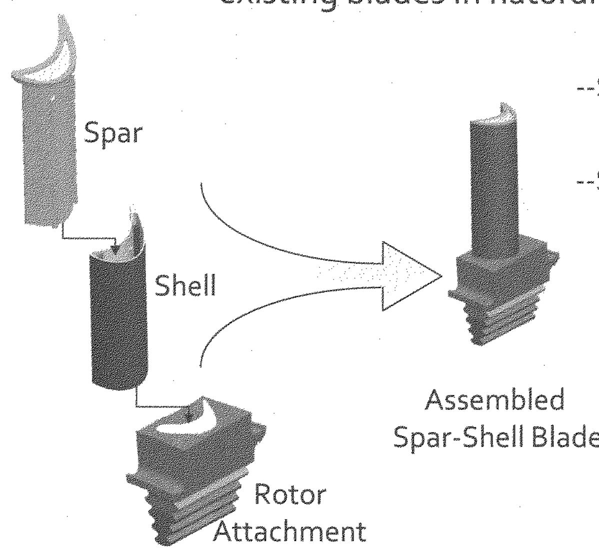
--Clearance Improvements

(Gaps between rotating and non-rotating parts are "Clearances")



Spar-Shell Upgrade Kit includes Spar Shell Blade

The Spar-Shell Blade is an assembly of three components, and can be a direct replacement for existing blades in natural gas-fired turbines



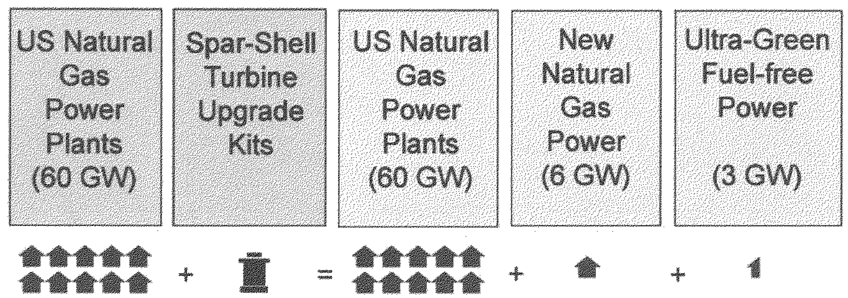
--Spar-Shell Blade is a Department of Energy Small Business Program

--Spar-Shell Blade is an Enabling Technology for Hydrogen Turbines

Efficiency Improvements Can Result in 15% Additional Power

Application of Spar-Shell Upgrade Kits to Natural Gas Fired GTCC Power Plants

(GW=Gigawatts or 1000 Kilowatts)



LEGEND

3 million households

Spar-Shell Turbine

Application of Spar-Shell Upgrade Kits to Natural Gas Fired GTCC Power Plants adds 9 GW to the US Electrical Generation Capacity. On a world wide basis will yield 4X the improvements shown above.

How Can Congress Help Turbine Efficiency?

Action:

- Enact legislation to give utilities financial incentives to run efficiently: Year over year efficiency improvements should get the same tax advantages as renewable energy sources

Result:

- Encourage investment in energy efficient technologies for retrofit kits

Turbine Efficiency *IS* Green Energy

How Can Congress Help Turbine Efficiency?

Action:

- Enact legislation to encourage research dollars for gas, steam, and wind turbine efficiency technologies

Results:

- Create technology jobs
- Reduce hundreds of tons CO_2 Emissions Annually
- US retain world leadership in energy technology

Turbine Efficiency *IS* Green Energy

How Can Congress Help Turbine Efficiency?

Action:

- Write letter to Department of Energy to encourage Spar-Shell Technology development

Result:

- Accelerate incorporation of Spar-Shell Technology
- Create 150 high technology jobs
- Create 3000 American manufacturing jobs
- Become a world-wide leader in a new technology
- Reduce 60 million tons of CO_2 Emissions annually

Turbine Efficiency *IS* Green Energy

The CHAIRMAN. Thank you, Ms. Brostmeyer. Thank you for your very important contribution to this whole discussion here this morning.

Our final witness is Mr. Jim Hoecker. Mr. Hoecker is the founder and the principal of Hoecker Energy Law Policy, but most importantly for the purposes of our hearing here today, Mr. Hoecker and I go back a long, long time. Mr. Hoecker was the Chairman of the Federal Energy Regulatory Commission, to name just a few of his achievements.

So it is good to see you again. We welcome you back. And we are sorry the table is just a little bit smaller than we had anticipated today. We have saved you for last because of your—we started off with the Federal Communications Commission over here, and we end with the Federal Energy Regulatory Commission. I think there is a good reason why we should start and end with these two subjects. So whenever you are ready, please begin.

Mr. HOECKER. Thank you very, very much, Mr. Chairman. I appreciate your welcome.

STATEMENT OF JAMES HOECKER

Mr. HOECKER. Good morning, Mr. Chairman, Congressman Sensenbrenner, and members of the Committee. It is a pleasure to be here. I come here today as the representative of WIRES, as their outside counsel.

WIRES, for your information, is a nonprofit trade group made up of transmission providers, operators, customers, technology companies. And we advocate for transmission investment.

Last night our President made it clear that we must pursue a transformational energy agenda in pursuit of alternative energy, energy independence, curbs on emissions that contribute to global warming.

Today's panel is about a key piece of that agenda. As a recovering regulator, I stand in awe of the technologists at this table and what they are seeking to achieve. And I want to associate myself with their testimony with respect to the importance of digital technologies in making our electricity system cleaner, more efficient, and responsive to consumer demand.

I also want to acknowledge Mr. Hall's remarks about the technology that applies, perhaps not digital but composite technologies, that improve the transmission system itself, including superconductivity and such new innovations.

The Wall Street Journal recently wrote about the popularity of small smart roads, smart bridges, smart grids. Today I want to impress upon the Committee that we need roads before we can have smart roads. We need bridges before we can have smart bridges. And we need an adequate transmission infrastructure as we apply the new technologies to help deliver reliable energy to market.

The North American electricity grid is the largest machine on the planet. It is also, unfortunately, a hodgepodge of individual and regional systems, much of it edging and congested, plan by an array of entities with different agendas, using different criteria, regulated by scores of agencies that use long lead times and unable to connect to places where renewable power supplies are plentiful.

The industry has, nevertheless, made huge advances in coordinating large transmission systems. And there are now scores of proposals on the table that, if developed, would bring clean energy supplies to market.

Whether public policy favors renewables, nuclear power, advanced coal, natural gas, all of the above, a transmission system that integrates and interconnects these new resources is essential.

A stronger transmission system is not the answer to all our energy challenges, but the solutions that we and the President are talking about cannot be implemented without it. Smart grid doesn't obviate the need for transmission, but it certainly complements it.

Policymakers and private companies can debate what shape this new grid should take and whether specific facilities should be built at all. But we need some basic reforms to get there, more effective and consequential planning and understanding about who will pay for these investments, predictable cost recovery, and efficient siting procedures.

We at WIRES propose to tackle some of these subjects in the Cannon House Office Building on Friday morning for those of you who are interested.

Mr. Chairman, I come here today in full support of what has been said and would like to add the interest of the transmission infrastructure to that chorus. Thank you for the invitation.

[The prepared statement of James Hoecker follows:]

United States House of Representatives
Before the Select Committee on Energy independence and Global Warming

Prepared Statement of James J. Hoecker

Counsel to WIRES (Working group on Investment in Reliable and Economic electric Systems)

Hearing on "Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions"

February 25, 2009

"We will build the roads and bridges, the electric grids and digital lines that feed our commerce and bind us together."

President Barack Obama
January 20, 2009

Chairman Markey, Ranking Member Sensenbrenner, and Honorable Members of the Committee, my name is James J. "Jim" Hoecker. Thank you for the opportunity to testify this morning on the future of smart grid technology deployment within the electric transmission system, and the grid's contribution to our dynamic clean energy future. I am especially honored to have the opportunity to appear before this Committee.

I. Introduction

Today I appear before you as Counsel to WIRES, the **W**orking group on **I**nvestment in **Re**liable and **E**conomic electric **S**ystems. WIRES is a new national coalition of both publicly-owned, investor-owned, and cooperatively-owned transmission providers, customers, and services companies. To my knowledge, WIRES is the only private sector group exclusively dedicated to promoting investment in the electric transmission system and educating policymakers and the public on the benefits derived from an upgraded and strengthened grid. WIRES' most recent work on transmission, including studies on cost allocation and integrating "location-constrained" resources like wind and solar power into the grid, can be found on it website (www.wiresgroup.com).

WIRES was formed to highlight the need for electric transmission investment and to explore ways to facilitate it. I am pleased to say that a range of business and special interests are taking a fresh look at the grid. Policy makers are coming to recognize that, properly planned, sited, and animated by digital technologies, transmission is a network industry with diverse benefits and beneficiaries and not simply an adjunct to other utility functions. During the time that I was Chairman of the Federal Energy Regulatory Commission, the focus of regulators was largely on enabling a competitive electric generation market. Those wholesale power markets will grow and endure and deliver benefits to consumers, but they are complex and comprised of thousands of transactions. Federal policymakers and the industry are now rediscovering electric transmission infrastructure in light of the need to utilize those markets to deliver reliable, low carbon energy from entirely new resources to load-serving entities.

The need for a more integrated and extensive transmission network is real. When the individual utility transmission systems were achieving a higher degree of integration a half century ago, we had no plasma TV's or energy-hungry computers; no one seriously conceived of the possibility that automobiles would be plugged into the electric system; large-scale regional bulk power markets were only a blip on the horizon; few people were concerned about the consequences of greenhouse gases in the atmosphere; and extensive deployment of "location-constrained" wind, solar, biomass, or geothermal technologies for electric generation – not to mention low-carbon forms of coal generation – was a fantasy. Today an American consumer uses 13 times the electricity he or she did a half century ago and there are twice as many of us. In most instances, we are asking the transmission system, and indeed the electricity system generally, to perform tasks for which it was not designed. The imperative we face is therefore to both upgrade and expand the system and to make it more interactive and "smarter" – *i.e., more digital and less electro-mechanical.*

My testimony today seeks to connect these objectives. As a representative of WIRES, I will focus principally on the challenges facing transmission providers and customers that seek to enlarge the capabilities of the transmission system as a network of wires and the related technologies and equipment that animate it. These challenges must be addressed if the U.S. is to have a chance at changing the energy economy and scaling back its emissions of deleterious greenhouse gases. Climate change is a global problem which demands a range of solutions, among which energy efficiency and demand response are among the most important in our estimation. However, because low-carbon alternative energy resources that utilize some of the most innovative technologies developed in the past quarter century are far from major load centers, transmission is an indispensible enabler of many of the new technological applications now being touted as the engines of energy independence and reduced emissions. In other words, Mr. Chairman, when we speak of the "smart grid," let's not overlook the "grid" itself.[1] The need to invest in smart grid technologies and to strengthen the grid generally are intertwined objectives. WIRES looks forward to working with you, the Committee, and technology companies to create a modern 21st Century electric system. I have attached to this testimony an outline of a legislative proposal that addresses the planning, siting, and cost allocation and recovery issues I discuss below. WIRES is engaged with many groups in an effort to find the best approach to solve the challenges facing the grid.

[1] Of course, the distinction is difficult to draw because the terms "grid" and "smart grid" are so often used interchangeably. There is no standard definition of smart grid. I believe it entails two-way communications technologies that provide customers with real-time information and tools that allow them to be responsive to system conditions, help ensure efficient use of the electric grid, and enhance system reliability. The wires network – both transmission and distribution -- is the platform upon which digital technologies will operate to empower customers to manage their carbon footprints and utilize system assets more efficiently.

II. The Benefits of Transmission

Electric transmission has several important benefits. The grid's benefits and the benefits of energy efficiency and distributed generation are not mutually exclusive. At one level, high voltage transmission provides network reliability benefits, including coordinating the operation of power production facilities to permit them to reinforce one another, providing a high degree of flexibility to accommodate changing conditions as they occur, and the sharing of generation reserves among interconnected systems across whole regions.

In addition, transmission systems allow electricity to be transported in large quantities from one production area to another. Power can be delivered to industrial, commercial, and residential customers from generators located at a great distance from those loads. This magnifies consumer access to less expensive, more diverse, or environmentally more benign resources. Transmission, assisted by modern communications technologies, enable buyers and sellers of power to engage in trading of electricity, providing opportunities to reduce the cost of power overall. The electric transmission system provides the greatest hedge against extreme conditions and events that could result in large economic dislocations and threats to the public health. Power from readily available resources can be transmitted to the broadest regional markets to maximize the economic and environmental benefits of those resources.

The benefits derived from the grid may be in direct proportion to the technological advances that will accompany its expansion. Investment in technologies that enhance system reliability, reduce line loss, increase transfer capability may be made without expanding the grid's footprint. Techniques that permit the aggregation of variable resources and transmission of remote renewable resources over greater distances are on the horizon. Control technologies that enable the grid to be "self-healing" by detecting frequency fluctuations and re-routing power to avoid interruption will produce a high-quality electrical economy. Those technologies can also increase the efficiency and transfer capability of existing transmission assets, thereby avoiding the need to develop new corridors for transmission facilities in many cases.

Educated estimates of the size of the investment that must be made to ensure that these benefits continue to flow in the face of the demands to be placed on the grid between now and 2030 range in the neighborhood of $300 billion. After a period of declining investment, U.S. companies will have spent about $30 billion on transmission in the period 2006-2009, at a rate roughly double the annual expenditures at the beginning of the century. However, as of mid-2008, only 668 miles of high voltage transmission has been built across state lines since 2000. Remarkably, the staggering expenditure on transmission will remain the smallest component of the investment we must make in the electricity system.

The most important potential benefit of transmission along these lines comes from the historic task undertaken by this Committee as part of a shift in public policy – its potential contribution to addressing climate change. The quest to curb greenhouse gas emissions will not -- indeed cannot -- succeed without squarely coming to terms with the need for greater transmission investment. The reasons for this are clear:

- Transmission is the principal means by which electricity from new clean energy resources such as wind, solar, geothermal, and biomass can be made available to the majority of American consumers. This is equally true for other low-carbon resources such as nuclear power and potential low-carbon coal generation. All of these resources are "location constrained" by their very nature and existing transmission infrastructure is inadequate to serve both the growth in traditional demand and development of these new generation resources.

- By both expanding the high voltage "backbone" network and ensuring that it becomes a "smart grid", we can empower consumers to control their own carbon footprint, enable companies to make optimal use of existing assets, and turn the grid into a driver of energy efficiency and demand response.

- Transmission ensures fuel diversity and provides the needed market access for new technologies like carbon capture and sequestration, wind power, and solar generation. Deployment of new transportation technologies like plug-in hybrid vehicles will necessitate a more uniformly strong transmission system to deliver power on demand.

This climate change challenge can be met. It will require leadership from Congress and the States, industry, and regulators. As the National Clean Energy Project Summit here in Washington amply demonstrated this week, transmission expansion is becoming a national priority.

III. Challenges to Transmission Development

The existing electric transmission system today faces well-recognized challenges, however. New competitive bulk power markets test the limits of the grid's capabilities. Transmission is persistently constrained and congestion costs have risen. As investment in transmission declined for a quarter century, electricity demand grew by 34% between 1992 and 2007. Most importantly, the regulatory path for facilities that could link major renewable and low-carbon resources to consumers many hundreds of miles away is a long and winding road. Barriers to transmission upgrades and expansions often delay or even deter the development of facilities truly needed for a low-carbon energy environment. The National Renewable Energy Laboratory, in a recent report entitled *20% Wind Energy By 2030* (May 2008), has identified some of these barriers:

A. Transmission Planning. Upgrades and expansions of the transmission system serve numerous purposes. They meet the needs of the next increment of generation, sustain the reliability of the electrical system as a whole, and serve an evolving need for a flexible low-carbon energy mix over the long term. Planning these enhancements, and execution of such plans, must be regional and national while accommodating local concerns. It should also anticipate the development of broad areas or "zones" of location-constrained renewable energy resources.

Sound transmission planning (to analyze benefits and costs and the distribution of benefits for the purpose of allocating costs) should incorporate a number of features. Yet, there is no generally accepted planning regime for these interstate facilities. WIRES believes the following:

- Transmission planning and analysis should be done on a regional level – tending toward larger regions as a general rule. While the overall planning process must encompass a large region, the planning studies cannot lose sight of the impacts on sub-regions.

- Transmission planning and analysis should include all of the demand loads (existing and anticipated) and all of the supply resources (existing and anticipated) located within the geographic region for which planning is taking place.
- Transmission planning should occur in a process that is open, transparent, and inclusive, and conducted by a credible entity without particular attachment to specific interests or market outcomes in the region. In other words, it should be compliant with the planning principles of FERC's Order No. 890.

B. <u>Allocation of Costs</u>. Public policy must provide a clear and consistent guide to who pays for additions to the electron superhighway, *i.e.*, the high voltage grid that has such broad regional benefits. While cost allocation may vary regionally, WIRES, as well as the NREL study, believe it should be founded on fixed, clear, and equitable principles, particularly where multi-state facilities are concerned. No generic principles guide the allocation of costs of transmission, which produces great difficulty when the facilities at issue cross multiple jurisdictions with varying regulatory criteria. Where transmission investment was once only a candidate for system-specific rate base, today such costs can be allocated to users of regionally-interconnected systems. They can be very diverse. In both organized markets (i.e., markets run by regional transmission organizations ("RTOs")) and non-RTO bilateral markets, the disputes over cost allocation and cost recovery, and the procedural delays occasioned by these disputes, can be prolonged and counter-productive.

There are numerous ways to allocate costs. At one end of a spectrum of approaches is so-called participant funding which seeks to allocate costs of a transmission upgrade or expansion to immediate "cost causers" such as interconnecting generators, even if facilities may have regional reliability or economic benefits. At the other end of the spectrum is the "socialization" of costs, meaning a broad allocation of all project costs to the perceived beneficiaries of the project across the market or region served. Different perceptions of the equities and the reliability or economic benefits of a grid expansion have often chilled transmission investment. The debate over cost allocation remains largely unresolved and many of our members identify cost allocation as the greatest deterrent to transmission development.

In 2007, WIRES commissioned an independent study of how best to allocate the costs of transmission. Entitled <u>A National Perspective On Allocating the Costs of New Transmission: Practice and Principles</u>, it is available on the WIRES website. It does not advocate "one size fits all," but instead a principled approach to determining what is the just and reasonable way to assign cost responsibility.

C. <u>Cost Recovery</u>. As a general rule, when state-regulated investor-owned companies invest in transmission assets, that investment typically goes into state-jurisdictional rate base subject to retail regulation. Retail customers are then asked to pay for those facilities in their rates even if the benefits of the facilities are traceable to beneficiaries beyond the utility's service territory. These rates can overlap with federal transmission rates established to recover costs from third parties that utilize the lines in an open access environment. This dual-pricing system complicates the allocation of costs and makes cost responsibility subject to various interests that have different public policy agendas.

The NREL study argues that this effectively dilutes incentives for development provided by the FERC under the 2005 Energy Policy Act and other laws and creates substantial regulatory uncertainty.

D. Facilities Siting. Laws governing the siting of transmission date from an era when utilities were generally not interconnected and the modern network of interstate lines and multi-state interconnections did not exist. According to NREL, the need to connect location-constrained generation resources to growing load centers over long distances, in part to implement climate change laws and renewable portfolio standards, requires a new regulatory approach.

Facilities siting is an intractable problem that often leaves all parties dissatisfied and the long-term interests of electricity consumers ignored. Congress sought a balanced approach to siting transmission facilities when it adopted Section 216 of the Federal Power Act in 2005. That provision allows FERC to site transmission as a "back-stop" to state procedures, and grant any necessary federal rights of eminent domain, only (1) if the facilities are located within broadly-defined corridors designated by DOE as experiencing significant market inefficiency, high prices, and threats to reliability that should be resolved through enhancement of the transmission system; (2) after states have had the opportunity to consider a project under their traditional authority to site facilities (or lack of such authority) and have failed to act in a timely manner; and (3) pursuant to its own subsequent review, including environmental analysis under the National Environmental Policy Act and applicable laws, to ascertain what the public interest requires. FERC's effort to expand its ability to utilize the backstop authority in cases where a state provided a reasoned denial of a project application was recently reversed by a Court of Appeals.

The DOE carried out its responsibilities by designating two National Interest Electric Transmission Corridors ("NIETC"). The NIETC process did not site facilities or determine the outcome of transmission siting or a planning processes, or take property or preempt or undermine protection of environmentally or culturally sensitive areas or assets. DOE was hyper-conscientious not to pick winners and losers or specify a required route for any line. Yet, the statutory process resulted in a perfect storm of controversy, delay, and inaction. To this date, FERC has not been formally called upon to exercise its authority under section 216 of the Federal Power Act. The NIETC process was never intended to be a planning device. And it has marginal value as a goad to state action.

While an arguably valid attempt to address the obvious mismatch between the interstate operation of the grid at the high voltages and the exclusive authority of states to determine if such lines are needed and can be constructed, the NIETC process has failed to resolve the delays that inevitably accompany the transmission siting process. Indeed the lead-time for planning and constructing transmission – which is already substantial -- promises to remain so.

The NIETC process may also fail to achieve its goals for two additional but related reasons. First, transmitting large amounts of remotely located renewable generation to load will unquestionably entail entirely new high-voltage network additions that will cross multiple jurisdictions in many circumstances. The need to take advantage of these domestic, "location-constrained" renewable and clean-coal resources will be central to any climate change and energy independence goals. Development of these generating facilities await some indication that transmission capacity will be available to them. Yet, DOE's focus in implementing corridors focuses on transmission constraints and congestion that already exist. Second, upgrades or expansions to the grid may also be necessary to ensure electric reliability for our digital society, promote energy security, or meet economic development and demographic trends. Section 1221 of EPAct, which adopted section 216 of the FPA, permits DOE to take these forward-looking factors into account when designating corridors but it has largely chosen not to do so. I am unsure whether this reflects a reading of the law or a practical decision about the difficulties of formulating future plans for integrating alternative energy resources.

In the final analysis, delay in selecting and building the right transmission in the right place to serve the right generation resources cannot be good for consumers.

IV. Conclusion

WIRES does not argue that transmission is a singular solution to the challenges facing the electric industry. On the other hand, WIRES is persuaded that the high voltage network provides benefits that are unattainable in other ways. It will, however, require modernization and technical innovation. If we are to fulfill our national ambition of a more secure, environmentally sustainable, and efficient power system, we need a workable regulatory process that ensures that transmission can be built on a timely basis, based on collaboration with stakeholders and a clear regulatory path to completion. That regulatory regime must be regional in nature. Under current circumstances, such a regime will require federal leadership.

WIRES has proposed a pragmatic redesign of federal regulation of the grid to address each of the challenges I outlined above. It is available on www.wiresgroup.com and I have attached it to this testimony.

"Smart grid" technologies may help reduce the difficulties of siting by obviating the development of new rights of way in many instances. Those smart grid investments will nevertheless encounter the same cost allocation and cost recovery problems that transmission already faces. Finally, if the vision of a clean energy economy with substantial contributions from renewable resources and electric vehicles is to be realized, it will be realized in part by a vibrant and liquid interstate bulk power market based on a platform of adequate transmission capacity.

Thank you once again for inviting me to make this presentation. WIRES looks forward to working with you, Mr. Chairman, and the Committee to attract investment to the transmission system. I will be pleased to take your questions.

ATTACHMENT

WIRES

OUTLINE OF PROPOSED PUBLIC BENEFITS GRID ENHANCEMENT INITIATIVE

Section 101. Purpose and Objectives

- To ensure electric reliability, fuel diversity, and rate stability across the grid.
- To reinforce, strengthen, and enhance grid infrastructure as an integrated network system.
- To advance the achievement of greenhouse gas reductions.
- To assist in reversing scientifically determined effects of climate change.
- To encourage development of location-constrained clean energy resources.
- To implement renewable portfolio standards and climate change legislation.
- To take maximum advantage of "smart" technologies to promote grid improvements, energy efficiency, and demand response.
- To improve correlation between the regional nature of the interstate high-voltage transmission grid and appropriate planning and siting regulation.

Section 102. Public Benefits Grid Enhancement Plan

A. Planning Requirement.

(1) All regions of the continental United States that are located within the Eastern Interconnection or the Western Interconnection must develop, and establish an entity to administer, a single comprehensive plan for the development of the interstate transmission system. Such regional planning process must be qualified under this section ("qualified planning process"). Each qualified planning process shall result in a regional transmission plan ("regional plan").

(2) A regional plan should (i) maintain and enhance the economic, reliability, and energy security benefits of the regional electric transmission system, including remediation of grid congestion, (ii) anticipate and facilitate development of electric generation from diverse energy resources, including the renewable resources and energy efficiency measures that help reduce greenhouse gases emissions from the production and sale of electric power in North America in all its applications, and (iii) integrate consideration of whether proposals to expand and upgrade high voltage transmission will promote service reliability, minimizing congestion, market integration and efficiency, economic development, deployment of smart grid technologies, and the clean energy goals of renewable portfolio standards and national climate change policy.

B. Regional Planners.

(1) Each region must have an independent regional transmission planning entity ("regional transmission planner") to administer the transmission planning process qualified under this section.

(2) A regional transmission organization ("RTO") or other regionally-based planning structure [*e.g. WestConnect or the Bonneville Power Administration*] with an established regional transmission process may be the regional transmission planner and any existing regional transmission planning processes shall be qualified and approved under this section, provided they meet the requirements of this section.

(3) In regions where no RTO or other qualified regionally-based transmission planner and no qualified planning process exists as of January 1, 2009, the

Federal Energy Regulatory Commission ("FERC") will direct public utilities and transmitting utilities, as defined under the Federal Power Act, to create an independent regional transmission planner and appropriate planning processes, to be effective not later than 18 months after enactment, to carry out the transmission planning purposes of this section. Federal utilities and power marketing administrations must conform their transmission plans to the regional plans developed by the regional planner and the requirements of this section or otherwise participate in a qualified planning process in accordance with this section.

C. Criteria for Planning Processes

(1) At the time of initial submittal of a regional plan formulated pursuant to this section, FERC shall examine whether the regional planning process developed and administered by the regional transmission planner conforms to the goals and requirements of this section. FERC shall ensure any such process –

(i) is non-discriminatory, independent, and developed in conformance with the planning standards of Order No. 890 and any successor order;

(ii) has actively solicited and considered the views and other direct inputs of local and state policymakers and market participants;

(iii) is sufficiently broad in geographic and market scope to produce economic and operational efficiencies;

(iv) is designed to meet the need for timely high voltage transmission upgrades or expansions; and

(v) has taken into account all applicable laws and regulations governing the procurement of generation, the potential effect on the transmission system or the regional transmission plan of rejection or withdrawal of a transmission project, the development of transmission facilities not originating within the planning process, and the availability of non-transmission resources such as the opportunities for energy efficiency, demand response, enhancements to economic dispatch, distributed generation, and installation of new control, metering, or capacity enhancement technologies.

(2) In considering the appropriate size and scope of a region for purposes of reviewing proposed transmission facilities under a regional transmission plan, FERC shall consider the optimal scope needed to ensure comprehensive planning and operational efficiency, the size and scope of existing RTOs and operating bulk power markets, and the ability of interregional coordination agreements to ensure a sufficiently broad planning process.

(3) FERC shall require that any regional transmission planner coordinate planning and cost allocation across regional boundaries within an interconnection, in order to ensure that the purposes of this section are achieved.

(4) Nothing in this section shall be construed as authorization to create multiple or overlapping planning processes for the same interstate transmission facilities.

D. Formulation and Filing of A Regional Plan; FERC Review of Determinations.

(1) A regional plan should be developed using standardized planning models for at least a 10-year planning horizon. Such plan may assess the potential for future transmission expansion based on a 15-year or longer horizon to facilitate in order to advance the next ten-year planning process. Determinations of the need for expansions and upgrades for the following ten year period shall be made at intervals not longer than every three years.

(2) Each regional planning entity shall file its current qualified transmission plan annually with the FERC. Such filings will be informational in nature, except to the extent that any regional transmission plan makes proposed findings and determinations under subparagraph (3). The FERC shall make all filed plans publicly available.

(3)(i). As part of the qualified transmission plan, the regional transmission planner shall identify and file with FERC under section 205 of the Federal Power Act any proposed regional transmission expansion and upgrade that it determines to be required by, and consistent with, the public convenience and necessity ("PC&N").

(ii) A proposed determination of PC&N by the regional transmission planner shall be based on whether a transmission expansion or upgrade is or will be: (a) necessary to ensure regional compliance with ERO reliability criteria or remedy reliability violations for a period of not less than five years; (b) necessary to provide significant relief from congestion as measured by objective criteria including the total cost of congestion, hours of congestion and the lack of adequate alternatives; (c) important to the diversification of energy supply throughout the region and the achievement of national climate change goals and the goals of state or national renewable portfolio standards; or (d) important to the development of smart grid technology that achieves the purposes of Title 13 of the Energy Independence and Security Act of 2007on a regional basis.

(iii) A FERC decision under the FPA to approve or disapprove any proposed determination of PC&N by a regional transmission planner under this section shall be the exclusive and dispositive determination and finding with respect to the need for any proposed transmission expansion and upgrade. FERC may treat multiple proposed projects in any regional plan as severable for purposes of determining whether a specific proposed transmission expansion or upgrade is in the PC&N.

(4) FERC shall give substantial deference to any proposed determination of the regional transmission planner that is fully supported and based on the criteria set forth in subsection (3) and shall approve any such determination that is based on substantial evidence that the transmission expansion or upgrade meets the public interest in terms of its engineering and economic characteristics and the criteria of subsection (3). Such approval will be subject to judicial review on the limited basis of substantial evidence.

(5) Consideration of a proposed PC&N determination regarding a transmission expansion or upgrade under this section is categorically excluded from review under the National Environmental Policy Act of 1969, provided an environmental assessment or environmental impact statement is required to be prepared under state siting laws. Such exclusion shall not apply to FERC actions taken when

FERC is authorized or required under Section 103 to site a transmission expansion or upgrade. FERC may adopt, wholly or in part, any draft or final Environmental Impact Statement issued by the regional planner. Nothing in this subsection shall be construed as prohibiting preparation of joint environmental review documents by agencies with authority over the siting of a transmission expansion or upgrade.

E. Cost Allocation; Cost Recovery.

It is the sense of Congress that FERC should require all high voltage transmission cost allocation processes and methodologies to adhere to a clear consistent set of regulatory principles, including as appropriate that the costs of any transmission expansion or upgrade shall be allocated consistent with the range and distribution of benefits within the region that are provided by such facilities. FERC may initiate a rulemaking to establish such principles.

F. Definitions.

(1) "Clean energy" and "Clean energy resources" means any low-carbon or alternative energy production facility or geographic "zone" of such potential facilities that contributes to achievement of the climate change goals of this legislation, including renewable energy (wind, solar, biomass, geothermal, landfill gas, marine, hydrokinetic and incremental hydro [see definitions in HR 4059]), nuclear energy, and coal-based generation technologies accompanied by carbon sequestration.

(2) "Beneficiaries" includes customers, market participants, and other entities or persons determined under the regional transmission plan to benefit from a transmission upgrade, enhancement, or expansion. Such benefits may be demonstrable economic benefits, improvements in service reliability, or reductions in greenhouse gases.

Section 103. NIETC Modernization

A. Federal Back-Stop Siting

(1) The entity proposing to construct transmission facilities included under a regional plan must apply for authorization to the siting authorities of the state or states in which the facilities would be located.

(2) Section 216 of the Federal Power Act is revised principally to eliminate the designation of national interest electric transmission corridors and the triennial congestion studies as described in section 216(a), to be replaced under this Act by determinations under regional plans.

(3) Section 216 is also revised to authorize the FERC to issue construction permits for any transmission expansion or upgrade determined as part of a regional plan submitted pursuant to Section 102 and approved by FERC to be required by, and consistent with, the public convenience and necessity, provided the FERC finds that it is authorized to issue such permits under section 216 (b)(1)-(6) of the Federal Power Act.

B. Exclusive State Siting Authority

States shall retain exclusive authority over siting of transmission facilities that are: (1) designed only to replace or update existing facilities; (2) determined by the regional transmission planner not to provide regional economic and reliability benefits; or (3) not within the scope of FERC authority as contemplated under Section 216 of the Federal Power Act, as revised.

Section 104. Clean Energy Bank

A. In the event that a federally-backed Clean Energy Bank [per S. 2730, sponsored by Sen. Domenici or S. 3233, sponsored by Sen. Bingaman, or a melded version of those two bills] is established as an independent funding entity to ensure the development of a domestic clean energy technology industry, such entity is hereby authorized to assist in the financing of transmission projects that (1) are determined to be in the public convenience and necessity under a qualified regional transmission plan, and (2), assist in the development of transmission and location constrained clean energy resources. To the extent possible, the Clean

Energy Bank will seek to ensure the simultaneous funding and development of the supply resource and the transmission resource.

B. The Bank, at its discretion, may use any or all funding mechanisms available to it, including, but not limited to direct loans, credit support such as loan guarantees and letters of credit, or insurance to support the development of projects determined to meet the requirements of Section 104(A).

The CHAIRMAN. Thank you, Mr. Hoecker, very much.

So that completes the time for opening statements. We will now turn to questions from the Select Committee. The Chair will recognize himself for a round of questions.

Mr. Casey, let me come to you. You were pointing out 80 percent of the benefits come from one side of the equation and 20 percent come from the other. Can you expand upon that, explain to us exactly what it takes? Let's just go to the 80 percent. What does it take to gain 80 percent of the benefits?

Mr. CASEY. Yes, Mr. Chairman. The 80 percent in this study comes from approximately half from system optimization, which is the various functions that make the electricity flow more efficiently across the grid.

So that is energy efficiency or grid efficiency, making sure that the voltage is proper, making sure the current is proper, making sure the balance between the channels is all appropriate, making sure that when there is a transformer that is degrading, it is recognized and either fixed or electricity is routed around it in the case of an outage and so on. So that is system optimization. That is about half of that 80 to 85 percent.

The other half of the 80 to 85 percent is that the renewables cannot really reach their full potential without having more intelligence in the grid to allow them to be managed and dispatched, as we talked about before.

So half of it is from the grid wires itself, and half of it is from what a smart grid will do for renewables.

The CHAIRMAN. And how much of that, Mr. Casey, do you think is going to be as a result of public monies having to be spent or just a different regulatory framework in which the marketplace is responding, as it did in the telecommunications field after the changes that were made that made it possible for MCI and Sprint—that is when you and I were working together in the 1970s—to be able now to gain better access to the network? How would you divide that question? And how much money do you ultimately think comes out of the public sector and how much out of the private sector?

Mr. CASEY. I think that the money in the stimulus package will determine the answer to that question. I believe that the approximately $11 billion that is set aside in the stimulus package for smart grid or energy efficiency measures is now sitting at the DOE. And the DOE is going to have to decide how to allocate that.

If they allocate it in ways that allow, as Mr. Gilligan said, solutions to be adopted at scale that can actually show the benefits of these various technologies that we are talking about, then I think the market itself will take off. And you won't need any more public money.

It will have to be, as several people on the panel have mentioned, there have to be regulatory changes because, as you remember from those days, Mr. Chairman, regulated rate-based monopolists don't have a lot of incentive to be efficient.

The CHAIRMAN. I think I remember that.

Mr. CASEY. And in telecom, what happened was technology developed. And new entrants came in. The new entrants were MCI, Sprint, and all of these people.

There is no competing long distance set of carriers. There is no cable television industry that can offer VOIP channels to consumers to give them a choice. There is no wireless alternative to give them a choice. So the economic structure of the electricity industry I think is different.

But if the regulatory regime allows them to make money by investing capital in technology that will produce efficiencies, then I think they will do it. And consumers will save money. And the society will be better off because we will be much greener.

The CHAIRMAN. All right. And then expand upon that. Talk a little bit about, then, the ability if we get this right to use renewable energy electric generation as part of the electric vehicle revolution.

Mr. CASEY. I think there will be an electric vehicle revolution, in fact. And I think it will happen faster than other people think it will happen. I think solar and wind and distributed generation at homes and in backyards, I think that is going to happen.

All of that needs a couple of things. The economics of the electric industry right now is very, very simple. They invest money. They get a return on it. They make the return by charging number of kilowatt hours sold times pennies per kilowatt hour.

So if we conserve as consumers or if government wants a conservation policy, what that means to an electric company is they get less revenue, but they don't have a corresponding amount of costs. As an investor-owned utility, they can't possibly do that. It is not right.

So the energy, the way they make money has to be altered. And that is complicated because their regulation is basically on the state level, which was another problem in telecom. And it was resolved in that sector.

The CHAIRMAN. My time has expired. I will just make this point that in the 1970s, there was just this confluence where I was a graduate of Boston College, Mr. Casey was a graduate of Boston College, three of the FCC commissioners were graduates of Boston College. And we all agreed.

Mr. BLUMENAUER. It was a conspiracy.

The CHAIRMAN. And, by the way, there was no course at Boston College on this subject. But we all agreed that it wasn't a good idea for our mothers to have to rent a phone for three bucks a month and to have everyone every time there is a long distance call to yell, "Grandma is on the phone long distance. Run to the phone."

Why is that the case? Because one company, one utility had 1.2 million employees, AT&T, and these little companies, MCI and Sprint, wanted to get into the business. So we changed the rules. And that was the rules. We changed the dynamic for the deployment of this telecommunications network, Mr. Casey.

Mr. CASEY. And we were all very concerned that our mothers would know that we were allowing that to continue, too.

The CHAIRMAN. It is exactly right. It was all driven by the same kind of guilt that Mr. Zimmerman is now inducing in people at Wal-Mart. Okay? [Laughter.]

And that is always the most powerful admonition that grips your brain.

Let me turn now and recognize the gentleman from Oregon, Mr. Blumenauer.

Mr. BLUMENAUER. Thank you, Mr. Chairman. I would like to just pick up where you left off because for me, that is the single most important element that is woven through the testimony here today.

I have no doubt that there are tremendous potential efficiencies to be wrung out of the existing system, whether it is design of turbines or just figuring out for people who don't have the benefit of scale of a Wal-Mart, say, and don't have the focus as well to be able to take advantage of it.

The colloquy between you, Mr. Chairman, and Mr. Casey, about what we do with the regulatory system because ultimately we need to incent the billions of decisions that are made every day by American consumers and the businesses that serve them and, dare I say, government itself, to be able to respond to the potential benefits, I was struck by what we have heard from GE and have been impressed with people from your organization. The IBM story I think is stunning in terms of your 45 percent reduction, Wal-Mart, the benefits of scale and focus. One of the things that is an unsung success story, you have done it in transportation, what you have done in energy consumption.

I wonder if our panelists, particularly those from these three major institutions, could follow up on the conversation, Mr. Chairman, between you and Mr. Casey to talk about the regulatory incentives that you could envision that would help change those billions of individual decisions.

Can you see a large organization like a GE or a Wal-Mart being empowered to negotiate an energy conservation tariff to be able to get even deeper greener? Can you foresee a differential rate of return for a private utility and their customers for investments that will save energy over time so maybe we incent that, so they invest capital in time and energy and the customers are motivated, not bey altruism, not by rules and regulations, although we think that people will be motivated by what is good for the planet and there is a role for appropriate rules and regulations? But can you talk about regulatory carrots that would make a difference to your three institutions?

Mr. GILLIGAN. I will start if that is okay. I think that there are demonstrated models in the utility sector today that do encourage investment in efficiency.

If you look at the State of California, where there is decoupling, there is encouragement for investment in efficiency. And because of that, we have seen the rate of growth in per capita electric use at about 50 percent. California is running at about 50 percent the rate of growth of the rest of the nation. So the decoupling process has been effective.

In some way, we need to encourage driving efficiency and incent utilities to invest in efficiency as if they were investing in new generation. Decoupling is one mechanism. I think there is a second challenge, though.

My experience around this industry is it is a conservative industry. And regulators are very conservative about spending people's money on new technology. So we need to think about, how do you encourage a given utility to be one of the first to adopt new technology?

Mr. BLUMENAUER. And I am mindful. I want to be short because I think my other colleagues want to speak. And so I won't flog this, even though I had a couple of extra minutes in my questioning. So what I would like to do is just follow up with each of you in terms of having something in writing.

But, Mr. Gilligan, what I am interested in—I want to be clear, and my friend Mr. Inslee has been a leader in his committee pushing decoupling. We have done this with legislation that I have been working on. But, rather than thinking of it as new generation, I am wondering if we can think of it as new lines of business for the 4,000 power, gas, sewer, and water utilities across the country, that they can think about the partnership with you incented by appropriate regulation as actually a new line of business that could be developed.

I will yield back, Mr. Chairman, but I would be keenly interested in following up with each of our three witnesses for them to respond with the smart people they work with on how we deal with this interesting avenue that you and Mr. Casey opened up.

Thank you, sir.

The CHAIRMAN. Thank the gentleman. And if you would respond in writing, then we will make sure that each of the members receives those responses.

The Chair recognizes the gentleman from Washington, Mr. Inslee.

Mr. INSLEE. Thank you. Thank you.

Mr. Hoecker, I wanted to ask about the need for additional federal action and/or state action on siting, planning, and financing grid improvements. I just would like you to address the urgency of that, which is kind of a rhetorical question, but I would like you to talk to us about why quick action is appropriate if you believe it is; and, two, how you would fashion the federal-state relationship in that regard.

Mr. HOECKER. Well, thank you, Congressman. I appreciate that softball. And we could talk quite a while about this. It is widely acknowledged that the existing transmission system is aging in many respects, that it doesn't reach areas where renewable energy is plentiful, that it is under a good deal of stress, and that we are looking at an increase in electricity demand of up to 30 percent over the next 20 years or so.

Now, a lot of the technologies we have been talking about will be able to help manage that load and perhaps reduce it, make it more efficient. But the electric transmission system is an enabler, not only of these technologies but our access to renewable energy and service reliability that will enable our economy to recover.

I think we are looking at a pivotal moment in the history of the grid. We are moving to new technologies, where we are putting more demands on this network infrastructure. And we need to think about it holistically.

The history of this industry is rooted in the early part of the last century in very discrete systems, where generators were built close to load and the only transmission was to interconnect it to over relatively short distances.

Now we have an emerging, highly integrated bulk power system. And it is being asked to do things that it wasn't designed to do.

So in order to expand that system, make it smarter, employ new technologies, we need a larger regional planning either institutions or procedures. We need to take a hard look at the siting of transmission, which happens on a state-by-state basis right now. And WIRES is not advocating that states be excluded from that.

But when we look at whether particular transmission facilities, especially extra high voltage facilities that are 345, 500 kV and above, that have regional impacts and perhaps even cross state lines, it makes no rational sense for the developer of those facilities to have to engage in procedure after procedure after procedure in multiple states in order to get authorization or recognition that the facility is needed.

So we need to step back and take a look at this large machine and plan it on a regional basis, site it in a more efficient fashion, and allocate the costs in recognition of the fact that the high voltage transmission system has regional beneficiaries, not just local beneficiaries.

Mr. INSLEE. So we are going to have a draft of a bill I would appreciate your input on here in the next few days. I hope that you will help us take a look at that.

Mr. HOECKER. I would be delighted.

Mr. INSLEE. Thank you.

Can the panel address this issue of electrifying our transportation system? I think we are moving substantially in that direction. I saw, I think it was, Battelle Research that showed we could essentially power our transportation fleet or 85 or 90 percent of it without additional generating capacity. You could essentially use existing generating capacity at night, if you will, to charge our autos.

Is that accurate? And what does the electrification of the auto industry portend what we need to do in the grid in general?

Mr. SCHURR. If I could take a stab at that? We have done quite a bit of looking at the electric transportation impacts on the electric grid. EPRI's studies support what you described and that there is substantial off-peak capacity that would support large-scale conversion of passenger vehicles to electric transportation, whether they be plug-in hybrids or battery electric vehicles.

One of the challenges is that there is not enough garage capacity for everybody to park at night. Only about one in five cars parks in a residential garage that they own overnight. And so we think that there is also a challenge of public charging, which will not always be between the hours of—you pick it—10:00 p.m.–6:00 a.m., when there is a lot of both generation capacity and transmission and distribution capacity.

So ultimately electric transportation is going to require smart grid intervention in order to manage charging in public situations and particularly during the daytime, where it is not just a matter of the bulk system having enough capacity but even lots of clustering of vehicles which might occur at a transit station or a place of employment. It will be critical that smart charging is part of and pricing signals are part of the ultimate scale-up of electric transportation.

I mentioned today that we are working on a project where we are integrating wind with that smart charging to really create the ultimate in clean recharging.

Mr. INSLEE. Thank you.

The CHAIRMAN. The gentleman's time has expired.

Here is where we are. We have three roll calls on the floor. We have approximately seven and a half minutes left to go, which will allow me to recognize Mr. Hall for all of his questions. We will then recess the hearing and then reconvene in approximately 20 minutes and then have approximately a 20-minute conclusion to the hearing—okay?—so everyone knows that there will be an opportunity for more questions and for Congresswoman Speier to also ask her questions.

Congressman Hall.

Mr. HALL. Thank you, Mr. Chairman. I will just ask one question of Mr. Hoecker, if I may. And thank you all for your testimony. It was very interesting.

Mr. Schurr, your company is the largest employer in my district. Although you are not based there, I am happy to say that IBM is a strong presence in New York's 19th District.

Mr. Hoecker, if superconductor technology is viable, is it viable? And if so, why would we consider building new transmission lines out of anything else, particularly copper line technology that is 50 to 100 years old, as some of you said?

Put another way, why go to the trouble of building a new Twenty-First Century smart grid with essentially a Nineteenth Century backbone?

Mr. HOECKER. Thank you, Mr. Hall.

I guess I would characterize superconductive research, such as that done by American Superconductor, as in the demonstration stage. This is very leading-edge technology. There aren't many facilities to produce it. And its response if installed in large quantities is not entirely clear yet.

They are about this big. You can bury them in the ground. It is super-cooled with liquid nitrogen. It is impressive. It has got enormous potential because you can deliver massive amounts of power in a relatively short space. That at least is the concept.

I think we will find in the coming years ways to prove this technology and to begin to install it, but this is a process.

And right now undergrounding any transmission in these kinds of facilities, in particular, is very expensive. And so I think we are looking at some long-term goals for installing some very, very beneficial technology, but I think we are at the beginning of that process, not at the end of it.

Mr. HALL. Thank you. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Well, Congresswoman Speier, we could recognize you for three minutes right now if you would like.

Ms. SPEIER. Thank you, Mr. Chairman.

I had just visited, just last week, a new company in my district called Green Box. They are actually creating the software to allow the homeowner, the consumer to assess all of their electrical equipment in their homes and make determinations on whether or not they should be taking it, unplugging them or not.

So my question is it sounds like we already have the technology. We have the smart grid technology. We have the technology to be put in our homes in the form of software to really change behavior in a dramatic way. So what is preventing us from getting there?

Mr. ZIMMERMAN. Speaking from someone who has to pay for everything that we do, it is first cost. I mean, it is a hard struggle for consumers, for other businesses to look at all the life-cycle costs and savings associated with these investments and in today's environment, making that significant first cost is just extremely difficult for people.

Ms. SPEIER. But if the smart meters indeed over 20 years pay for themselves by virtue of just the manpower you don't have coming out to read the meters, if the software is readily available and is going to save people money from day one literally, to me, it——

Mr. ZIMMERMAN. Right. It is positive cash flow from day one. All of the initiatives that we have employed the last few years, we are typically seeing two to three-year paybacks. So it is not a hard decision if you look at those costs.

I can't speak for other companies, but it must just simply be the availability of that capital right now in these times of the incentives.

The CHAIRMAN. I apologize, but there are now only two minutes left to go to walk about a quarter of a mile, which would be a good task. But if the gentle lady would like to return, we will have more questions in approximately 20 minutes.

And, by the way, this is Congresswoman Speier's first hearing. She is the newest member of the Select Committee on Global Warming and Energy Independence. And she has an outstanding record on these issues in California. And we are looking forward to her participation on this incredible adventure we are on this term.

So we stand in recess for approximately 20 minutes.

[Brief recess.]

The CHAIRMAN. We welcome you all back to the Select Committee on Global Warming and Energy Independence. We just had a brief interlude while the members could cast their votes on three different issues out on the House floor. We have got a brief period of time here where we can continue the question and answer period.

I would like to ask Ms. Brostmeyer, if you could, to relate what you are saying to what Mr. Casey is saying about the network and how what you are testifying about is related to this larger revolution.

Ms. BROSTMEYER. Okay.

The CHAIRMAN. If you could, please turn on the microphone.

Ms. BROSTMEYER. I would be glad to do that. Thank you.

Yes. The chart that I showed—and I did take the liberty to put that up there—shows that 65 percent of the energy is lost in inefficiencies. This is actually in the power plant itself. There is also a value here for transmission and distribution losses on the same chart. So you can see that that is also a loss.

So we are both talking about losses, inefficiency, which can be helped. If those losses are reduced, then we will be able to deliver more power with our existing infrastructure.

So I think we are the same in that regard. And we also are the same in that we feel there is some technology that needs to be accomplished here. In our case, we feel that technology to create retrofitable kits is a very relevant part of our energy solution or must be. And in that case also I believe that are some technologies. And I don't know a lot about the subject, but it sounds like an investment is really required to optimize the grid.

The CHAIRMAN. Okay. Thank you.

Back to you, Mr. Casey. You were talking in terms—I think Mr. Gilligan as well made reference to the stimulus package and how the use of that money might demonstrate how this would work, although you made earlier reference to the fact that in Boulder, Colorado and other locations, it is already happening.

What can we learn from what is already occurring in these communities? And what more could we learn from investments made by the stimulus package?

Mr. CASEY. The two deployments that are in commercial operation in the United States, one in Dallas and one in the smart grid city in Boulder, are relatively small.

The CHAIRMAN. When you say, "relatively small," what do you mean?

Mr. CASEY. Dallas, the network covers 125,000 homes. In Boulder, we are in the middle of building it. We are at probably 25,000 now and heading to 50,000 just within the City of Boulder itself.

Those two networks are showing us that the conservation benefits that we talked about and the efficiency benefits that we talked about are real, that they are achievable.

What the stimulus funding will do is it will overcome for other utilities the regulatory impediments to them making the same decision to start deploying in their territory.

The CHAIRMAN. May I ask you, what level of satisfaction do Dallas and Boulder have in their experiment thus far?

Mr. CASEY. Obviously I don't want to put words in their mouth, but the CEO of the Dallas utility wrote a letter to the chairman of the Texas Public Service Commission when we gave him our early reports, saying, "We have just experienced a Neil Armstrong moment in electricity."

The CHAIRMAN. And this is in Dallas?

Mr. CASEY. In Dallas.

The CHAIRMAN. Talking about something that happened in Houston? That's a big moment.

Mr. CASEY. In Dallas, yes.

The CHAIRMAN. That is what I am saying.

Mr. CASEY. Right.

The CHAIRMAN. That is a big moment. That is a huge——

Mr. CASEY. That is right, exactly.

The CHAIRMAN [continuing]. Analogy concession, yes. Are they expanding upon that? In other words, is the success in Dallas and Boulder being built upon in Dallas?

Mr. CASEY. In Dallas, while we were building the 100,000, the Texas Public Service Commission issued an order requiring that all of the utilities within the State of Texas enable all homes within their service territory with smart meters that had direct connect/

disconnect capability. And that was going to cost some hundreds of dollars per home times some millions of homes. And so——

The CHAIRMAN. And that would be made, then, part of the rate base?

Mr. CASEY. Yes, that would be made part of the rate base. In fact, they were allowed to charge a premium, a surcharge, to recover that investment. And so Encore basically stopped the 125,000 homes and said, "Look, we have to go do this now. And so then we will come back."

In Boulder, they are working on it. And they have the same issue that they have committed to do 50,000 homes in Boulder. But then they intend to stop to assess whether the benefits were what they had hoped they would be. And so far they have been. But then they have to go to their regulators and ask for rate recovery for the investment because they can't risk so much capital without some regulatory approval.

The CHAIRMAN. So as you and I remember, back in the 1970s, U.S.Tel—a lot of these companies came out of Dallas——

Mr. CASEY. Right.

The CHAIRMAN [continuing]. The competitive telecommunications companies that were stymied. Is that a phenomenon that we are seeing in Texas right now, that this experiment in Dallas is now being embraced by the state PUC and is now something that we can expect other states to look at?

In other words, what are we learning from Texas in terms of that being the laboratory? We are passing a federal stimulus for these kinds of experiments, but it seems as though Texas had already been moving, notwithstanding the stimulus package.

Mr. CASEY. They did, but the business structure in Texas was very different from any other business structure. In Texas, we built the network ourselves. We paid for the manufacturing of the equipment. We paid to have it installed. And we were going to offer broadband internet access to consumers, plus sell smart grid services to the electric utility.

So it cost them nothing to do it. And we were going to make our money back by selling broadband. DirecTV was actually our partner in Dallas marketing broadband internet access to consumers.

The CHAIRMAN. I see.

Mr. CASEY. So as long as they had no risk and no financial, you know, they could take a chance. But even at that time, they stopped when the commission told them to install meters. They stopped this market deployment because they had to go to install the meters.

In Boulder, Xcel Energy is funding part of it, but their willingness to risk funding is limited. And so when they hit that limit, they will stop until they get regulatory approval.

The CHAIRMAN. So the stimulus is needed, then?

Mr. CASEY. I believe until these are established, it absolutely is essential to get these other utilities to start the process where they become familiar with the benefits themselves. They can then take the data from those experiments and show it to the regulators. And then the regulators can move forward with the structure.

The CHAIRMAN. So you think that once the individual utilities and individual PUC members become familiar with these concepts, then they embrace it and begin to implement it as a state strategy as well?

Mr. CASEY. I think they will when they see the benefits, yes. I think the relative benefits of meter-only installations—and I will take two examples from the State of California. San Diego Gas and Electric received authority to invest $650 million in meters and proposed a $692 million benefit. The net value difference between the cost and the benefits was $40 million.

I think SoCal Edison in California has regulatory approval to invest almost $2 billion in meters. And the value, the net value of that investment, is $9 million.

We have a study that Booz Allen and KEMA and other utility executives have done with us where the benefits of a smart grid are $3 billion. The net present benefits of a smart grid are $800 million.

When regulators see that and see the benefits that are that significant, I think they will be willing to create structures to make it happen. But right now it is an argument. And they need to see it.

The CHAIRMAN. Just an argument. Well, we do have kind of an eastern United States grid and a western United States grid and a Texas grid.

Mr. CASEY. Right.

The CHAIRMAN. And Texas likes it that way. They see themselves as the lone star grid. So we are getting some of the benefits here of this experimentation which is going on there.

Mr. Gilligan, could you comment here on what Mr. Casey is saying in terms of how you view this? Are you familiar with this Dallas experiment and Boulder?

Mr. GILLIGAN. We are familiar with both. We are not participating in either one of those today. We are working with other utilities in other areas.

What we see is very similar. The return on investment for meter reading alone is insufficient to justify the investment. You need to get the benefits——

The CHAIRMAN. Can you say that again? That is a very important sentence for everyone to hear.

Mr. GILLIGAN. Yes. The infrastructure investment to put in place advanced meter infrastructure, the benefits for meter reading alone is insufficient to justify that investment.

The CHAIRMAN. What would make it sufficient, Mr. Gilligan?

Mr. GILLIGAN. You have to use that infrastructure to do demand response, so be able to send pricing signals to the consumer that allows the consumer to shed power, shed load, and get rewarded for doing that, for using the devices in off-peak power times. We also need to use that communication —

The CHAIRMAN. Shed load in off-peak power time. Now, can you try again to put that into English so that your mother would understand what you are working on every day?

Mr. GILLIGAN. Okay.

The CHAIRMAN. Can you do it for her?

Mr. GILLIGAN. Yes.

The CHAIRMAN. Okay.

Mr. GILLIGAN. So how do we levelize the use of power across——

The CHAIRMAN. You would use that word with your mother? Really? [Laughter.]

Mr. GILLIGAN. Sure. Sure.

The CHAIRMAN. Come on. No. Try again. Try again. You are talking to your mother. "What are you doing? What do you doing today?"

Mr. GILLIGAN. We are working to get a more efficient system.

The CHAIRMAN. Okay.

Mr. GILLIGAN. Okay?

The CHAIRMAN. "How does that help me?"

Mr. GILLIGAN. By allowing you to share in the benefits of that efficiency. So use power when it is cheaper.

The CHAIRMAN. Where are you from?

Mr. GILLIGAN. From Atlanta.

The CHAIRMAN. How does it help me in Atlanta?

Mr. GILLIGAN. If I can use power when it is cheaper in Atlanta, I will do that. But I need the utility to be able to tell me when the power is expensive and when it is cheap so that I can act appropriately. So the demand response is part of that opportunity.

The CHAIRMAN. I know. But your mother is saying, "Bobby, Bobby." [Laughter.]

Mr. GILLIGAN. She hasn't called me that in a long time.

The CHAIRMAN. I know she hasn't. She is watching right now on C–SPAN. They are broadcasting this. And she can have a copy of it. So what exactly are you asking for this utility? What utility is she using right now?

Mr. GILLIGAN. I have no idea.

The CHAIRMAN. Oh, she doesn't live in Atlanta.

Mr. GILLIGAN. No, she doesn't.

The CHAIRMAN. That is right. There are not many Gilligans down there. No.

Mr. GILLIGAN. No. They are up in the Northeast.

The CHAIRMAN. Where are the Gilligans living?

Mr. GILLIGAN. They are in Massachusetts.

The CHAIRMAN. There you go. [Laughter.]

I don't know why I thought that might be the case. We have the Caseys and the Gilligans and the Markeys all having a conversation here.

So explain it in Massachusetts terms to her. What community are you from in Massachusetts?

Mr. GILLIGAN. They are from outside of Boston.

The CHAIRMAN. Which is?

Mr. GILLIGAN. Cape Cod.

The CHAIRMAN. Cape Cod?

Mr. GILLIGAN. Yes.

The CHAIRMAN. What high school did you go to?

Mr. GILLIGAN. No. I didn't go to school there.

The CHAIRMAN. Oh, you did not?

Mr. GILLIGAN. No, I didn't.

The CHAIRMAN. So they moved there for the weather? [Laughter.]

Mr. GILLIGAN. Oh, yes. It is beautiful there.

The CHAIRMAN. Okay. So I will go to Mr. Casey. Then I am going to come back to you. Mr. Casey, can you try to take a whack at that question?

Mr. CASEY. The benefits of what we do are that you will pay less for electricity, and you will breathe. And your children will breathe, and your grandchildren will breathe.

The CHAIRMAN. Right.

Mr. CASEY. That is what I do when I tell my mother.

The CHAIRMAN. When you tell your mother.

Mr. CASEY. She thinks I am great. [Laughter.]

The CHAIRMAN. Yes. So, Mr. Schurr, would you like to take a whack at that question?

Mr. SCHURR. I would love to take a shot at that. My mother lives in Sacramento. It gets very hot in the summer. So here is how it works.

The CHAIRMAN. Okay.

Mr. SCHURR. On a hot summer day, when there are fewer resources available to generate power during those peak afternoons, if you are willing to exchange utilities' control of your thermostats for short periods of time,——

The CHAIRMAN. So for your mother——

Mr. SCHURR [continuing]. They will pay you money.

The CHAIRMAN. For your mother in the course of the day——

Mr. SCHURR. "You are not even there, Mom."

The CHAIRMAN. But you said "peak."

Mr. SCHURR. During the peak periods.

The CHAIRMAN. How would you explain it but not using that word?

Mr. SCHURR. So during the hot afternoon when power is in short supply, that is the peak.

The CHAIRMAN. Why is it in short supply in the middle of the afternoon?

Mr. SCHURR. Hot weather. Everybody runs their air conditioner at the same time. Office buildings are lighting at the same time.

The CHAIRMAN. Oh, good. Now you have got it. Okay. Now, her air conditioning, everyone else's air conditioning is running. Go ahead.

Mr. SCHURR. So if you are willing to exchange control of your air conditioner on behalf of the good of the community——

The CHAIRMAN. What do you mean "exchange control"?

Mr. SCHURR. Let the utility control——

The CHAIRMAN. Who will I exchange control with?

Mr. SCHURR. The utility.

The CHAIRMAN. With the utility?

Mr. SCHURR. Instead of——

The CHAIRMAN. You would give the utility control over her air conditioner?

Mr. SCHURR. For a short period of time.

The CHAIRMAN. Okay.

Mr. SCHURR. She will receive a payment from the utility——

The CHAIRMAN. A payment from whom?

Mr. SCHURR [continuing]. To reduce her bill.

The CHAIRMAN. From whom?

Mr. SCHURR. From SMUD in this case.

The CHAIRMAN. From whom?

Mr. SCHURR. Sacramento Municipal Utility District, the local utility.

The CHAIRMAN. And they will pay her to do what?

Mr. SCHURR. Just give them the right to do that. It is like an emergency supply.

The CHAIRMAN. And then they are going to turn down her air conditioner?

Mr. SCHURR. Well, in this case turn up the thermostat for just a few degrees over maybe an hour or two. And that peak load reduction is one of the other benefits.

The CHAIRMAN. That what?

Mr. SCHURR. Peak load. You don't like that word.

The CHAIRMAN. Try again. [Laughter.]

That what?

Mr. SCHURR. That hot afternoon.

The CHAIRMAN. Okay.

Mr. SCHURR. Load reduction——

The CHAIRMAN. Okay.

Mr. SCHURR [continuing]. Is one of the benefits that advanced metering gives to the utility, in addition to meter-reading reductions.

The CHAIRMAN. Just remember, all of you, that in order for us to pass legislation, we have to convince your mothers.

Mr. SCHURR. Understand.

The CHAIRMAN. Okay? Not whoever you do your PowerPoint presentations to. You know what I am saying? So that is the whole key to this story and how the testimony has to be.

Mr. Zimmerman, you talk to your mother. You are always thinking about your mother at Wal-Mart.

Mr. ZIMMERMAN. Actually, my mother passed away several years ago.

The CHAIRMAN. Oh, I am sorry.

Mr. ZIMMERMAN. But we do exactly already what was described here with several utility companies, all the way from giving them actual control through our system to make those adjustments to still the old-fashioned way. They call us and say, "Hey, between 3:30 and 5:00 tomorrow, can you shed 10 percent of your load from your stores?" And we can do that.

What the smart grid allows us to do is we are making those decisions maybe a day or two ahead of time. And then we get to that time. Maybe you didn't need to do it for an hour and a half. Maybe you needed to do it for two hours. But since we have manually programmed this, we are going to do it for that set time, for that set hour and a half versus with the smart grid that has been described, it will only occur during the time that it really makes sense and for the duration that really makes sense so it will always keep the system running at peak efficiency.

The CHAIRMAN. Okay. So, you know, my mother, she always said to me, "Eddie, you have got to learn how to work smarter, not harder." And nothing ticked her off more than these utility bills, nothing, or the auto insurance rate for my father, by the way, who never had an accident. But because we lived in Malden, he had a higher rate than a kid who had three accidents who lived in Winchester. It always used to drive her crazy.

So they are all experts on these things, but they don't talk about it in the terms that you are, their utility bills. So the deal that you are going to offer to them is a deal politically as well that we will change policies in order to benefit them. Right? And that is what we have to sell here politically and to put it into terms that they understand as they are talking to other people in their age group about these issues.

And they will go, "Why don't we do that? I have never liked the utility. I have always felt they were overcharging me. If this gives me an opportunity to save some money, then that is a great thing." Okay? And that is the pitch that we have to make as public officials to change the rules. And then IBM and GE and Wal-Mart all become beneficiaries of it, obviously, but we have to put it in those terms to win this argument.

So let's do this. There is a roll call again that has been called on the House floor. I am going to give everybody one minute to summarize for the record what you would like us all to remember from your testimony so that we can move forward.

Our intent is to obviously pass legislation this year in this Congress on these issues to add on to what was in the stimulus package and to look at it from a regulatory perspective, from a tax perspective. And anything you can do to summarize in terms of how you view the issue and what you think needs to happen would be very helpful to us.

So let's go in reverse order of the opening testimony. We will begin with you, Mr. Hoecker.

Mr. HOECKER. Thank you, Mr. Chairman.

My closing comment about electric transmission and the need to strengthen and upgrade the transmission grid is simply that it provides options, and it provides choices. If you have got a good, solid grid, you can use a preferred energy mix. You can access renewable energy. You can access the cheapest or the greenest power available. You can access emergency power. Your utility can integrate those variable resources we have been talking about. And you can serve new customers.

The electric transmission grid, as I said, doesn't solve all the problems, but everything we have talked about in terms of efficiency and clean energy can't happen without transmission and a stronger transmission system.

The CHAIRMAN. Thank you, Mr. Hoecker.

Ms. Brostmeyer.

Ms. BROSTMEYER. Thank you, Mr. Chairman.

Yes. The incorporation of turbine efficiency technologies is so important in today's discussion on clean energy. And I would like to really have that in everybody's mind when they think about green energy and how we should be moving to get more power as our power needs in the world increase.

Spar-Shell is one great example that our company has developed that would improve the amount of power available and also provide green energy because some of the new power generated would actually require no fuel to generate.

So my hope is that, going forward, when people think about green energy, they say, "Wow. The first thing we ought to do is fix those plants that are on the ground already, some of them 30 to 50 years old, and let Florida Turbine and other companies put some new technologies in them to make them cleaner, to make them create more power, up to 15 percent more power, without putting too much money into infrastructure.''

The CHAIRMAN. Thank you, Ms. Brostmeyer.

Mr. Zimmerman.

Mr. ZIMMERMAN. Mr. Chairman, Wal-Mart because of our scale represents one of the largest footprints in the world, about 750 million square feet. We have about 150 million customers walking through our doors in our U.S. stores every year.

The things we have done with energy efficiency and existing control technologies, we have the data that proves the results of those efforts and the paybacks. I think part of our role is to share that.

We already have relationships with NREL, Oak Ridge, DOE, and others, but we are the biggest laboratory that you could hope to find. We want to be partners in this discussion and share all of that.

And, in closing, I have just got to add one of the things we can't lose sight of is energy efficiency. It is still the lowest-hanging fruit. And, as I walked into this room, I looked up at the lighting. It is T12 fluorescents. We haven't installed a T12 fluorescent lamp in a Wal-Mart store in over a decade. We need to keep moving forward with energy-efficient measures.

The CHAIRMAN. Did you know that the Bush administration actually missed all 35 deadlines for improving appliances and lighting from 2001 to 2007?

Mr. ZIMMERMAN. Well, now is our chance.

The CHAIRMAN. Well, now is our chance, yes. They missed their chance. [Laughter.]

So, believe me, it is going to happen. That is a classic working smarter, not harder issue. You solve the problems with technology.

Mr. Schurr.

Mr. SCHURR. Thank you for the opportunity today to testify. I think my mother will also appreciate your exchange, and I will make sure she gets a chance to see it.

The CHAIRMAN. Thank you.

Mr. SCHURR. I think it is evident that the smart grid is needed for energy efficiency and renewables. All the testimony today came to that conclusion. Yet, there is a substantial amount of inertia in the market. We don't think that inertia is from consumers or voters.

We just finished a 5,000-consumer survey. They all want to be more involved. In fact, 90 percent of them said they want a smart meter, if you believe that. So we are sure that consumers are ready for this.

And I think you are right in describing that it is important that they understand what the benefits are and so forth, but this inertia is real. And I think the stimulus money will be excellent seed funding. It will get some areas started that otherwise wouldn't start. And we need to monitor that closely. And I think there could be an opportunity for additional funding to support what works.

And, finally, I think the DOE focus on standards would be a very helpful place to focus where standard acceleration, already it is working but it is working too slowly, would also be a place where we could make inroads.

The CHAIRMAN. And, Mr. Schurr, just in terms of talking about mothers, when Bill McGowan, who was the founder of MCI, came into my office in 1977 and started talking about another phone company, I was thinking, “Now, how is he going to do that? Will he build like three-foot-high phone poles all across America? How can you have another phone company? How can you have lower phone bills?”

So it took me about two months just to internalize this shift, but you have to explain it to people in ways that they then embrace that change and try to break the connection with the old way of doing business. So we thank you for your testimony.

Mr. Gilligan.

Mr. GILLIGAN. Thank you.

The smart grid is about enabling high penetration of renewables, both wind and solar. It is about more efficiency, less losses and waste in a delivery system. And, for my mother and consumers, it is about getting them information so they can make more informed choices about how and when they want to use their power to save money.

To accelerate this and to get the most beneficial use out of the stimulus money, we are recommending that we focus on really demonstrating these benefits so that the cost-benefit equation is clear to utilities and to regulators and that this investment continues to transform the grid well after the stimulus money is gone.

We believe that the technology is ready today and that the benefits are real, but it needs to be demonstrated.

The CHAIRMAN. Thank you, Mr. Gilligan.

Mr. Casey.

Mr. CASEY. Thank you, Mr. Chairman.

The smart grid, as we all have acknowledged, has the potential to reduce emissions by an enormous relative amount. One expert has estimated it to be the equivalent of taking 140 million cars off the road, a big impact.

It has been called the single most productive application of an information technology solution to climate change. Eighty-five percent of the carbon emission reduction benefits come from the grid and the operation of the grid.

So what is needed to make that happen? Part of it is a cost problem. We talked about that. Some of that can be solved simply by getting manufacturing volume. Some of that will be solved as technology innovates with deployment. But we need the stimulus package, the money that is now at the DOE. It has been given to them with somewhat flexible assignment. They have to disburse money to the programs that Mr. Gilligan talked about where we can prove this.

Regulatory changes in the states need to be made so that the utilities, who are the ones who are going to deploy this equipment, actually can make money at it, instead of lose money. And I think standards as well are an important element.

The CHAIRMAN. Great. Well, we thank each of you for your testimony today. This is a very important hearing going forward. The revolution that is now under way is something that we have to speed up. We have to make it happen faster.

It will create more jobs. It will help with our environment if we can electrify the cars that we drive, back out the oil that we import from OPEC, and make our whole system of producing goods in our society more efficient while reducing the price of electricity for people at home.

So this is win-win-win-win-win-win. But we have to really try to work hard now to get this done. And while my mother passed away ten years ago, her admonitions still grip my brain. And she gave me an agenda, as each of our mothers do, for what we should be doing every day. And so my intention this year is to make this revolution become something that is national and not just localized.

We thank each of you for your testimony today. Thank you. This hearing is adjourned.

[Whereupon, at 12:06 p.m., the Commmittee was adjourned.]

Written Responses of Tom Casey to Follow-up Questions for the Record

Tom Casey

Chief Executive Officer

CURRENT Group, LLC

Before the House Select Committee on Energy Independence and Global Warming

"Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions."

June 12, 2009

WRITTEN RESPONSES TO QUESTIONS FOR THE RECORD FOR TOM CASEY, CHIEF EXECUTIVE OFFICER OF CURRENT GROUP, LLC

CURRENT Group, LLC ("CURRENT") hereby submits the written response to the follow-up Questions for the Record for Tom Casey, Chief Executive Officer of CURRENT.

1. What steps can Congress take to reduce the time to deploy smart grid technologies?

Response: The electric utility industry must be a central element of the nation's program to reduce carbon emissions. Congress has repeatedly recognized the industry's vital role and encouraged the adoption of Smart Grid solutions, including in Title XIII of the Energy Independence and Security Act of 2007 which among other things made Smart Grid the policy of the United States and in the American Recovery and Reinvestment Act of 2009 (ARRA) which provided funding for Smart Grid projects and encouraged the development of open standards.

Under traditional rate base regulatory models, prices are determined by forecasting how much revenue is necessary to cover a utility's operating expenses and to produce an adequate return on the capital such utility has invested in the regulated business. Usually, revenue is the product of the number of kilowatt hours sold multiplied by the price per kilowatt hour. Decreases in the amount of power delivered to customers (and therefore the amount of carbon emitted in generating that power) can be achieved through increases in efficiency in the transmission, distribution and use of electric power or by reductions in demand. Both of these results are essential to the nation's climate goals; both require a utility to monitor and manage its grid (through a Smart Grid) and, under a traditional rate base regulatory model, both would result in a utility losing money because a utility must pass operating efficiency gains on to the customer.

Thus, unless the incentives created by traditional rate base regulation are changed, there is no reason to believe that a for-profit entity will (or should) spend money in order to earn less. Additionally, because a utility can earn a much higher rate of return on new generation plants or on new transmission lines than on conservation, a utility is incented to spend more capital on such traditional assets. One utility has publicly acknowledged that "the real risk in a true coal-to-cool-air, wind-to-light implementation of the smart grid is that these technologies that transform conservation and efficiency efforts can lead to degradation of the regulated return and uncompensated demand destruction."[i]

Utilities traditionally are also subject to after-the-fact state regulatory review of their investment decisions. A utility faces the realistic prospect that cost recovery for an investment could be denied in a rate-making proceeding that occurs several years after the utility has completed its investment. This is one reason that regulated utilities are often averse to adopting new and innovative technology (utilities rank near the bottom of all industries in research and development spending as a percentage of sales[ii]) and may delay investment in Smart Grid technology absent prior regulatory approval. In addition, utilities typically received no higher rate of return or incentives for the effort of implementing new technologies and thus tend to focus on a business as usual approach.

Today, the electric grid, especially the local distribution system, which is the part that directly serves our homes and offices, works much the way it did 50 or even 100 years ago. As Dr. Michael W. Howard of the Electric Power Research Institute (EPRI) testified before the House Subcommittee on Energy and Air Quality, a Smart Grid combines millions of sensors throughout the grid and an "advanced communication and data acquisition system to provide real-time analysis by a distributed computing system that will enable predictive rather than reactive responses to blink-of-the-eye disruptions".[iii] A Smart Grid is more than just using meters and in-home energy management. It also encompasses sensors deployed on the distribution grid to monitor and manage the flow of electricity and the equipment used to do so.

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[i] Xcel Energy. 2008. *'Xcel Energy Smart Grid A White Paper'* Accessed 01 Oct 2008. Available from http://birdcam.xcelenergy.com/sgc/media/pdf/SmartGridWhitePaper.pdf.

[ii] S. Massoud Amin, D.Sc., Presentation given at the 2009 MIT Energy Conference, *'Smart Grid: Opportunities and Challenges Toward a Stronger and Smarter Grid',* March 2009

[iii] *See* Testimony of Michael W. Howard, Ph.D., P.E., Senior Vice President, R&D Group, Electric Power Research Institute, *"Facilitating the Transition to a Smart Electric Grid,"* Before the House Subcommittee on Energy and Air Quality, May 3, 2007.

It allows for improved efficiency and reliability on the grid and the increased use of renewables and distributed generation. Ontario Canada, who has one of the largest implementations of smart meters recently concluded, "[The] full promise [of conservation, renewable generation and smart meters initiatives] will not be realized without the advanced technologies that make the smart grid possible."[iv]

As an integrated end-to-end solution, the Smart Grid value chain extends beyond the utility to its end customers and to society in general in the form of lower outages, lower electric costs and less carbon emissions. But even beyond a utility's disincentive to make investments that reduce its profitability, as discussed above, any investment to promote societal benefits that do not directly result in lower prices or improved service specifically for that utility's rate payers would generally be denied cost recovery by state regulators. So state regulatory policy must be structured to assure that the entire value creation is included in the benefit case so that utilities can be assured appropriate rate recovery, a policy Congress could implement by requiring or promoting distribution Smart Grid policies in pending legislation.

In drafting upcoming energy and climate change legislation, Congress should recognize the inherent nexus between climate change, the realization of broadly deploying clean renewable energy resources and the efficient operation of a "smarter" national grid, including both transmission and distribution.[v] Similar to the way Congress created national priorities and policies in the telecommunications industry, Congress should provide that each distribution utility must implement a Smart Grid throughout its service territory. Both the U.S. electric grid and the climate change issue impact interstate commerce. The MIT Technology Review recently stated "without a radically expanded and smarter electrical grid, wind and solar will remain niche power sources."[vi] The estimated cost of outages in lost productivity to the U.S. economy is 50 cents for every dollar we spend on electricity annually[vii] with 90% of all outages resulting from

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[iv] Report of the Ontario Smart Grid Forum, *Enabling Tomorrow's Electricity System*, February 2009, available at: www.ieso.ca/smartgridreport.

[v] For example, The Center for American Progress's Wired for Progress 2.0, Building a National Clean-Energy Smart Grid (April 2009 at vii) states "The natural complement to a robust interstate transmission network for renewable electricity is an intelligent "smart grid" distribution system that delivers electricity right to the plugs in consumers' homes."

[vi] Talbot, David *"Lifeline for Renewable Power"*, MIT Technology Review, January/February 2009

[vii] Electric Power Research Institute. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation*' Available at: http://www.epri.com, pg 40.

issues on the distribution grid.[viii] Absent a distribution Smart Grid, utilities and end users will be unable to take advantage fully of the economic and environmental benefits of renewable energy resources brought over transmission lines and distributed generation resources (e.g., rooftop solar panels, plug-in vehicles and wind turbines). Additionally, they will not be able to achieve the necessary and desired carbon reductions. Utilities should be assured that their investment in Smart Grid systems will be adequately recovered and that they, their shareholders and their customers will share in the benefits the Smart Grid creates.

Congress should also recognize that the Smart Grid can provide the most direct and certain form of energy efficiency and demand response by enabling the electric utility to operate its distribution system more efficiently and thus reduce the amount of generation required to serve the ultimate customers. It is estimated such optimization of the distribution grid can reduce electric generation requirements and related carbon by 3 to 5% without impacting on, or requiring any change in, customer behavior. These benefits can be realized as on-going energy efficiency, at peak load or a combination thereof. Many of these applications can be deployed on a modular basis without requiring an investment in "smart meters" and the National Association of Regulatory Commissioners now recommends that regulators and utilities focus initially on these "direct value" investments.[ix] Congress should work to include such benefits of distribution system optimization in any energy efficiency or demand response grants, funding or requirements. Examples of where such a requirement could be added include in the American Clean Energy And Security Act of 2009 (H.R. 2454) Part E, Section 141(6) where the definition of peak load reduction could be expanded to include "energy savings from efficient operation of the distribution grid resulting from the use of a Smart Grid," and in Part E, Section 144(d)(1) where "or through the use of a Smart Grid" could be added at the end of the sentence. Another example is in the Combined Efficiency and Renewable Electricity Standard section of the same bill, (Section 101(a) where "or other efficiencies from the use of a Smart Grid" should be inserted after the word "electricity"). Similarly in HR 2212: 21st Century Energy Technology Deployment Act (Inslee), the definition of *Clean Energy technology* should be expanded to include "distribution smart grid" in Section 3(5) and "efficiency or other improvements from a

[viii] California Energy Commission, '*2007 Integrated Energy Policy Report*', November 2007 at 196.

[ix] National Association of Regulatory Utility Commissioners (NARUC), '*The Smart Grid: Frequently Asked Questions for State Commissions*', May 2009.

distribution Smart Grid" added to the list in Section 5(a).

2. **How much will the whole development of a smart grid cost? How should these costs be allocated?**

Response: According to the DOE, there are approximately 142 million customers of electricity in the U.S who purchase about $343 billion of electricity annually[x]. EPRI estimates a national distribution Smart Grid would cost $127 billion, with an additional $38 billion required to make the existing transmission grid smarter. EPRI projects that such an investment will produce benefits of $600 to $800 billion over 20 years (equal to 4 to 5 times the required investment).[xi] Assuming the 20-year investment cycle, EPRI estimates the combined investment to be approximately $8.3 billion a year, which represents only 2.5% of annual sales. It should be noted that the cost of a Smart Grid is a small portion of the Brattle Group's estimate of the approximately $1.5 trillion investment electric utilities will require over the 2010 – 2030 period (which includes $560 billion for new generation).[xii] CURRENT estimates that the core Smart Grid infrastructure (meters, sensing on the grid, real-time Internet Protocol (IP) communications and analytic software) would cost approximately $55 billion to cover all of the nation's local distribution networks and would provide the foundation for the other Smart Grid investments.

As to funding the investment, in the case of the local distribution networks, the local distribution company will make the Smart Grid expenditures with the existing applicable rate setting mechanism allowing such local distribution company to recover for such investments that are reasonable and prudent. However, in many cases as described in the response to Question 1, regulators and consumer advocates focus on the immediate rate impact without taking into account gains from efficiency, conservation, renewables or a world where carbon has a cost. In addition to any federal funding to offset the cost of a Smart Grid, Congress can further Smart Grid deployments by requiring state regulators to deem electric distribution Smart Grid investments as reasonable and prudent. Utilities also need to be encouraged through mechanisms

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[x] U. S. DOE Energy Information Administration, *"Electric Power Annual, Table 7-1 Number of Ultimate Customers Served by Sector, by Provide" and "Table 7.3. Revenue from Retail Sales of Electricity to Ultimate Customers by Sector, by Provider, 1996 through 2007"*, January 2009.

[xi] EPRI, *Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits*, July 2004 at 5-1.

[xii] Brattle Group, '*Transforming America's Power Industry: The Investment Challenge*' April 2008.

where they benefit from investing in a Smart Grid.

3. Do you support the inclusion of nuclear energy as a source of low-carbon electricity?

Response: CURRENT's focus is on the electric distribution grid and not on nuclear generation. Thus, CURRENT does not have a position on the use of nuclear as a source of low-carbon electricity.

4. How does the problem of intermittency in renewable energy add to the challenge of a smart grid?

Response: Rather than renewable intermittency adding to the challenge of a Smart Grid, a Smart Grid helps to overcome the challenge of intermittency in renewable energy. There are two types of renewables: centralized (e.g. wind farms and concentrated solar) and distributed (e.g. roof top solar). Distributed renewables create several problems for the existing electric grid. First, as opposed to centralized power plants that send electricity one way from the plant to the home, renewables out on the grid itself (like a roof-top solar panel at a big box retailer) create a two-way power flow on a grid that is designed to go one way. This means that the utilities' assumptions about how the grid operates are no longer valid and that increased monitoring is required. Lines can be energized by distributed resources even in the event of an outage, which poses safety issues for line workers, and power flows can become inefficient and uneven based upon uncoordinated adoption of distributed resources. Thus, utilities are identifying a need to begin to monitor the output of distributed renewables. A Smart Grid enables the utility to monitor and manage these distributed renewables and know in real-time the power they are producing as well as any impact the two-way power flow is having on the grid itself.

Second, utility practices today are presently, and rightly, designed to minimize variability. Most forms of renewables, however, are inherently variable or intermittent. As electric grids must be in balance, a sudden drop in generation from renewables requires the utility to maintain balance by adjusting other generation sources, storage or consumption itself to keep the system in balance. Today this is typically accomplished by adding spinning reserves typically in the form of gas-powered peaking plants or by operating coal plants at less than peak capacity (which allows operators to quickly increase load, but results in a less efficient coal plant operation and thus higher carbon output per megawatt produced). For example, to achieve the European 2020 targets (20% renewables, 20% reduction in CO_2 by 2020), the United Kingdom estimates that short term reserve requirements such as these would double to almost triple.[xiii]

A distribution Smart Grid can mitigate these additional costs and emissions by dynamically adjusting overall load in real time, providing generation and transmission operators with a powerful new tool to manage generation fluctuations and transmission issues such as those associated with renewables. Sensors located throughout distribution systems can automatically adjust overall distribution system voltage by up to 3% or more of the load in response to fluctuations in generation and thus reduce the need for these spinning reserves.

By reducing or eliminating the need for backup coal or gas-based power generation plants, a distribution Smart Grid monitoring and managing renewables will reduce emissions and allow utility capital to be shifted from purchasing conventional power sources to buying more clean renewable power.

5. **The hearing pointed out the need for regulatory policies that reward electric utilities for their investment in smart grid technology and energy efficiency. Can you suggest ways that Congress can help make this happen?**

Response: Congress has already taken some very positive steps in the ARRA by providing both stimulus funding and by providing guidance on the use of IP and other standards. It is important that the stimulus funding be used to advance the deployment of a full Smart Grid as opposed to any one particular technology or technologies that the utility already received rate recovery approval to implement.

As discussed in the response to Question 1, a further positive step would be for Congress to find that a Smart Grid is in the interests of interstate commerce due to its impact on renewables, climate change and overall reliability and to require utilities to build a Smart Grid (including on the distribution systems) while protecting the utilities legitimate return on those investments.

Congress should also recognize that a distribution level Smart Grid can provide the most

[xiii] House of Lord Select Committee on Economic Affairs, "*The Economics of Renewable Energy*", November 2008 at 35.

direct and certain form of energy efficiency and demand response by enabling the electric utility to operate its distribution system more efficiently and thus reduce the amount of generation required to serve the ultimate customers. It is estimated such optimization of the distribution grid can reduce electric generation requirements and related carbon by 3 to 5% without impacting on, or requiring any change in, customer behavior. These benefits can be realized as on-going energy efficiency, at peak load or a combination thereof without requiring a change in consumer behavior. Many of these applications can be deployed on a modular basis without requiring an investment in "smart meters" and the National Association of Regulatory Commissioners now recommends that regulators and utilities focus initially on these "direct value" investments.[xiv] Congress should work to include such benefits of distribution system optimization in any energy efficiency or demand response grants, funding or requirements. Examples of where such a requirement include in the American Clean Energy And Security Act of 2009 (H.R. 2454) Part E, Section 141(6) where the definition of peak load reduction could be expanded to include "energy savings from efficient operation of the distribution grid resulting from the use of a Smart Grid." and in Part E, Section 144(d)(1) where "or through the use of a Smart Grid" could be added at the end of the sentence. Another example in the same bill is in Combined Efficiency and Renewable Electricity Standard, (Section 101(a) where "or other efficiencies from the use of a Smart Grid" should be inserted after the word "electricity"). Similarly in HR 2212: 21st Century Energy Technology Deployment Act (Inslee), the definition of *Clean Energy technology* should be expanded to included "distribution smart grid" in Section 3(5) and add "efficiency or other improvements from a distribution Smart Grid" as a part of the list in Section 5(a).

6. **What changes need to be made to the regulatory system for electric utilities that will provide them with incentives to invest in the energy efficiency of their customers? Are there ways to establish a market for other companies either working with the utilities or on their own, to make money by reducing the electricity use of consumers and business?**

Response: Grid based efficiency improvements are very important opportunities to reduce electric usage. It is important to recognize that their benefits are in addition to the potential

[xiv] National Association of Regulatory Utility Commissioners (NARUC), '*The Smart Grid: Frequently Asked Questions for State Commissions*', May 2009

energy efficiency gains that customers can achieve through managing their usage or by using more efficient appliances. As described in the response to Question 1, the limited incentives of electric utilities and the exposure to having innovation disallowed retroactively need to be changed to encourage regulated utilities to invest and innovate in energy efficiency. The present disincentives are even greater when the utility owns generation and transmission facilities whose revenues would be also reduced by energy efficiency.

The recent action by several states and the language in the proposed American Clean Energy And Security Act of 2009 to require a certain percentage reduction in baseline energy consumption on an ongoing basis or at peak, or both, is an effective mechanism, especially if a utility can include in the saving targets any efficiency gains it receives from the use of a distribution Smart Grid. Another effective alternative is to reward utilities through incentives for being more efficient and for making its customers more efficient through concepts such as decoupling, efficiency gain sharing or the ability to recover energy efficiency related capital investments with a rate of return. In a similar manner, improving energy efficiency in appliance standards and in building codes are effective mechanisms for long term energy efficiency gains.

Energy efficiency businesses that help reduce energy cost for consumers and businesses exist today. With increasing attention on global warming, carbon and the cost of energy, it is likely investment in energy efficiency by consumers and businesses will continue, especially if standards and codes are raised. It is also likely that various new forms of businesses focused on changing the way electricity is generated and consumed will emerge, especially if we deploy an IP based Smart Grid, similar to the way the Internet has given risen to entirely new industries.

7. **What can we do to provide regulatory incentives for businesses and customers to act to reduce their own use of electricity and adopt smart grid technologies?**

Response: The CAFE standard for the auto industry seems to be an effective mechanism on improving fuel efficiency. In a similar manner, improving energy efficiency in appliance standards and in building codes can be effective mechanisms for long term energy efficiency gains. The American Clean Energy and Security Act of 2009 cap and trade provisions will also provide incentives for large generators of carbon.

While the concept of end-user energy management gets the most media attention and will certainly be part of the solution, the Climate Group estimates that 85% of the carbon reduction benefits of a Smart Grid come from making the grid itself more efficient and from integration of renewables and only 15% will come from end-user energy management.[xv]

8. What can we do to encourage electric utilities to conserve energy by operating more efficiently?

Response: As further discussed in the responses to Question 1, 5 and 6:

- Provide Regulatory Assurance and Incentives: Electric utilities need to have assurance that they and their shareholders will be compensated (or at least not injured in the form of lower return) for their investment in conservation and efficiency.
- Mandate Reductions over a baseline: The recent action by several states and the language in the proposed American Clean Energy And Security Act of 2009 to require a certain percentage reduction in baseline energy consumption on a ongoing basis, at peak, or in both cases is an effective mechanism, especially if a utility can include in the saving targets any efficiency gains it receives from the use of a distribution Smart Grid.
- Mandate a distribution level Smart Grid

9. Moving to a smart grid will be very expensive and take time, what are the first steps we should take in developing a smart grid?

Response: While it will take a number of years for a Smart Grid to be deployed, a Smart Grid is not expensive compared to the benefits it will achieve. As noted in response to Question 2, the EPRI estimates a national distribution Smart Grid would cost $127 billion with an additional $38 billion required to make the existing transmission grid smarter and projects benefits of $600 to 800 billion over 20 years (equal to 4 to 5 times the required investment).[xvi] On an annual basis, this represents only 2.5% of annual sales. It is interesting to note that the estimated cost of outages in lost productivity to the U.S. economy is 50 cents for every dollar

[xv] The Climate Group *'SMART 2020: Enabling the low carbon economy in the information age'*, 2008 available at http://www.theclimategroup.org/assets/resources//publications/Smart2020Report.pdf pg 70.
[xvi] EPRI, *'Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits'*, July 2004 at 5-1.

spent on electricity annually,[xvii] an amount that in one year exceeds the total estimated cost of a 20 year investment in a Smart Grid.

Good first steps in the development of a Smart Grid:

1. *Focus on the Grid Efficiency itself before focusing on extending meters to every household.* Some smart meter rate cases for residential customers project a cost of $325 or more per household (before any investment in programmable thermostats, in-home displays or in-home energy management systems which would add hundreds to thousands of dollars to the cost of each home) and take nearly 20 years to breakeven in a cost benefit analysis taking into account both utility and consumer benefits.[xviii] It is estimated it would cost approximately $40 billion (the equivalent of 30% of the overall Smart Grid cost) to install residential metering alone for the approximately 124 million U.S. residential customers. Commissioner Frederick F. Butler, a member of the New Jersey Board of Public Utilities (NJBPU) and President of the National Association of Regulatory Utility Commissioners (NARUC) recently expressed his concern about focusing initially on the consumer in his testimony to the Senate Committee on Energy and Natural Resources, "This means that we should not focus immediately on the end user and demand response; rather, we must start with the backbone—the transmission and distribution systems—while proceeding carefully to go inside consumers' homes."[xix]

2. *Deploy High-Value Solutions First-* State regulatory commissions and utilities may not be prepared at this time to fully define a comprehensive and functional Smart Grid system complete with all the utility distribution grid and customer applications that could be supported. There are, however, highly cost-effective Smart Grid alternatives that enable utilities, as a first step towards full Smart Grid

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[xvii] EPRI. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation*' Available at: http://www.epri.com, pg 40.

[xviii] For example, Southern California Edison is spending $1.981 billion to replace approximately 5.3 million meters ($373 per meter). Over a 20 year useful life, the project is expected to result in benefits of $1.990 billion or a net present value of $9 million. (See SCE Decision at http://www.sce.com/NR/rdonlyres/6DC13EB1-0AFA-40A8-B9E3-93546F24015C/0/081114_A0707026Final_Decision.pdf).

[xix] Written Testimony of Honorable Frederick Butler, Commissioner, New Jersey Board of Public Utilities on behalf of the National Association of Regulatory Utility Commissioners to the U.S. Senate Committee on Energy and Natural Resources, '*Smart Grid*', March 3, 2009.

implementation, to conduct a pilot project of a sufficient magnitude to provide a thorough comparison between a distribution grid that benefits from Smart Grid technology and one that does not. For example, a utility could conduct a pilot project in which it deployed sensors at carefully selected locations on the electric distribution grid to implement system optimization that reduces line losses and optimizes voltage levels. State regulatory commissions should allow utilities to recover the costs of such Smart Grid pilot projects. The potential benefits of a Smart Grid system are enormous, and a thorough examination of the technology on a scale sufficient to effectively gauge the potential costs and benefits to all ratepayers warrants inclusion of pilot project costs in system wide rates. It is estimated such optimization can reduce electric generation requirements and related carbon by 3 to 5% without impacting, or requiring any change in, customer behavior. Further, such a targeted infrastructure approach to Smart Grid allows utilities incrementally to deploy individual applications with a lower cost of entry, while retaining the option to grow and expand the overall Smart Grid system as needed. Significantly, if deployed with open standards, this basic Smart Grid infrastructure system would serve as a communications backbone that can support full smart grid implementation at a later date, while providing the utilities and customers with immediate and demonstrable benefits that far exceed those expected from "smart meter" or Advanced Metering Infrastructure programs.

3. *Encourage Smart Grid Innovation* - There are various forms of regulatory treatment that could be afforded utility investments in Smart Grid on a larger scale. For example, as discussed in the response to Question 1, a shared savings incentive ratemaking mechanism would encourage Smart Grid investments. To the extent that a utility invests in Smart Grid infrastructure and applications that result in quantifiable savings in distribution operations and maintenance, a sharing of the savings between ratepayers and shareholders provides the right economic incentive for the utility to continue to make cost effective Smart Grid investments and maximize shareholder earnings while simultaneously continuing to reduce system costs for its customers. This would encourage a more innovative approach

to a Smart Grid and allow different utilities to try out projects they think will best deliver results based on their particular operating circumstances. The results could be shared to encourage other utilities. Congress should direct or at least encourage the States to adopt such regulations that will provide incentives that promote utility deployment of Smart Grids that actually reduce the cost of electric delivery.

10. Are you seeking federal stimulus money from the Department of Energy to deploy your technology?

Response: CURRENT is in discussions with a number of utilities about potential projects under the federal stimulus. We believe that the ARRA language and the initial DOE rules encourage some of the innovation described in the response to Question 9. This will especially occur if the focus is on awarding new projects and innovations, not funding projects that already are or will likely be approved by state regulators for recovery in the rate base.

11. What sort of interoperability standards need to be developed to facilitate a transition to a smart grid? How will the development of those standards affect the deployment of your products?

Response: To achieve the Smart Grid vision, it is important that standards be adopted including that a network use real-time communications as well as the open standards like IP as required for funding under ARRA. The Smart Grid will provide the network platform for the distribution of electricity and also enable the attachment of currently unimagined numbers and kinds of devices and software applications to improve both the performance and the usefulness of electricity. For example, it is highly likely the "iPod" of home energy management has been invented yet and it is just as likely that it will not be invented by a traditional vendor of utility equipment. If the Smart Grid network, the devices that attach to it and the software applications that run on them are not designed to a common open standard, the Smart Grid will be delayed or degraded and rate payers will have to pay to replace devices before the end of the their useful lives. CURRENT believe that ultimately, in many cases, it may be appropriate to leverage existing IP public networks like the existing cable, DSL or wireless 3G or WIMAX networks.

In addition to communications standards, it is important that common interoperability standards and data descriptions be defined to facilitate the exchange of data between various Smart Grid applications and databases and existing utility systems.

CURRENT has already integrated its open standard technology with multiple grid device manufacturers, in-home energy management systems and a variety of back office utility systems. If each interface must be custom developed, substantial delays and additional costs will result.

CURRENT is also working in Europe on the open standards. Europe has actually advanced further than the United States in certain standards areas, especially meters data collection. For example, in the United States, the communications portion of the meter and the collection devices that collects the meter data from various meters have usually been part of a closed proprietary system sold by a metering company. Thus, once utilities choose a meter communication system, they can not move to a different vendor if another vendor develops a better collection system without replacing the meters. Europe has recognized that a common metering standard where any meter can talk to any collection device will result in a lower cost for the metering system and greater flexibility to adopt and adapt to new technologies and applications. CURRENT is a member of a consortium of utilities and technology providers working on a European Commission-funded project to develop an Open Metering Standard, which is expected to significantly reduce smart meter costs.

12. What sort of cyber-security concerns need to be addressed? Are you confident that a smart grid can resist a cyber attack?

Response: While no system can be absolutely invulnerable, we believe that the Smart Grid can resist a cyber attack, especially if the utility industry leverages the security knowledge and technology of other industries. For example, significant and continual investment is made to keep our online shopping, banking and other financial transactions safe and secure with Internet sales alone exceeding $127 billion in 2007.[xx] One of the reasons the use of IP standards is very important is that the U.S. expertise in IP and open standards (and the related security) is very advanced from our experience in the telephone, computer, Internet and other technology based markets. While no one can ever be confident and constant vigilance and security improvements

[xx] U.S. Census Bureau, '*The 2009 Statistical Abstract, 1016 - Online Retail Spending, 2001 to 2007, and Projections, 2008*'.

are required, CURRENT believe a properly designed IP based open standards Smart Grid that continually leverages best practices in other industries can resist a cyber attack.

13. You note your contributions to the development of a smart grid in the European Union. What has been the most challenging aspect of the E.U. project? Are there lessons learned that can be applied here in the United States?

Response: Smart Grid technology will eventually be deployed worldwide and if the United States does not promote the development, improvement and deployment of a wide range of Smart Grid technologies, other countries will do so and such countries and their citizens will enjoy the benefits of a worldwide market. For example, Cisco recently estimated that the Smart Grid opportunity could rival the size of the Internet.[xxi] This means "green jobs" and exports and billions of dollars to the economy. The United States has the opportunity to be a global leader and must capitalize on such an extraordinary opportunity.

Europe has done a good job in pushing towards open standards such as the open meter collection project mentioned in Question 11 and in promoting utilities and various technology providers work together on a wide variety of pilot projects. One challenging part of the E.U. project has been the E.U. mandate to install smart meters for all residential customers. We have seen in a number of places that this mandate has made it harder to move the broader vision of the Smart Grid forward as utilities and regulators have focused their entire efforts on a narrow metering solution. Based on our experience, CURRENT believes it is in the best interest of the United States from a market leadership standpoint (as well as to achieve our efficiency and climate goals) to focus on deploying a wide range of Smart Grid technologies including those focused on improving the efficiency and reliability of the distribution grid. As noted in the response to Question 1, Ontario Canada who made a similar decision to focus on meters has already decided that a broader Smart Grid is necessary and we are actively engaged in discussions in a number of countries where there is a desire to expand from metering focused priorities to a full Smart Grid.

14. How do you anticipate renewable electricity will be delivered without a significant

[xxi] Martin LaMonica, CNET News, '*Cisco: Smart grid will eclipse size of Internet*', May 18, 2009.

upgrade to the existing grid regardless of "smart" technology? Does CURRENT support FERC's authority to designate National Transmission Corridors?

Response: There are two different types of renewable energy, centralized (e.g. wind farms, concentrated solar) and widely distributed renewables such as roof top solar. A distribution Smart Grid allows the increased use of both centralized and widely distributed renewables, as explained in the response to Question 4. The use of centralized renewables may require an additional investment in transmission to connect the sources of these renewables to the load centers. CURRENT generally supports the FERC's Proposed Smart Grid Policy Statement and Action Plan and its efforts to improve the efficiency, reliability and security of the Nation's transmission and bulk-power systems. The Federal Power Act excludes local distribution systems from FERC's jurisdiction over the bulk-power system, but FERC's Policy Statement recognizes the inherent nexus between a smart transmission system and the local distribution systems. As such, in its Comments in response to FERC's Policy Statement, CURRENT called upon FERC to encourage the promotion of parallel policies at the Federal and State levels to implement distribution-level Smart Grid systems contemporaneously with the implementation of Smart Grid technology at the transmission level. Distribution-level Smart Grids will significantly aide in easing the increasing constraints on the bulk-power system in part, by allowing utilities to have a dynamic control of the distribution grid load which will help the transmission systems and grid operators manage congestion and deal with the intermittent nature of renewables.

15. **What gains in energy storage capacity must be attained prior to wide scale deployment of a smart grid? Without adequate storage capacity, how can a smart grid resolve the underlying problem of intermittency in renewable electricity? Even with the existence of a smart grid, isn't there a basic need for base load generation?**

Response: CURRENT does not develop storage technology. Nevertheless, our understanding is that while storage will be an important tool to address intermittency of renewables, cost effective widely deployed storage is not yet available. As discussed in the response to Question 4, a Smart Grid provides both a monitoring capability for widespread renewables and a powerful new tool for generation and transmission operators to manage intermittent generation fluctuations by dynamically adjusting overall load in real time. This Smart Grid System Optimization, which utilizes sensing throughout distribution feeders, real-time communications and analytical software, can automatically adjust overall distribution system voltage by up to 3% or more of the load in response to fluctuations in generation and thus reduce the need for the spinning reserves. By reducing or eliminating the need for backup coal or gas-based power generation plants, emissions are reduced and utility capital can be shifted from purchasing conventional power sources to buying cleaner renewable power.

A Smart Grid can reduce overall load and enable renewables. CURRENT submits that, between efficiency gains, demand reduction enabled by a Smart Grid and the more rapid deployment of centralized and distributed renewables, it may be possible that the forecasted load growth could be served without the need to build conventional power plants.

16. What is the best manner to overcome the "chicken and the egg" problem of selling smart meters vs. real-time pricing?

Response: Whether real-time pricing will ever be adopted in the United States in a meaningful manner that reduces electric consumption warrants further study. In looking at both meters and real-time pricing, the success of these systems from an overall energy policy perspective will largely be based on several issues – 1) will consumers be mandated to participate, and if not will they voluntarily choose to participate, 2) what behavior changes will they make that they could not be otherwise encouraged to make and 3) what is the carbon impact of those changes.

It is important to focus first on demographics. Approximately 63% of the total electricity is used by the 18 million commercial and industrial customers,[xxii] with meters for all those customers estimated to cost approximately $10 billion. Many of those commercial and industrial meters are already installed although not necessarily integrated to building and industrial control systems. Since such a small number of customers make up such a large percentage of the overall electric usage, it clearly makes sense to focus on advanced meters, pricing and control systems for these commercial and industrial customers.

[xxii] U. S. DOE Energy Information Administration, '*Electric Power Annual, Table 7-1 Number of Ultimate Customers Served by Sector, by Provide' and 'Table 7.3. Revenue from Retail Sales of Electricity to Ultimate Customers by Sector, by Provider, 1996 through 2007'*, January 2009.

The remaining 37% of electricity is used by the approximately 124 million residential customers for whom it would cost approximately $40 billion to install smart metering. This is exclusive of the additional needed consumer investment in programmable thermostats, in-home displays or in-home energy management systems that would add hundreds to thousands of dollars to the cost of each home. These smart meters themselves do not "automatically" reduce customer electricity use.[xxiii] They simply enable a utility to record how much the electricity is used at different intervals and, in some cases, to communicate that information to a display or device within the home that has been purchased at an additional cost by the consumer. This, in turn, permits the utility to discourage usage during peak periods by imposing higher charges at such times. Consumers who are able to do so may respond to these higher prices by shifting some of their usage to off-peak periods. They can do so in many ways, from choosing not to run certain appliances during the peak period, turning their thermostats up or down as the case may be, etc.

Business Week recently had an article[xxiv] questioning if time-of-use rates or other plans would be mandatory and noting that consumer advocates express concern about such programs. California tried to mandate the utility control of programmable thermostats in new homes and in renovations but public opinion was strongly negative and the policy was not approved. California and New York Public Utility commissions have both interpreted existing laws to prohibit mandatory time-of-use rates.[xxv] Most other consumer-focused industries (long distance, internet usage, cellular phone minutes and even movie rentals (Netflix)) have moved from time-of-use rates to all-you-can use packages. Thus, consumer acceptance of time-of-use rates should be validated before $40 billion is spent on meters whose justification presupposes it.

Another area that needs further study is whether people will agree to change their behavior on a long-term basis. In the California State Wide Pricing Study, which is often quoted as evidence of the demand reduction potential of meters, a little-mentioned fact is that only 20% of the people contacted agreed to participate despite an offer of a $175 cash

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[xxiii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 7 (July 2008).

[xxiv] Business Week, '*The Static Over Smart Grids*', April 2, 2009.

[xxv] CPUC Rulings and Alexander, Barbara, "*Smart Meters, Real Time Pricing and Demand Response Programs: Implications for Low Income Electric Customers*", Report prepared for Department of Energy, May 2007, pg 32 and 52.

payment.[xxvi] Of the participants, 22% moved or otherwise dropped out in the first year, indicating that a new participant pool would need to be recruited every 5 or so years. In an East Coast study, the estimated penetration was closer to 17% of homes with air conditioning or roughly 10% overall.[xxvii]

As to the potential savings, the Brattle Group estimated a house with central A/C could reduce its load by 1.4 kwh of which 85% is a result of controlling the central air conditioning while a house without central air can reduce its load by only 0.3 kwh.[xxviii] It must be noted that 40% of U.S. homes do not have central A/C and thus have no use for a programmable thermostat or the capability to substantially reduce their load.[xxix] As for any permanent load reduction, a recent survey of people interested in using smart meters in the United Kingdom showed the primary way they would save energy is turning off the television, turning off computers/printers, turning the heat down or turning lights off in a room.[xxx] It is unlikely a meter and a display are required to tell people to take these actions since, as NERA Economic Consulting noted in studying smart meters for Australia; much of any projected load reduction from a smart meter program likely could be achieved by education alone without requiring an investment in smart meters.[xxxi] Additionally, many classes of customers, such as retirees, night workers and families with young children at home may find it difficult to change their electric usage patterns and thus would be potentially penalized by higher time-of-use rates during peak periods. Similarly, many low income customers already minimize their consumption and will not be able to afford or inclined to pay for the in-home devices necessary to control their appliances and many high income customers can afford to pay the higher rates and will do so rather than endure the

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[xxvi] Charles River Associates, '*Impact Evaluation of the California Statewide Pricing Pilot*', March 2005 pg 30-32.

[xxvii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 10 (July 2008).

[xxviii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate (referencing Brattle Group), '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 9 (July 2008).

[xxix] U. S. DOE Energy Information Administration (EIA), Office of Energy Markets and End Use, "*2005 Residential Energy Consumption Survey*". The same survey indicates of the people who have central air conditioning. According to data from the same study and EIA total sales data, electric heat represents less than 1% of overall electric sales.

[xxx] Energy Savings Trust Green barometer measuring environmental attitude issue 4 Clever Clocks – introducing smart meters (March 2008).

[xxxi] NERA Economic Consulting. 2008. '*Cost Benefit Analysis of Smart Metering and Direct Load Control*'. Report for the Ministerial Council on Energy Smart Meter Working Group at 206 Available from http://www.mce.gov.au/assets/documents/mceinternet/SmartMetering%20BAPhase2Stream1_overviewNERA20080305175957.pdf.

inconveniences of making changes to their lifestyle.

Unfortunately, real-time pricing and smart meters will not necessarily reduce CO2 emissions since the primary benefit is reducing load at the 50 or so peak hours of a year, not to eliminate the usage itself.[xxxii] Ironically, this usage shift may actually increase CO2 emissions by moving usage from a time (peak) at which the incremental power source is gas to a time (off-peak) when the base power source is coal. Indeed, the DOE has recognized this and has warned that "policymakers should exercise caution in attributing environmental gains to demand response, because they are dependent on the emissions profiles and marginal operating costs of the generation plants in specific regions."[xxxiii]

Additional studies and pilots should be undertaken to explore the cost effectiveness of smart meters and real-time pricing. Smart meters are a small portion of the overall Smart Grid. Commissioner Frederick F. Butler, a member of the New Jersey Board of Public Utilities (NJBPU) and President of the National Association of Regulatory Utility Commissioners (NARUC) recently expressed a similar concern in his testimony to the Senate Committee on Energy and Natural Resources, "This means that we should not focus immediately on the end user and demand response; rather, we must start with the backbone—the transmission and distribution systems—while proceeding carefully to go inside consumers' homes."[xxxiv]

17. Who should pay for smart meters? Consumers? Utilities? What incentive do consumers have to spend a large sum on the device?

Response: Under our regulatory system, the customer ultimately pays for capital investments. While some customers will benefit from a smart meter, it is not clear that all customers will benefit, especially as additional equipment such as programmable thermostats, in-home displays or energy management systems are required for the consumer to interact with the smart meter. Most smart meter rate cases for residential customers project a cost of $325 or more per household (before the additional equipment which can cost hundreds or even thousands of dollars) and take nearly 20 years to breakeven in a cost benefit analysis taking into account both

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[xxxii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 13 (July 2008).

[xxxiii] U.S. DOE Report to Congress, Feb 2006 "*Benefits of Demand Response and Recommendations*" pg 29.

[xxxiv] Written Testimony of Honorable Frederick Butler, Commissioner, New Jersey Board of Public Utilities on behalf of the National Association of Regulatory Utility Commissioners to the U.S. Senate Committee on Energy and Natural Resources, '*Smart Grid*', March 3, 2009.

utility and consumer benefits.[xxxv] In most cases, approximately 55% of the 20 year benefit payback from smart meters comes from operating cost reductions, primarily as a result of eliminating meter related jobs.[xxxvi] The remaining benefit payback comes from a forecast of reduced load either at peak or a permanent change in life style. The largest estimated savings is from using programmable and communicating thermostats and in home displays to reduce central air conditioning load at peak but the cost of such devices are excluded from the benefit projections since rate payers are expected to purchase those devices on their own.

The Brattle Group estimated a house with central A/C could reduce its load by 1.4 kwh of which 85% is a result of controlling the central A/C while a house without central air can reduce its load by 0.3 kwh.[xxxvii] The U.S. average cost for a kwh is approximately 15 cents. Thus a home with central air would save 21 cents an hour and a home without central A/C would save less than 5 cents an hour. Even if we use a peak rate of five times the normal rate, the savings would be a $1.00 per hour with central A/C and approximately 25 cents without it. Such savings are estimated to occur at the 50 or so peak hours of a year.[xxxviii]

As noted in the response to Question 16, 40% of U.S. homes do not have central air conditioning and thus do not have a use for a programmable thermostat[xxxix] and probably would not benefit from a smart meter. Additionally, many classes of customers, such as the elderly, night workers and families with young children at home may find it difficult to change their electric usage patterns and thus would be potentially penalized by higher time-of-use rates during peak periods. These people would all be paying what ever the peak rate is, with little potential for savings.

[xxxv] For example, Southern California Edison is spending $1.981 billion to replace approximately 5.3 million meters ($373 per meter). Over a 20 year useful life, the project is expected to result in benefits of $1.990 billion or a net present value of $9 million. (See SCE Decision at http://www.sce.com/NR/rdonlyres/6DC13EB1-0AFA-40A8-B9E3-93546F24015C/0/081114_A0707026Final_Decision.pdf).

[xxxvi] Brockway, Nancy, National Regulatory Research Institute, '*Advanced Metering Infrastructure: What Regulators Need to Know About Its Value to Residential Customers*', February 2008 pg 18 highlights two different utility regulatory filings where between 53 and 60% of the operational benefits related to eliminating manual meter reading costs.

[xxxvii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate (referencing Brattle Group), '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 9 (July 2008).

[xxxviii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 13 (July 2008).

[xxxix] U. S. DOE Energy Information Administration (EIA), Office of Energy Markets and End Use, "*2005 Residential Energy Consumption Survey*". The same survey indicates of the people who have central air conditioning. According to data from the same study and EIA total sales data, electric heat represents less than 1% of overall electric sales.

18. In your testimony you mention the possibility of PHEVs and their integration into the existing grid. Even with enhancements that may accompany a smart grid, how much additional generation and infrastructure will be necessary to support the additional demand? Who should pay for the additional investment and how would this affect the timeline for the development and deployment of smart grid technologies?

Response: The use of PHEVs creates both opportunities and challenges. PHEVs have the potential to contribute significantly to reducing transportation emissions as well as to serve as a source of energy storage. At the same time, they represent the potential for a new type of electric usage – a device that can appear on the grid anywhere (i.e., home, work, shopping center or even vacation destination) and in large numbers, especially at peak hours when people arrive home from work. A study done by the Pacific Northwest National Laboratory found that existing "off-peak" electricity production and transmission capacity could fuel 70% percent of the U.S. light-duty vehicle (LDV) fleet, if they were plug-in hybrid electrics.[xl] A Smart Grid will be required to manage the complexity of both the storage capability and the variable nature and location of the charging - but new generation will not necessarily be required.

As noted in the response to Question 2, according to estimates by the EPRI and the Brattle Group, the required investment for Smart Grid is less than 10% of the overall investment required for the U.S. electric system and on an annual basis is 2.5% of industry revenues. EPRI also projects benefits of $600 to $800 billion over 20 years (equal to 4 to 5 times the required investment).[xli] Due to the small percentage of total investment and annual revenues and the high benefits, a distribution level Smart Grid should be prioritized and accelerated to address PHEVs.

[xl] Pacific Northwest National Laboratory Press Release, 'Mileage from megawatts: Study finds enough electric capacity to "fill up" plug-in vehicles across much of the nation', December 2006.

[xli] EPRI, *Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits,* July 2004 at 5-1.

THE SELECT COMMITTEE ON
ENERGY INDEPENDENCE AND GLOBAL WARMING

Dear Mr. Zimmerman:
Following your appearance in front of the Select Committee on Energy Independence and Global Warming, members of the committee submitted additional questions for your attention. I have attached the document with those questions to this email. Please respond at your earliest convenience, or within 3 weeks. Responses may be submitted in electronic form, at aliya.brodsky@mail.house.gov. Please call with any questions or concerns.

Thank you,
Ali Brodsky

Ali Brodsky
Chief Clerk
Select Committee on Energy Independence and Global Warming
(202)225-4012
Aliya.Brodsky@mail.house.gov

1. **What steps can Congress take to reduce the time to deploy smart grid technologies?** Congress has already done much to speed the deployment of a smarter grid, particularly in the Energy Independence and Security Act of 2007 and the American Recovery and Reinvestment Act of 2009. However, as the notion of a smart grid begins to gather momentum, it will be important to allow an open architecture with a common communication interface to allow room for creative applications to rapidly flourish. We do as a part of managing our own business, have energy data and control systems that we would be happy to demonstrate in a practical business application.

2. **How much will the whole development of a smart grid cost? How should these costs be allocated?** The overall costs of smart grid development are beyond my area of expertise. However, I can say that technology development along with widespread utilization and deployment will help keep costs lower than they otherwise would be.

3. **Do you support the inclusion of nuclear energy as a source of low-carbon electricity?** This is a question better left to policy makers. Walmart supports the development and use of low-carbon renewable energy.
4. **How does the problem of intermittency in renewable energy add to the challenge of a smart grid?** Obviously intermittency presents an obstacle that must be overcome in order to achieve more widespread deployment of renewables like solar and wind. However, we believe that aggressive demand response policies, coupled with advances in battery storage capabilities and more sophisticated grid operations can help solve this issue.

5. **The hearing pointed out the need for regulatory policies that reward electric utilities for their investment in smart grid technology and energy efficiency. Can you suggest ways that Congress can help make this happen?** Making the grid more resilient and efficient is in the long-term interest of all consumers. For energy efficiency, it is critical that all (including utilities but not limited to utilities) have a strong financial incentive to invest in energy efficiency. Outdated regulatory structures that only reward utilities for generating and selling more energy do need to be changed to provide a fair return to utilities for these types of investments. It is equally important, however, that cost recovery by utilities is proportionate to customer benefit and that the utilities not be given an unfair advantage in the energy efficiency marketplace that would have the effect of stifling investment by non-utility players.

6. **What changes need to be made to the regulatory system for electric utilities that will provide them with incentives to invest in the energy efficiency of their customers? Are there ways to establish a market for other companies either working with the utilities or on their own, to make money by reducing the electricity use of consumers and business?**

   Again, utilities do need to have a financial incentive to invest in and encourage energy savings and state regulatory bodies need to change compensation structures to incentivize utilities to do more than build more generation and sell more energy. Creating a strong market for energy efficiency investments is the most important thing Congress can do. Utilities should be full participants but must not be given an unfair competitive advantage. If through a carbon offset market or otherwise there was a "bounty" on inefficiency that any party could claim if they made the investments to reduce energy use, then utilities and other parties would have a business incentive to find and harvest inefficiency. With a bounty, those with the least cost approach to harvesting these inefficiencies should emerge on a level playing field. This would keep the cost of carbon as low as possible and mitigate the energy price increases. But it is critical that the playing field is level.

7. What can we do to provide regulatory incentives for businesses and customers to act to reduce their own use of electricity and adopt smart grid technologies? Much has been done in the competitive markets that exist in the United States to address these issues but more can be done. Education about efficiency and costs savings can go a long way towards empowering consumers to make smart decisions about use and conservation.

8. What can we do to encourage electric utilities to conserve energy by operating more efficiently? If utilities are required to hold emissions allowances that reflect their baseline performance, then the system should encourage the utilities to make improvements in their own generation efficiency or in their other operations so that they then have unneeded allowances that they can sell. Also, utilities should be held financially accountable for building their own power generation in situations where independent power producers are able to build cheaper and more efficiently.

9. Moving to a smart grid will be very expensive and take time, what are the first steps we should take in developing a smart grid? We should first learn from the steps that have been taken already by companies like Walmart to use information technology to monitor and improve energy performance. We don't claim to have the answers as to how policy should be written to enable the smart grid, but demonstrations using government subsidies is a sound first step.

10. **Your testimony focuses primarily on energy efficiency initiatives that Wal-Mart is pursuing. Can you explain how a smart grid would influence these projects?** Currently we embrace these projects in the absence of a truly smart grid because they make sense from an efficiency, environmental and financial standpoint. A properly designed smart grid can only make these projects more widespread and thus more cost effective, not only for Walmart, but for all electricity consumers.

11. **What is your break-even time for a variety of your energy efficiency projects, such as the rooftop heating and air-conditioning units and the LED freezer lights?** It varies depending on the initiative, however, for the most part we see retrofit projects achieving simple paybacks of 3 years or less. For new installations, paybacks are typically range from 5 to 6 years or less.

12. **How have your economies of scale enabled the complex energy monitoring system? Do you think such a complicated system is feasible for firms that aren't as large as Wal-Mart? Does your energy monitoring capability easily translate to smaller firms?** Although our system is sophisticated, it is far from complex. In fact there are new technologies available today that are much more advanced than those that we currently employ. With regard to scale, other than the ability to negotiate lower costs, it has very little to do with the actual viability of the system. I believe that even an organization with only 10 locations could benefit from being able to monitor and control those locations from one central point.

13. **Have the current economic conditions affected your ability to secure financing for these capital projects? How do you prioritize energy efficiency projects compared to other capital projects, such as continuing to invest in your supply networks?** As a general rule, we invest our capital in those initiatives which have the highest return. Given the paybacks mentioned in a previous answer, there has been no

slow down in our pursuit of these initiatives. In fact, there is a more intense focus to find similar initiatives, given the proven returns. These projects are basically self-financed.

14. **In your testimony, you note Wal-Mart's goal of being supplied by 100% renewable energy. How much of your existing energy is generated by renewable sources? What steps must be achieved in order to meet this goal? How does Wal-Mart plan to overcome the intermittency issues?** Our goal to be supplied by 100% renewable energy is obviously ambitious and clearly aspirational. And although we've made great progress, our work in this area is really just beginning. However, we're off to a great start: We have agreements for solar power to supply well over 20 stores in California and Hawaii, a commitment we recently doubled; last year we announced a wind energy agreement in Texas that will supply nearly 360 stores with 15% of the electricity they need on an annual basis; and we're experimenting with diesel-hybrid technology to help increase the efficiency of our trucking fleet.

15. **Did you seek Federal assistance to implement the efficiency upgrades in your store?** Not to my knowledge. **Does Wal-Mart believe these changes and upgrades have been cost effective?** Absolutely, that is why we continue to implement over 1,000 such projects in the U.S. alone this year, and thousands more around the world.

16. **Is it necessary to spend taxpayer's money to encourage technologies that are already market viable?** It really depends on the technology and the size of the company looking to adapt a given technology. What may be viable for Walmart, may not be viable for another company. It also depends on the desire of policy makers to see certain efficiency performance metrics achieved. Just because a technology may be "market viable" does not mean that it will be widely adopted and this is where public policy can play a helpful role.

17. **What impediments exist that prevent other companies from following Wal-Mart's lead in efficiency upgrades?** The most common issue that I hear from my peers in the industry is the issue of increased first cost. All of these initiatives cost more on the front end. Fortunately, Walmart analyzes their decisions on an internal rate of return model rather than a first cost model. Companies need to further explore the options available to them and really analyze the phenomenal paybacks associated with these initiatives. For those who do not have the capital readily available, there are companies who specialize in doing these retrofits and sharing in the savings as a part of their fee.

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June 11, 2009

Honorable Chairman Markey and Members of the Committee:

Thank you so much for hearing my testimony before the Select Committee on Energy Efficiency and Global Warming. Enclosed are my responses to your questions, as well as a general overview of "Turbine Efficiency Improvements of Existing Power Plants". **As you recognize, turbine technologies which improve the efficiency of existing power plants are an essential part of our energy independence plan**. Just as it is important to improve efficiencies on the consumption side of electricity (dishwashers, air conditioners) it is equally important to improve efficiencies on the production side of electricity—or the efficiency of turbines.

With over 3500 years of turbine experience, Florida Turbine Technologies would like to be a resource for you and other members of Congress on energy issues. We are excited to use our knowledge to help to solve our nation's energy crisis.

Sincerely,

Shirley Coates Brostmeyer
CEO
Florida Turbine Technologies, Inc
PH: 561-427-6330 / 561-222-4827

1. What steps can Congress take to reduce the time to deploy smart grid technologies?

While Florida Turbine Technologies (FTT) does not specialize in smart grid technologies, Page 4 of the attached "Turbine Efficiency Improvements for Existing Power Plants" presentation shows that 65% of available energy is lost to turbine inefficiencies ("conversion losses") in contrast to the 3.1% loss for transmission and distribution (T&D). FTT's Spar-Shell Upgrade Kit can be retrofit into existing gas turbines to improve turbine efficiency by 5% and deliver 15% more power.

2. How much will the whole development of a smart grid cost? How should these costs be allocated?

FTT cannot estimate the development cost of a smart grid, but estimates that an extremely effective technology such as the Spar Shell Upgrade Kit would cost approximately $12 million to develop. Once the Spar Shell Blade concept is proven in a test engine, it will become a commercially viable product and create thousands of long-term technology jobs.

3. Do you support the inclusion of nuclear energy as a source of low-carbon electricity?

Turbine efficiency is equally important for nuclear power plants, since steam turbines are the prime mover for the generators in a nuclear plant. Improvements to steam turbine efficiencies would benefit nuclear and fossil fuel powered plants.

4. How does the problem of intermittency in renewable energy add to the challenge of a smart grid?

The intermittent characteristic of renewable sources can be overcome with the efficient and quick start and shutdown characteristics of natural gas fired turbines. For this reason, gas turbine efficiencies will become even more critical to our energy future.

5. The hearing pointed out the need for regulatory policies that reward electric utilities for their investment in smart grid technology and energy efficiency. Can you suggest ways that Congress can help make this happen?

Year over year efficiency improvements for <u>all</u> energy production or consumption equipment should get the same tax advantages as renewable energy sources. This will encourage existing plants to incorporate modern technologies.

6. What changes need to be made to the regulatory system for electric utilities that will provide them with incentives to invest in the energy efficiency of their customers? Are there ways to establish a market for other companies either working with the utilities or on their own, to make money by reducing the electricity use of consumers and business?

   Tax credits for turbine efficiency improvements will lower operating costs for utilities, in addition to saving energy. Regulations regarding the energy efficiency of businesses and other energy consumers would be most effective when directed toward the consumers, instead of encouraging utility involvement.

7. What can we do to provide regulatory incentives for businesses and customers to act to reduce their own use of electricity and adopt smart grid technologies?

   Businesses and customers should be given incentives to reduce electricity consumption and to produce energy from waste, if applicable. Many existing industrial waste streams are potential sources of energy. Additionally, combined heat and power systems exceed 90% efficiency, and should be encouraged for businesses with large heat requirements.

8. What can we do to encourage electric utilities to conserve energy by operating more efficiently?

   Congress should enact legislation to give utilities financial incentives to run efficiently. Year over year turbine efficiency improvements should get the same tax advantages as renewable energy sources. Turbine efficiency improvements lead to more power with the same equipment, one-third of which is carbon-free and fuel-free.

   Additionally, Congress should encourage investment in energy efficient technologies. Because of the high cost of power outages, utilities are risk-adverse, and new technologies are only commercially viable after the completion of extensive test programs. These programs should be a priority in future energy funding, leading to long-term, high technology American jobs.

   See attached overview, "Turbine Efficiency Improvements for Existing Power Plants".

9. Moving to a smart grid will be very expensive and take time, what are the first steps we should take in developing a smart grid?

   The first steps toward smart grid development <u>and</u> turbine efficiency improvements should be investment in technology and gradual adoption of Cap and Trade policies. This will create technology jobs and retain our nation's position as a leader in energy technology.