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Climate Change Challenges Facing the Electric Industry

Ron Asche, President and CEO, Nebraska Public Power District

I would like to echo Prem Paul's comments. I think the Nebraska Center for Energy Sciences Research is a great partnership between NPPD and the university. I'd like to thank Chancellor Perlman for helping foster that, Vice Chancellor Paul and our center director, Dr. Ken Cassman. Without the support of the NPPD board, that partnership wouldn't have happened. Three of the NPPD board members are here today: Virgil Froehlich from Norfolk, Larry Linstrom from North Platte and Dennis Rasmussen from Lincoln. I'd also like to acknowledge Alan Dostal from NPPD, who is our coordinator between NPPD and the university on our activities and the research center. Thank you.

Ron Asche

Climate change – a real interesting area for the electric utility industry. We're kind of at a crossroads right now of how we go forward in the future with a new issue that appeared on our radar scope only four or five years ago. Climate change is getting much, much discussion in our industry, across the entire country, and we're watching very closely what Congress is doing in that regard.

Our understanding is that Congress is going to debate the Lieberman-Warner climate change bill in the next few weeks, and you can be assured that the electric industry is very, very interested in where that debate goes.

A little background on NPPD. Some of you may not know us very well since a lot of you are here from Lincoln, affiliated with the university and are served by Lincoln Electric System. First of all, Nebraska is an all-public-power state. There are no investor-owned utilities in this state, at least on the electric side of the business. All of the customers we serve are our owners, so that's who we answer to. We don't have shareholders or stockholders, if you will, like the investor-owned utilities. NPPD has about $800 million in revenue on an annual basis and 2,200 employees, and we are capable of generating 3,000 megawatts. I'll talk a little bit in just a moment about the types of generation we have.

We are primarily a wholesale power supplier to rural power districts in the state and municipalities. The City of North Platte, for example, who is hosting this meeting today, is a wholesale customer of NPPD. We sell them the power, and they, in turn, distribute it to all the residential and business people in this community. We supply about half of the total electric requirements in the state. And fortunately we can say that we're one of the lowest-cost states in the country.

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We have historically been in the bottom 10 in terms of price, which is where you want to be. And the latest data I saw, which was for the year 2006, indicated Nebraska had the fifth-lowest electric rates in the nation. Some states in the country pay two to three times what we pay here in the state of Nebraska. NPPD understands the importance of having reliable, affordable, low-cost energy for the state of Nebraska and what it does for business. The economy of this state is very important. We understand our relationship with water and the ag industry. That's all very important to NPPD. And our goal, bottom line, is to continue to provide reliable, affordable energy.

A little bit on our fuel mix and its contrast with the rest of the country. On a national basis, about half of the electric energy in the U.S. is produced from coal, and I think we all realize that coal is one of those fuels that is a significant contributor to CO_2 emissions and potential global warming-climate change issues. Nationally, about 22 percent of electric energy comes from natural gas and oil and other fossil fuel. Those sources have about half of the emission rate of coal. The other 29 percent of the nation's energy requirements are provided from a combination of nuclear, hydro, wind, solar, geothermal, all of which are non-emitting resources of electricity.

Contrast that to the state of Nebraska and NPPD more specifically. About 57 percent of our energy is produced from coal in this state. We have a very large coal plant west of North Platte, our Gerald Gentleman Station. That's a 1,365-megawatt coal-fired plant. We also have a 225-megawatt coal plant southwest of Lincoln, our Sheldon Station. We burn very little oil and natural gas today, which is very good, given the price of oil and natural gas. We get 24 percent of our energy from nuclear power, which again is non-emitting. We get about 10 percent from hydro and wind, which also are non-emitting, and a small percentage that we purchase on the market.

Thirty-four percent of our total resource mix is from non-CO_2-emitting resources. But we all know that coal, oil and natural gas are major contributors to CO_2 emissions in this country. When you look at the entire electric industry, production of power from coal and natural gas and oil contributes about 42 percent of the total CO_2 emissions nationally from all sources, transportation being the other major contributor.

In Nebraska, electric power contributes about 48 percent of our CO_2 emissions. You can see transportation is also the other big contributor. And we contribute about 1 percent of the national CO_2 emissions on an annual basis.

As I said, we're following very closely what's going on in Congress regarding CO_2 emissions. A number of bills have been considered and introduced. The one that gets the most discussion is the Lieberman-Warner bill. You can see where our total greenhouse gas emissions are in 2005. It's a little over 7,000 million metric tons a year, including CO_2, methane, fluorocarbons, all of the different types of greenhouse gases. The goal has been set to try and get down to 1990 emission levels by the year 2020. You can see that's quite a dramatic change from what we would project emissions to be if we went forward into the future on a business-as-usual basis, and we don't expect that's going to happen.

Some of these bills have an expectation that by 2050 we would get down to 60 to 80 percent of 1990 emission levels. So, that is a dramatic change this industry might be faced with going forward. And as you saw from the previous charts, coal

"Climate change is getting much, much discussion in our industry across the entire country, and we're watching very closely what Congress is doing in that regard."

and fossil fuels play such a significant part of producing energy in this country. It's very difficult to change that overnight. This is something that's going to have to be addressed on a very long-term basis. A number of bills are being considered. Some are cap and trade that will put limits on CO_2 emissions, and eventually you have to get down to some lower level. There has also been talk of having a carbon tax or a greenhouse tax on sources. That has not received as much debate in Congress, apparently because they don't like to add other taxes to already high taxes, so it's easier to hide some of this – if I can use the word "hide" in a cap-and-trade type program – which is a little bit less transparent to the public. But, nevertheless, it has some significant economic costs.

For NPPD, this is what we would look like. The top blue line is where NPPD is today. We put just under 12 million metric tons of CO_2 a year into the atmosphere. If we proceeded on a business-as-usual basis as we had done in the past, we project that by 2027, we would be up to almost 16 million metric tons of CO_2 a year. We've just completed some resource planning, looking at different things that we can do to stem the growth of our CO_2 emissions. At least under reasonable scenarios, we can maintain basically current levels, which is the red line up there. And by 2027, we could still be around 12 million metric tons, even with the continued low growth we would expect to occur in the state of Nebraska, trying to just maintain existing CO_2 levels.

From part of the legislation we expect (at least from the Lieberman-Warner bill) each utility that uses coal would be given some allocation for CO_2 emissions. That's represented in the blue area. Based on our interpretation of that bill, only about 40 percent of our CO_2 emissions would come back with some free allocations. The other 60 percent or so we would have to buy out of the marketplace or somehow find offsets going forward in the future.

So, we have a real challenge. Most of the legislation would give no more free allowances to any utilities by 2030. We'd have to find other offsets or buy emission allowances from other utilities or other sources that were able to reduce their CO_2 emissions. The cost impacts or potential cost impacts are a significant concern for our industry.

The EPA did an analysis of the Lieberman-Warner bill, looking at CO_2 costs starting in 2012, assuming that that bill were passed. They're looking at carbon costs to start at $30 to $40 a ton, escalating up to $90 a ton to $120 a ton by 2030. And that is a fairly significant cost increase. If you translate that into the dollar impact to NPPD, we estimate that in 2012 – if carbon costs are, in fact, in that $30 to $40 a ton range – we would either have to buy or find offsets that would cost us an additional $200 million to $300 million a year in our operation. And that's pretty significant.

So, what does that mean to our electric customers, business, industry, residential, commercial, etc.? We're at these ranges of $30 to $40 a ton or $200 million to $300 million in total for NPPD, which would cause our wholesale electric rates to go up in that 33 to 40 percent range for customers like the city of North Platte and the rural power districts we serve. This is a fairly significant increase. End-use customers, residential, commercial and business would probably see their electric rates go up 20 to 25 percent. Again, a fairly significant increase, and that's why there is so much attention on this particular issue in our industry today.

Our big question within the industry is what we can do going forward. The

paradigm has changed. In the past, when we looked at generation resource planning, coal was kind of the de facto source of new generation. Part of that was driven by the oil embargo back in the 1970s, when we were going to get away from reliance upon the foreign sources, even for electric production. Then in 1978, you might recall, the accident at Three Mile Island, the nuclear power plant in Pennsylvania, happened. So, foreign oil and nuclear plants went off the table at that point in time back in the '70s, and coal became the primary de facto source of new generation, along with natural gas. Both of those are fossil fuels that obviously emit CO_2. Now the paradigm has changed, and CO_2 emissions are a concern because of climate change regulations.

What do we do going forward in the future? With nuclear still a challenge, with coal now being a challenge, how do we meet our future power supply requirements and our future load in this country? The industry supports the Electric Power Research Institute (EPRI), the research arm of our industry. They have done a lot of analysis of the implications of CO_2 restrictions and operating in a carbon-constrained world or economy. They have found there's no single silver bullet out there to address our issues. They have found it's going to take a multiple approach to solving this issue from the electric power standpoint. It's going to take end-use energy efficiency programs. It's going to take more renewable energy programs.

"What do we do going forward in the future? With nuclear still a challenge, with coal now being a challenge, how do we meet our future power supply requirements and our future load in this country?"

We need to probably resurrect the nuclear industry in this country, which has been dormant in terms of new construction for the last 20 to 30 years. We need new technology in both types of power plants. It's hard to walk away from a power source such as coal that is abundantly available in this country, in both the eastern and western parts of the country, particularly the Wyoming area. We need technology on CO_2 storage and capture. We need new technology for vehicles, plug-in hybrids. We need to look at distributed energy resources as well.

EPRI's so-called "PRISM" analysis (from the colorful appearance of the graphical results) takes off on where we were with CO_2 emissions in 1990 and what it would look like going forward into the future under the business-as-usual case. You can see the dramatic growth in that. It would take multiple approaches to get emissions down to the 1990 level by 2030. The blue part of that prism is additional energy efficiency that would need to be achieved. The green part is additional renewable energy. The yellow is new nuclear. Today we have only about 104 nuclear plants in this country. To get that level of reduction, we'd need in the area of 50 to 60 more new nuclear power plants by 2030.

The red is new advanced coal technologies that are much more efficient than existing technologies. Our Gentlemen Station unit, a typical coal plant, today operates at an efficiency in the low 30 percent, meaning that for every Btu of energy you put into it, you only get about a third of that out in the form of electricity. We need to find new ways to get more output for every Btu of input. The orange is carbon capture and storage. That's something we're not doing today. That will probably need to be a big part of our goal of achieving the lower emissions going forward into the future. And I think that's where science is really going to have to help us make that feasible at a fairly cost-effective rate.

Finally, we can do more with plug-in hybrids and distributed energy resources. A number of organizations out there have looked at models different from what EPRI has studied. Each of them has their own little twist as to how much can be done by energy efficiency, how much can be done by renewables, etc. I'm not

going to get into the debate of whose models are right. I think the point I would emphasize is that it's going to take a multi-pronged approach in our industry to achieve CO_2 reductions in the future if we're going to get away from our historical business-as-usual.

I get an opportunity in my business to go out and talk with other utility executives across the country. They are all concerned about how we are going to meet our future power supply requirements across the nation, particularly during the next five to 10 years. It's going to take longer than that to develop new nuclear power generation in this country. Most of the coal plants that have been talked about have been deferred or canceled. How do we fill that void? That is a real concern. Some utility executives are predicting that certain parts of the country, within five to 10 years, are going to start seeing significant numbers of brownouts, potentially even blackouts.

Trying to meet the challenge is not going to come without some impact on cost of electricity. In some scenarios, we can see that electric costs here in Nebraska could triple from where they are today. On average, our electric rates here in the state are around 6 cents a kilowatt-hour for most customers. Under some scenarios, we can see that go up to 15 to 18 cents a kilowatt hour or more. Some of the areas of the country are already there. Our concern is, what impact does that have on our economy in this state and how do we address that and try and keep the energy supply reliable and affordable at the same time?

Long term, we need to slow, stop and then reverse the amount of greenhouse gas emissions. It's not unlike driving your car down the highway at 60 miles an hour, heading north and then suddenly determining that you need to be going south instead. You can't change directions immediately. You've first got to slow down, then you've got to stop, and then you can go in reverse and get back to going to where you want to go. And that's the challenge we see in our industry.

There are no silver bullets out there that are going to cause us to be able to reverse what we've done overnight. It's going to take time to do that. As I indicated, science is going to have to play a key role in this whole effort, including new technologies that we haven't seen before, particularly for carbon capture and storage. Basin Electric Cooperative in North Dakota has a coal gasification plant where they're taking coal and converting it to synthetic gas. In the process, they're capturing the CO_2 and then transporting it via pipeline to oil fields to enhance oil recovery from the earth.

Some of you might have seen recently in the *Omaha World-Herald* a month or two ago about a Nebraska company that has announced a coal gasification plant, or at least is proposing one, in Texas. A coal gasification plant converts coal to synthetic gas and, in that process, captures CO_2 and again uses it for enhanced oil recovery in the oil fields in Texas. Unfortunately, with all the CO_2 emissions we have and all the coal-fired plants, there are not enough oil fields out there to handle all of the CO_2. So, you really get into a question of what do we do with it once we capture it, if we can capture it?

A lot of work needs to be done. To do that, we expect there would have to be a national pipeline system not unlike the natural gas pipeline system. Once you capture that CO_2, you've got to get it someplace where you're going to store it, whether it would be in the deep ocean storage areas, deep underground, etc. And that's expected to add significant costs to coal-fired generation. The other thing is

that in the process, you lose about a third of the output of your power plant. The process will require mechanical equipment, pumps, compressors, motors and all the other carbon capture equipment that you will have to have. You're going to have less output that you can take out onto the grid. So, you effectively lose about a third of the available capacity and energy you can use to serve your customers.

Storage is probably one of the biggest challenges and really has not been addressed yet in this country from a policy standpoint. It's something we don't expect is going to be easy. I think probably all of you are familiar with NIMBY, "Not in My Backyard." I know NPPD faces it when we want to build a new power plant someplace or build a new transmission line. And I understand people don't want to have a power pole or a power generation facility in or near their backyard. But these are societal needs. The plants and lines have to go someplace. Now a new term has been proposed for CO_2 storage: NUMBY, "Not Under My Backyard."

The question becomes, who owns the CO_2 in the storage facility? Who is responsible for it if it escapes? What happens to it once it is injected? What does it do to the groundwater, for example? Does it contaminate the groundwater? Those are questions I think science is going to have to help us answer. Will the public accept it? I don't know. Contrast the potential storage of CO_2 with the issue of storage of spent nuclear fuel from nuclear power plants. How successful have we been in this country with public acceptance of storing that in a central repository? Yucca Mountain has been talked about for about 20 years, probably. NPPD has sent over $150 million to the Department of Energy to help fund the cost of a central repository for spent nuclear fuel. That's just NPPD. The entire nuclear industry has contributed billions of dollars.

NPPD wind turbines near Ainsworth, Neb.
Photo by Brett Hampton

We do not have any type of either temporary or permanent off-site storage facility yet. It goes back to public acceptance. I see a similar challenge dealing with CO_2 storage – where it can be done and whether the public will accept it.

So, where will our electricity come from in the future? As I indicated, coal has taken the back seat right now with concerns over CO_2 emissions and climate change. Many new plants that have been proposed have either been deferred to the future or taken off the drawing board entirely. Two new coal plants were proposed here recently for northwest Kansas. The state of Kansas denied their air permit because of CO_2 concerns. Those power plants are very much needed by the utility that wanted to build them. A coal plant in northwest Missouri was put on the shelf and deferred. The state of Texas about six or eight months ago canceled eight of the plants that were being planned. Florida Governor Crist said no more coal in Florida. The state of California said no coal plants in California. California won't even allow energy produced from coal in other states to be imported. So, where is the future of coal? That's a real good question.

The future viability of the nuclear industry is still a huge uncertainty. We've got 104 nuclear plants in this country today. A new one hasn't been constructed in the last 20 to 30 years. Quite frankly, we have lost the technical skills and ability to even build nuclear power plants in this country. We don't have the pipeline in many of the universities anymore. We're seeing a little bit of resurgence coming in

some areas of the country. But where are we going to get the nuclear engineers we need, the skilled craft people we need to build these plants? It's a real challenge. And then once they're built, will they be accepted? That's another challenge. There are huge risks associated with nuclear.

My predecessor is Bill Fehrman, who now is CEO of MidAmerican Energy Company, which is part of Warren Buffet's conglomerate. I had a chance to visit with Bill in January of this year. He had just completed an effort that took six to eight months looking at a new nuclear power plant for MidAmerican Energy, which has no nuclear resource mix right now. When they got done, they concluded there was too much risk, too much financial uncertainty for them to move forward. And if Warren Buffet's company thinks it's too much risk and too much cost, what does that say for the rest of the industry, particularly for entities like Nebraska Public Power, which certainly are not very big in comparison to Warren Buffet's company? So, there are lots of questions.

The other thing on new nuclear is that this country has lost the manufacturing capability to make most of the major components that are required of nuclear power plants. Those are all outsourced. I was at a nuclear conference in Chicago about three weeks ago. What I heard was that 80 percent of the major pieces of equipment in a nuclear plant will be coming from overseas. A big part of that is the forged steel reactor vessel, for example. We no longer have the capability in this country to make them.

Even though there is an interest in the nuclear industry stepping up and building more nuclear power plants to help address the CO_2 issue, the real challenge is where we are going to get the engineering talent, the management talent, the skilled labor talent and the materials we need to do it. The rest of the world is already moving forward with new nuclear– about 30 nuclear plants are under construction in other parts of the world. If we wanted to start today, we've got to get into the queue with some of the major equipment manufacturers. That's going to take time itself.

And the whole process is very lengthy. It takes about 10 years to build a nuclear plant. It takes about two years just to put together the information for the application we have to submit to the Nuclear Regulatory Commission. Once they get the application, it takes three-and-a-half to four years to review it and to give the go-ahead to start construction. And then construction takes probably five to six years, at a minimum, if everything goes well and no interveners try to stop it. Even under the best case scenario, it will probably take 10 years before new nuclear will be around. I also heard at the industry conference that the first new nuclear plants will be online in 2016 to 2018. And that's still really iffy. Many utilities are reluctant to be the first ones out of the box. They want to let "Mikey do it" first and find out what all the problems are before they commit their resources to it. It's a real issue.

What I'm hearing in the industry is if coal is kind of a no-no and nuclear is a long way away, how are we going to meet our requirements in the interim? I hear three things – more natural gas power generation, more renewable energy generation and more energy efficiency and conservation. The problem there, at least with natural gas, is availability and what might the price be. NPPD built a gas-fired power plant that went online in 2005. At that time, gas was trading about $2 to $3 a million Btu. Today we're $8 or $9 a million for Btu fuel costs out of that plant alone, or 9 to 10 cents a kilowatt hour just for fuel costs alone. And whether gas

supply would be available remains another big question.

I haven't found one person in the electric utility industry yet who believes renewables and energy efficiency can solve our whole problem. It will be part of the answer, but it will not be the solution to meeting all of our new low growth going forward in the future or be the sole source to help us reduce CO_2 emissions from our coal plants. It's a real challenge for the industry.

If coal is to remain in the mix – and I think it needs to because we have an abundant supply – we've got to find a way to deal with carbon capture and storage. And if we can't do that, we need to find ways to offset those carbon emissions. That's something we'll be working with the university on and finding ways, particularly here in Nebraska, that we can partner with the agricultural community. What you're doing in your industry can help offset part of the emissions in our industry so we can partner and try to find a solution that will benefit all of us. NPPD recognizes the growing public concern about CO_2 emissions. We're undertaking programs to help at least stabilize our CO_2 emission levels at current levels so they don't grow going forward, focusing more on energy efficiency, doing more renewables, etc., and trying to come up with a strategy that will balance both our customers' needs for low cost and reliable energy and, at the same time, help address the climate change issue. We think there needs to be a balanced approach on that.

"If coal is to remain in the mix … we've got to find a way to deal with carbon capture and storage. We need to find ways to offset those carbon emissions."

Here are some specific things we are doing.

- Sheldon Station is one of our coal plants southwest of Lincoln. It was built back in the 1960s, so it's fairly old technology. We're looking at re-powering Sheldon using new technology, including biomass as a source of fuel rather than coal.

- Our board of directors just recently approved the goal of meeting 10 percent of our energy needs from new renewable energy resources by 2020. We built one major new renewable resource a couple years ago. It's a wind farm up south of Ainsworth. Some of you probably have seen that facility. We just signed agreements with two other private wind project developers for a total of 120 megawatts of wind to be built up near Bloomfield. John Hansen is here. John is representing one of those groups. When those projects come online, they will take our new renewable energy from being about 1 percent of our portfolio to about 2.5 to 3 percent. So, it's moving in that direction. I think our board of directors was very insightful for setting the target out there.

- We've looked at lots of different options, and we're going to continue to update our 20-year resource plan, but we realize that renewables and energy efficiencies will have to be a bigger part of our energy future in a carbon-constrained economy.

- We'll be rolling out the energy efficiency programs later this year or early next year. We already did a major program last fall on compact fluorescent lights. We were able to place about 30,000 CFLs out in our service territory. You're going to see more of that in the future. We're working with the state Energy Office, looking at providing low-interest loans to people to upgrade energy efficiency in their homes and businesses. We're looking at pumped hydro storage facilities that utilize a two-reservoir system, a lower reservoir

"Making significant reductions in CO_2 emissions while providing reliable, affordable energy to our customer base is going to be a huge challenge for us. It's probably one of the biggest challenges our industry has ever faced."

and an upper reservoir. During nighttime hours when the wind is blowing and you can otherwise get lower-cost energy, you pump water up to the upper reservoir, and then during the daytime hours when the energy demand is high and energy prices are high, you can release that water and generate electricity. So, that's a project that we're looking at as well.

- And, of course, we think over the long term, our partnership with UNL through the Nebraska Center for Energy Sciences Research is going to help identify some new opportunities and technologies that we can incorporate in the state to help us be more energy-efficient and help us address the CO_2 issue.

I would just close by saying that making significant reductions in CO_2 emissions while at the same time providing reliable, affordable energy to our customer base is going to be a huge challenge for us. It's probably one of the biggest challenges our industry has ever faced. We're really at a crossroads right now on issues that have never approached this magnitude in the past. New technologies will have to play a role, including new technologies for energy storage. We were looking at compressed air energy storage, pumped hydro storage, new types of batteries. Technology is going to be very important, and I think our partnership with UNL is going to be very beneficial.

The bottom line is that NPPD is going to be doing some things to address climate change and be more environmentally friendly on CO_2 emissions, something that enhances our economy and the state, recognizing that our final obligation is to provide a reliable source of power to our customers at as low a cost as we possibly can. We understand the importance of that for the Nebraska economy and the people who live here.