[LR455]

The Committee on Climate Change met at 9:00 a.m. on Friday, October 21, 2016, in Room 1510 of the State Capitol, Lincoln, Nebraska, for the purpose of conducting a public hearing on LR455. Senators present: Tyson Larson, Co-Chairperson; Ken Haar, Co-Chairperson; and Patty Pansing Brooks. Senators absent: John Kuehn; Heath Mello; Ken Schilz; and John Stinner.

SENATOR LARSON: Welcome to the LR455 Committee. My name is Tyson Larson, the cochair of the LR455 Committee, along with Senator Ken Haar. I am from O'Neill. Committee members present: we have our legal counsel, Ken Winston; Senator Ken Haar from Lincoln; and I believe Senator Patty Pansing Brooks will be joining us...

SENATOR HAAR: At some point? [LR455]

SENATOR LARSON: ...this morning; and then Senator Mello this afternoon. There are two different sign-in sheets located on the tables in the back of the room. Whether or not you are invited or are just planning on testifying, we do ask that you fill out one of those sign-in sheets and return it before you testify to our committee clerk Aaron Bos on my left. Today will be invited testimony for the first four testifiers. After that, we will open it up. I have a list of those that have indicated an interest in testifying, so we will be able to go through that. When you come up to testify, please speak clearly into the microphone, please tell us your name and spell your first and last name. Also please tell us whom you are representing, if anyone. We will be...for the invited testimony we won't necessarily be using the lights. I will have Aaron turn them on for five minutes just so the senators understand where our time is because we do have a lot to get through. But the invited testifiers, please keep it concise. If you can keep it at five minutes, that would be great, but I won't really hunker down after five minutes. For those that are not invited testifiers, we will be using the lights as more strictly, and be keeping those to five minutes. When you...it will be green and at four minutes you'll receive a one-minute warning and then the light will turn amber. And then the red light will be up at which you need to wrap up your statements and then I will be cutting you off. Please turn your cell phones or other electronic devices to silent. If you have conversations, please keep them to a minimum or take them out into the hallway. The LR455 Committee tries to go paperless. If you have documents

we will hand them out and get them to the committee. But at the same time, if you have anything that you can send electronically, that would be great as well. We appreciate your conversation...or we appreciate your cooperation, I'm sorry. And today we will begin with Dr. Don Wilhite, with the University of Nebraska-Lincoln. The morning session is focusing on climate action plans and what the state of Nebraska should do in focus of a climate action plan and what one should contain and if the committee should draw upon one and recommend one. So welcome to the LR455 Committee, Dr. Wilhite. [LR455]

DON WILHITE: Thank you, Senator Larson. I feel like I'm sitting in the...anyway. [LR455]

SENATOR LARSON: Have you testified before in front of the Legislature? [LR455]

DON WILHITE: No. [LR455]

SENATOR LARSON: Well, welcome. [LR455]

DON WILHITE: Welcome, okay. My testimonies in the past have been with Congress but not in this body, so I appreciate the opportunity. So thanks for the invitation. I've provided copies of some PowerPoint slides that I'm going to be using or referring to in my presentation. Your indulgence with time, in talking with Aaron, I think he said maybe 10 minutes or 12 minutes or something. I'll probably go... [LR455]

SENATOR LARSON: Yeah, 10 or 15. We'll just keep the lights off for you, like I said, with our invited testifiers. [LR455]

DON WILHITE: Okay. Okay, that's fine. So if you refer to the handout that I provided, first of all, I'm a retired professor from the University of Nebraska, a professor emeritus. I was one of the main authors of the university study on the understanding and assessing the implications of climate change for Nebraska. And I also refer to a round-table report that we produced this year, early this year, as a result of round tables that we held on the issue of climate change for different sectors in the state. So the first slide there, the "Implications of Climate Change for Nebraska: Do we need a 'Plan of Action'?" I could make this presentation really short and just

say, yes. And so I could then sit down, but let me go on and maybe outline some reasons why I think this is important. The second slide is looking at the picture of the cover of the report that we did, "Understanding and Assessing Climate Change: Implications for Nebraska." This was done in the hope of pulling together a lot of factual information on the science of climate change, the implications for different sectors, projections into the future--particularly towards the end of this century and so on--what kinds of changes in climate we should expect as we move forward. The next slide is looking at global temperature anomalies from 1880 through 2016. Obviously 2016 isn't over, but I've drawn a red line there beginning about 1970 or so where we've seen this dramatic rise in global temperatures. And as most of you know, 2015 was the warmest year on record; 2016 is expected to exceed that by a considerable degree. In fact, every month of this year has exceeded any of the historical records and so on, with the exception of September. September was the second-warmest month globally. So 2016 we're on course to set new records. The next slide is looking at a comparison showing global average temperature. And you once again can see those years shown in red as being indicating the dramatically increasing temperatures that we've experienced globally. Also on that graph you see CO2 concentrations. CO2 concentrations are incredibly important. They've been increasing dramatically and at an increasing rate. And so the warming that we've been seeing is closely related to the increased concentration of greenhouse gases in the atmosphere, particularly carbon dioxide, so this is very important. The next slide is looking at the changes in temperature that we've seen in the U.S. in recent decades compared to a historical average. And you can see the greatest amount of warming in the U.S. has been along the northern tier of states and then in the west. Nebraska is kind of a mixture, more warming in the western or Panhandle portion of the state, less in some of the other areas. But essentially, all areas of the U.S. have shown pretty dramatic warming in recent decades. This translates into the next slide, which is looking at "Observed Increases in the Frost-Free Season." For the Great Plains as a whole, and this map comes from the National Climate Assessment report that was issued in 2014, for the Great Plains as a whole, we're looking at an increase of ten days in the length of the growing season. For Nebraska that's highly variable around the state, so it actually varies between about 5 days increase to as much as 25 days increase in the growing season. So we expect this trend to continue as you move forward. The next slide is looking at plant hardiness zones and so once again we're translating that temperature into the kinds of changes that we've seen in terms of what crops will grow where; things you plant in your garden; plant hardiness; you know, what will survive in a particular

climate; and so forth. And so it's interesting that in 1990 the line of demarcation between Zone 4 and 5 ran through central Nebraska and in 22 years that line between Zones 4 and 5 has shifted to the southern border of South Dakota. So this is reflecting this change in temperature, length of growing season, and so forth. The next illustration here is looking at temperature change over the past 11,000 or so years and you can see the blue line is indicating a rather stable climate that we've experienced over this period of 11,000 years. And then you'll see the red line there towards 2000. I've placed a dashed red line on the graph to show that this is where we are today, so we've experienced considerable degree of warming already. But if you look at projections towards the end of the century, we're looking at projections of an increase in temperature of, say, 8 degrees Fahrenheit, where as so far we've warmed by only a little over a degree. And so we've essentially entered a period of unstable climate as opposed to a stable climate that we've experienced over the last 11,000 or so years. So when people talk about climate change there's a lot of confusion. If you look at the next slide, where I've illustrated some of the key points with regards to natural causes of climate change versus anthropogenic causes, and there we're referring to human causes. And so the natural forcings, as we call them, to our climate systems are things like variations in the earth's orbit; variations in the energy from the sun; volcanic eruptions, which can put a lot of aerosols and other debris into the atmosphere which affect global temperatures; and short-term climate variations, such as El Nino and La Nina that can affect weather patterns around the world for periods of a year or 18 months or so, something like that. It's important to point out with the natural forcings that these natural forcings are forcings that occur over tens of thousands of years. So when we talk about the coming on of an ice age or the disappearance of an ice age we're talking about long periods of time in which those forcings are affecting the climate. If you look at the human forcings of climate change, here we're talking about increased concentrations of greenhouse gases--carbon dioxide in particular, but also methane and nitrous oxide, water vapor and so on; changes in land use, such as deforestation, because this changes the albedo or the reflectivity of the earth's surface and how much it absorbs and how much energy it absorbs from the sun versus reflected; and changes in aerosol particles associated with burning of fossil fuels or biomass burning. So the anthropogenic forcings are ones that occur over much shorter time scales and so what we're looking at and what we're projecting into the future with regards to climate change is really related to human forcings, not related to natural forcings. These natural forcings are continuing to occur, but again, on much longer time scales. So the ability of societies really to adjust or adapt to these changes is really being strained

because of the fact that how rapidly these changes are occurring and will continue to occur in the future. The next slide is looking at climate projections for Nebraska. And so the projections for Nebraska--and this is out to like the third quarter of this century so we're only talking now about maybe 50, 60 years from now--an increase in temperature in Nebraska ranging from 4.5 degrees to 8 or 8 to 9 degrees by the last quarter of this century. And so the ranges that we see here are largely due to the uncertainties in future emissions. So when the climate modelers look at the climate system and they model that system and do projections into the future, they're doing these projections based upon different scenarios of how much carbon dioxide is going to increase in the atmosphere. And since we don't know what the concentrations of carbon dioxide are going to be in the atmosphere in 2050 or 2070 or 2100, they run these models and then have different scenarios for how much carbon dioxide is going to be in the atmosphere. We've gone from around 280 parts per million in the atmosphere at the beginning of the industrial revolution, we've now exceeded 400 parts per million. And this is continuing to increase and will go to 450, go to 500, and so on. So depending on what kinds of actions we put in place in the United States and the countries around the world in terms of limiting emissions and, therefore, trying to scale back the concentrations of carbon dioxide and other greenhouse gases in the atmosphere is going to determine different alternative futures in terms of how much change in temperature we're going to experience in the future. So the curve or the scenario that we're on right now is for us to experience an 8- to 9-degree increase in temperature. And so this is kind of the business as usual, as it's usually referred to, and we're actually exceeding that level at the moment. Project that high-temperature stress days, these are days over 100 degrees, are expected to increase dramatically. And again, under the higher admissions scenario which we are currently on, we're looking at 22 to 25 additional days over 100 degrees. Just to give you an idea, Lincoln averages about five days per year over 100 degrees. In 2012, during the drought, we had 17 days over 100 degrees and so 2012 is more indicative of what we can expect in the future, so very, very hot temperatures, very warm summer growing season and so forth. The number of warm nights are increasing and will continue to increase in the future, and we expect to see a continuing increase in the frost-free season. So the next slide is looking at the, what I would call, the inevitability of climate change. And there you see maps showing different scenarios of greenhouse gas concentrations and what this is going to translate into in terms of average annual temperature out in the last quarter of this century. So I've circled two of those scenarios because those are the ones that I referred to in the previous slide. So the low-emissions scenario is the one in the upper

left-hand corner which, again, is showing around 4 to 5 degrees Fahrenheit increase in temperature. The more realistic scenario is the one in the lower right-hand corner, which is showing the 8 to 9 degrees increase...or 8 to 10 degrees increase in temperature. Again, depending upon future concentrations, emissions of greenhouse gases, it's going to determine which of these scenarios is most reflective of what we're going to see in the future. Climate change is just not about temperature. You know, we hear about global warming, but global warming triggers all kinds of other changes in the atmosphere. And so precipitation, the trend projected through these climate models is that there's going to be a drying in the central Great Plains, soil moisture is going to decrease. This is largely a reflection of increasing temperatures and increased evaporation and transpiration. Flood magnitudes, we've already seen an increase in flood magnitudes, well, in the Midwest and along the eastern edge of the Great Plains, and this is likely to continue. This is associated with these very heavy or intense rainfall events that we're seeing more and more frequently in the region and then also snow cover is a major concern. And this is not necessarily in Nebraska, but decrease in snowpack in the Rockies is going to change surface flow in the Platte and the Missouri River system and so it's going to change surface flow across the state of Nebraska and the seasonal timing of that. The next slide is showing a cover of this round-table report. Following the issuing of the 2014 report on assessing and understanding climate change in Nebraska and its implications, I organized a series of eight round tables that were sector-based and so we had these round tables that focused on agriculture and water and energy and urban infrastructure. The faith community was part of this, ecosystems, forest and fire and so forth; a number of key sectors in the state. So we brought together over these eight round tables that were held in the fall of 2015 about 350 stakeholders from around the state that looked at the implications of climate change in their particular sector and tried to identify adaptation and mitigation strategies that would help those particular sectors deal with the issue of climate change. The next slide shows this range of sectors that we looked at and we...the people that organized and the people that participated in these were experts in these various sectors so they were able to interpret the climate projections in terms of the implications for those sectors. So I wanted to go through just a few of the key findings from the round table broken into different topical areas. First, in terms of water, which is so critically important in Nebraska with agriculture and irrigation and so on, there are threats to both water quantity and water quality; implications for both the availability of ground water as well as surface water; potentially tremendous impacts on agricultural productivity; increased energy demand associated with

higher temperatures; and higher demand for irrigation during the growing season. An increased frequency of extreme events like droughts and floods is of major concern to water users in the state and to the agricultural sector. Increased conflicts between water users: As increased demand for water increases, the conflicts are going to increase between water users, between urban and agriculture and other sectors, ecosystems and so forth. We're very fortunate in this state to have natural resource districts because it really can help us deal with the management of ground water resources in the state. But unfortunately, natural resource districts are really not taking this issue seriously in their planning with one exception. And so it's really important that the NRDs get on board with the issue of climate change and how that's going to affect water use in the state and the management of ground water as we move forward. In the agricultural sector, again, concern about the increased occurrence of extreme events, how these projected changes in climate are going to affect the resiliency of agricultural systems and ecosystems, and sometimes what we hear from agricultural producers is that, well, we always manage for weather variability from year to year. And obviously we have had historically a lot of variability in our weather from year to year and so forth. But one of the key findings from the National Climate Assessment report is that the types of changes in climatic conditions that we're going to see in the future, the greater occurrence of extreme events like floods and droughts is going to be well outside the range of anything that agriculture producers have been involved with in the past. And so in order to deal with these changes it's going to require new innovations, new technologies in order to deal effectively. Increased cost to producers associated with climate change and their changes in management practices, which is going to translate into an increased cost of food production and food cost for consumers. And then finally it was mentioned in the agricultural round table, impacts to food security, not necessarily in this country because we're blessed to have a large amount of food available and at reasonable prices, but this is going to produce a destabilizing effect in many countries around the would, which...destabilizing their governments and so on, so we're going to see more environmental refugees like we've seen recently coming out of Syria and out of Iraq and so forth. And some of these are related or being triggered by climatic events. Other key findings from the round tables, I've just pulled out a few of these. In energy I've already mentioned the increased demand for energy and the impact that's going to have as we move forward. And so I think it's important we take advantage of resources that we have here--wind and solar energy, very important. One of the sectors that we don't hear as much about but I think we're going to hear a lot more about in the future is the implications of climate change on

human health. These implications are incredibly important as we move forward and really I think personalizes the issue of climate change when you're talking about how it's going to affect you, your health, and your family's health, and future generations. And then education and information needs that we need to build more understanding and awareness of climate change, so educating our population. Higher education but also K-12 plays a significant role in educating young people as well as adults about this issue. And there's been some discussion at the university as whether we should develop a climate hub or a climate center that would bring together a lot of the resources at the university to better address this issue, both from a research perspective as well as from an education perspective. And one of the key findings from all eight of the round tables was all eight of the round tables the output from those round tables indicated that we really needed to develop a climate action plan for the state. We need to pool together the resources that are going to allow us to deal effectively, to adapt to these changes as they're occurring, and also mitigate some of the greenhouse gas emissions as we move forward. So we need to be proactive. Obviously a climate action plan would set forth at the beginning measurable goals and time lines. In order to produce a climate action plan, you have to bring together the broad range of stakeholders to discuss and participate in that process. And while there are some costs associated with the development of a climate action plan, the benefits really far outweigh the costs. And so my final illustration is I've shown here a map of the status of drought plans in the United States. My history is that I founded the National Drought Mitigation Center at the University of Nebraska and that's become a global center recognized for its expertise and we work with countries all over the world. I've circled the state of Nebraska. When I started working on the drought and drought management issue as a climate scientist, there were only three states in the country with drought plans; now we have 48 states with drought plans. So we've made a lot of progress. And the reason I'm pointing this out is that I worked specifically with the state of Nebraska in the mid-1980s to develop Nebraska's first drought plan, when Bob Kerrey was Governor. And then we revised that drought plan in 1999 and 2000 when Governor Nelson was in the office. And the process by which we did that is very similar to the process that we would use in development of climate action plan. We brought together stakeholders from clear outstate, we had hearings, we talked with them, incorporated their input into development of a better early warning system for the state, putting together various kinds of actions and strategies to lessen the impacts, to lower the risk, and how agencies of government and other agencies would coordinate with one another. So that's really what we're talking about with a

climate action plan, but in this case we've already gone through this process a couple of times with drought, developing a drought mitigation plan for the state. And so I think we can draw from that experience significantly in terms of developing a climate action plan for the state. So even though I was a professor with the university for a long time, I'm now retired. I'm testifying in the affirmative as a private citizen that this is really a critical issue for the state. And it's particularly important because of the fact that we live in a very fragile ecosystem in the Great Plains and any modification or changes in our climate are going to produce tremendous impacts on ecosystems, on agriculture, and our economy in the state because of the wide variation in precipitation from year to year and also the gradient that we have from east to west in the state. So with that, I appreciate your attention and if there are any questions, I'd be glad to try and answer those. Thank you. [LR455]

SENATOR LARSON: Thank you, Dr. Wilhite. Are there questions from the committee? [LR455]

SENATOR HAAR: Yeah. [LR455]

SENATOR LARSON: I'll start with Senator Pansing Brooks. [LR455]

SENATOR HAAR: Sure. [LR455]

SENATOR PANSING BROOKS: Thank you for coming... [LR455]

DON WILHITE: Sure. [LR455]

SENATOR PANSING BROOKS: ...and for all of your amazing work, Dr. Wilhite. I am just wondering, on the last graph you talked about 48 states now have mitigation. [LR455]

DON WILHITE: Right. [LR455]

SENATOR PANSING BROOKS: But that doesn't coincide with this graph, so I'm trying to figure out what this shows versus what you said about 48 states. [LR455]

DON WILHITE: Okay. Okay, well, the only two states that don't have drought plans are the ones shown in gray, so that's Alaska and Wisconsin. [LR455]

SENATOR PANSING BROOKS: Oh, okay. So can you...what's the difference between mitigation and response? [LR455]

DON WILHITE: Okay, so typically many states, at least in the early stages of developing a drought plan, what they were principally doing is put together a plan that is responding to a drought, so it's reactive. And that's what we did in Nebraska in the mid-1980s with Governor Kerrey. And so the issue is when drought occurs a lot of states will pull together a drought task force and they'll talk about what they can do to deal with the drought. But the drought's already here and what you can do is very limited once you're in a drought. The states that are shown in orange are states that have become more proactive, in which they're looking at where are the vulnerabilities associated with drought in a particular state, which sectors, which communities, and so on and, therefore, trying to put in place actions that are going to lower the risk so that when drought occurs the impacts are less. As just a quick example, our Department of Health and Human Services, one of the things they did as part of the drought planning process that we went through in 1999 and 2000 is they did an assessment of the vulnerability of water supply in small towns around Nebraska. And those that were the most vulnerable, they worked with those communities to essentially diversify or enhance their water supply so they didn't run out of water. So that's a proactive measure, as opposed to just responding to a crisis. And so that's why some states are in orange. Other states, you see here, indicates like local...in the state of Mississippi, for example, in that case that state actually the authority for drought preparation or drought planning is down at a more local scale. So in Nebraska that could...the equivalent could be like to require natural resource districts. [LR455]

SENATOR PANSING BROOKS: NRDs, yeah. [LR455]

DON WILHITE: So it's more local level rather than a state level plan. Okay? [LR455]

SENATOR PANSING BROOKS: Okay. So thank you for that. And I presume the reason we're orange is because of your work historically, so thank you for that. [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR PANSING BROOKS: But what I'm also interested in is what is the difference...how could you explain or how could I explain the difference between a state drought plan and the climate action plan that you're trying to suggest? [LR455]

DON WILHITE: Okay, okay. Well, a drought mitigation plan, which is what we have in this state and what many states have, is really focused on one natural hazard. [LR455]

SENATOR PANSING BROOKS: One (inaudible), okay. [LR455]

DON WILHITE: It's focused on drought and what do we prepare for drought and how do we respond more effectively to drought when it occurs. The climate action plan that's focusing on climate change is something where we're looking at how changes in climate--temperature, precipitation, so this including everything, it's not just drought--how these changes... [LR455]

SENATOR PANSING BROOKS: It would include drought, it's broader. [LR455]

DON WILHITE: Right, it would include drought. So in other words, the projections that the climate models are providing us are showing that droughts are likely in many regions of the world but certainly in the Great Plains. They're going to become more frequent, more severe, and maybe last longer. So a drought mitigation plan that we have would be really helpful in dealing with droughts in the future. But what about all of those other things like the changes in high-temperature stress days, the changes in precipitation distribution different times of the season, and how all of the different businesses and sectors are going to respond to that, how ecosystems are going to respond to that? So drought is one element of a climate action plan. [LR455]

SENATOR PANSING BROOKS: Okay. [LR455]

DON WILHITE: But it is only one element. Yeah, it's...climate change is a much broader concept. [LR455]

SENATOR PANSING BROOKS: Just wanted to clarify that, thank you. [LR455]

DON WILHITE: Right. Yeah. I think you had a question. [LR455]

SENATOR HAAR: Yeah. Well, first of all, I would like to say that I want to thank you and the university because the university, a land grant university, as I learned, has three charges: research, education, and outreach to the community. And I see all of those reflected in the study you did in 2015 and I appreciate that. [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR HAAR: You're one of the world's experts on drought mitigation and so the question, won't humans just adapt to climate change as it happens, how do you respond to that? How do I respond to that? [LR455]

DON WILHITE: Yeah. Well, they will adapt. The degree of hardship that they're going to experience is going to increase exponentially depending on how much warming we actually have. And so we are already adapting to climate change because it is occurring now. And so farmers are planting earlier and so forth, so there are a lot of examples where we're adapting to climate change. But the degree of change that we're projecting into the future is kind of outside of the range of what we've experienced in the past and so if we want to reduce the impact of climate change on society in all the different sectors, we need to lessen the amount of warming so that the challenges of adaptation are much less than they would be. You know, if we could stay on a 3 or 4 degrees Fahrenheit range, it's going to be much easier to deal with than we're talking 8 to 9 to 10 degree range. So it's a degree of hardship that we're going...so we're going to have to adapt, we have no choice. How quickly and how able we're going to be to adapt to a warming that's projected under the business-as-usual scenario is going to be a real challenge. [LR455]

SENATOR HAAR: And then just for the record, the Nebraska rural poll that was taken in 2015 concentrated on energy and on climate change. And in that polling done by the university, 61 percent of rural Nebraskans either agreed or strongly agreed that the state needs a climate action

plan. So this is, as a committee, we're not really going out on a limb talking about climate change; in some ways we're responding to what the citizens of Nebraska are asking us. [LR455]

DON WILHITE: Yeah. I mean, certainly what we've seen as a result of the 2014 report and also the report of the round tables is there's this groundswell of momentum that's been building from local communities and grassroots organizations, environmental groups, and so forth really pushing for the concept of developing a climate action plan. We need to put together a process and carry that forward. So it was really pleasing to see the results that you just mentioned with regards to 61 percent of rural Nebraskans because one would think that these are the most conservative. And if 61 percent of rural Nebraskans feel we need a climate action plan, if you polled all Nebraskans, I think the percentage would be considerably higher. So there is this groundswell I think of interest and need for action that's coming from the local level and I think the state government needs to respond to that. [LR455]

SENATOR HAAR: And again, I want to thank you. As an emeritus, you're still staying around, right? [LR455]

DON WILHITE: I'm still staying around, that's my plan so. Okay, thank you. [LR455]

SENATOR HAAR: That's good. [LR455]

SENATOR LARSON: Not quite yet, Dr. Wilhite, I do have some questions. [LR455]

DON WILHITE: Oh! Oh, you have a question. Oh, I thought I was going to get off easy. [LR455]

SENATOR LARSON: Well, mine are possibly a little more technical. [LR455]

DON WILHITE: Okay. [LR455]

SENATOR LARSON: As I know Senator Pansing Brooks and I will continue to be around in the Legislature for at least the next two years, I'll leave after that and she has to run for reelection, so, and with Senator Haar... [LR455]

SENATOR HAAR: I'm out. [LR455]

SENATOR LARSON: ...exiting due to term limits it's...the committee can, I think what we're looking to do, is recommend that the next Legislature actually move deeper into the climate action plans, and whether that's funding or whatnot. So I guess I kind of want to get a little more into just a few details of what that is,... [LR455]

DON WILHITE: Okay. [LR455]

SENATOR LARSON: ...because I think, as Senator Haar and I have discussed as cochairs, we might not be quite getting down into the weeds but making more broad recommendations. [LR455]

DON WILHITE: Okay. [LR455]

SENATOR LARSON: So I'm about ready to get a little more into the weeds with you, if that's all right,... [LR455]

DON WILHITE: Okay, okay. [LR455]

SENATOR LARSON: ...just to give you a little bit of a background. [LR455]

DON WILHITE: All right. Okay, that's fine. [LR455]

SENATOR LARSON: So as we move forward, and I'm looking at some of these key findings from the round tables in terms of what a climate action plan contains, and I know our next invited testifier has probably done some of, you know,... [LR455]

DON WILHITE: He was, right. [LR455]

SENATOR LARSON: ...done climate action plans and whatnot, but Nebraska is such like an agricultural-heavy state. And when we're looking at the things that has been offered or what you offered in terms of the shifting of what can be planted and whatnot, are there things that...and we understand that any type of climate action plan our goals and benchmarks and what the Legislature can do or what the state can do to encourage, and so I'm focusing on agriculture here. I represent an ag district. Are there ways that, you know, are there different crops that, instead of the corn and the beans, that will grow better, do need less water, that we can like encourage farmers to do or work with? Or when we look at water, you know, obviously you talk about how there...we'll possibly...facing more droughts or there just won't be as much water. And we obviously have a great natural resource in the Ogallala Aquifer, so. [LR455]

DON WILHITE: Right. [LR455]

SENATOR LARSON: And in the afternoon session we're having, you know, carbon reduction. Is there things that we can look at in terms of, well, we still need to use the water but let's focus on making the wells more efficient or solar or whatever else? [LR455]

DON WILHITE: Right, right, right. [LR455]

SENATOR LARSON: What are we...are those options? You know, are there...what do you think a climate action plan such as... [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR LARSON: And obviously I'm asking specifically on agriculture, what NRDs, if they incorporate climate action into their planning, how? How would the state...you get what I'm saying? [LR455]

DON WILHITE: Okay, okay. Right, right. Yeah. [LR455]

SENATOR LARSON: There's a number of questions I'm trying to get just more into the weeds on. [LR455]

DON WILHITE: Right. Well, you know, it comes down for agriculture, it comes down to the best management practices for the water resources available. And so obviously we've moved to more efficient irrigation systems. We're not necessarily saying that, you know, irrigation is going to disappear in Nebraska. [LR455]

SENATOR LARSON: I hope not. [LR455]

DON WILHITE: Yeah. But I think irrigation in the future is going to become more limiting because of conflicts between water users for a finite amount of water resources and so forth. And then we have to look as you look to the future if you're looking at a more variable climate and maybe less effective precipitation because of higher temperatures. There's going to be an increased demand for pumping of ground water, for example, and so the more efficient we can be in the use of that water, the better. So that means that we are going to have to continue to look at more drought-resistant crops that were growing in the state. And obviously we're growing more drought-resistant corn than we used to in most areas of the state and so on. At some point we may get to a point where corn is not the best option in some sections of the state for a crop, we have to move to more less water-intensive crops. And so the university can provide a major role through extension service in terms of advising farmers because this is going to be a gradual process. Farmers are always adopting new technologies and so on, so, you know, the use of fertilizers and, you know, the planting rates and all of these kinds of things. The better information we can give to farmers, the better they're going to be able to adapt to these changes as they occur. And they are occurring and they are adapting now but the projected changes into the future are kind of outside of the range of what they've had to deal with in the past. So from an agricultural perspective there are a lot of things that can be done in terms of soil conservation, retaining water on the soil. We've already seen that with the minimum till and all of that that's come into play, so that's had a huge impact in Nebraska already. And I think these kinds of technology will continue to develop as we move forward, as well as more efficient irrigation. And then eventually, you know, you are looking at probably some changes in crops and what we

can grow and the seeding rate for those crops and so forth in order to respond to this change in climate that's occurring and will continue to occur in the future. [LR455]

SENATOR LARSON: And I appreciate that and as you were sitting there talking I'm running a lot of things in my mind and I'm just thinking of how Innovation Campus, with how we're focusing on agriculture and developing new seeds... [LR455]

DON WILHITE: Right, right. [LR455]

SENATOR LARSON: ...and genetically working with these types of crops, kind of actually facing a lot of these, the university is already actually... [LR455]

DON WILHITE: Right, right. [LR455]

SENATOR LARSON: ...trying to ensure as we move forward that we are able to plant those crops or different types of crops. [LR455]

DON WILHITE: Exactly. And as Senator Haar was indicating, you know, the role of a land grant institution is to do exactly that. And, you know, when I worked with now-Chancellor Green on the production of our first report in 2014, I mean, he was anxious to support that effort because that is the role of a land grant institution is to research these emerging issues and to get this information out to people and also to stimulate new research that's going to help, in this case, agriculture and other sectors adapt to these kinds of changes as we move forward. [LR455]

SENATOR LARSON: So, yeah, we'll probably...I have a feeling the committee will recommend that the Legislature reinstitutes this committee moving forward and so I think, you know, specifically...I don't know if Senator Pansing Brooks will want to continue on in the committee or not but I'm sure we'll have more specific questions specifically of like how certain institutions work because I'm sure every state is different with their climate action plan. [LR455]

DON WILHITE: Right. [LR455]

SENATOR LARSON: And we want make sure, you know, we don't want to...and I've made it clear to Senator Haar, I want to create, grow our economy, while at the same time working to reduce our carbon footprint. [LR455]

DON WILHITE: Right, exactly. [LR455]

SENATOR LARSON: So, you know, looking at strategies of how we do that because we're already seeing the population decline. [LR455]

DON WILHITE: Right, right. [LR455]

SENATOR LARSON: And I've talked to Senator Haar about some of those ideas of how, you know, things that this committee can recommend... [LR455]

DON WILHITE: Right. [LR455]

SENATOR LARSON: ...on how we can grow rural Nebraska but at the same time focusing on carbon reduction things so. And I think we're getting there but we'll continue... [LR455]

DON WILHITE: Yeah, yeah. You know, I think, you know, the work that I've done historically with states and with countries around the world on drought mitigation planning, you can learn a lot by looking at what other people have done. So you're not reinventing the wheel. But you look at what they've done and you adapt that to your local needs and so we've done that and other states have done that as they develop drought plans. One of the first questions they asked is, you know, what sort of actions or what do the drought plans look like in neighboring states? And so they take a look at those and then they say, okay, this is appropriate for us and this isn't appropriate or we've already done this and so forth, we don't need to repeat it. And it's the same way with climate action plans. We can look at the climate action plans of other states and see what they've done and adapt them to us because our economy is different than Iowa's or Colorado's or California's, but we can learn by some of the actions that they've taken and adapt those ideas to our particular needs so we're not starting from zero. [LR455]

SENATOR LARSON: Sounds good. Senator Haar. [LR455]

SENATOR HAAR: This is a question for your expertise. Some people have said to me, well, gee whiz, carbon dioxide is what makes plants grow so more carbon dioxide, won't that just make better corn and better soybeans and so on? [LR455]

DON WILHITE: Well, I mean, the research has shown that that's true to a degree but very quickly you get into plateauing and so carbon dioxide concentrations will increase biomass, you know, if you do this in a controlled environment, for example in a greenhouse. But then you reach a saturation point, then it no longer continues, it's no longer effective in terms of increasing biomass. And so, and this only occurs in certain types of crops, not all crops. So, yeah, so as we move forward and, you know, we've already passed the 400 parts per million, as we go to 450, 500 and so on, yeah, that's not going to save us. So the research has shown that. And I think the people who say these kinds of things, I think it's based on research that was done or speculated about back in the 1980s but the research since then has really said that we quickly reach a saturation point and further increase in carbon dioxide in the atmosphere is not going to affect biomass that much or production. And the negative side of that in terms of how it affects temperatures and changes in climate at the local, regional, and global scale are much more significant. So those are the things we have to look out for. [LR455]

SENATOR HAAR: Okay, thank you. [LR455]

DON WILHITE: Okay. [LR455]

SENATOR LARSON: Can you make sure that you e-mail our committee clerk, Aaron, a copy of this for the record? [LR455]

DON WILHITE: Sure, sure (inaudible). Yeah, I will... [LR455]

SENATOR LARSON: We keep everything electronically so if anybody asks for it. [LR455]

DON WILHITE: Yeah, I will do that. [LR455]

SENATOR LARSON: We try to save paper. [LR455]

DON WILHITE: Okay. All right. Well, yeah, I was going to do PowerPoint but then I found out that (inaudible). [LR455]

SENATOR LARSON: We don't allow...the Legislature does not allow any of this. [LR455]

DON WILHITE: That was going to be a challenge, so, yeah, I'll e-mail that to Aaron. Okay. [LR455]

SENATOR LARSON: Yep, and we'll keep it in the record. So appreciate it. [LR455]

DON WILHITE: Okay, sounds great. Okay, yeah. [LR455]

SENATOR LARSON: Thank you for your time, Dr. Wilhite. [LR455]

DON WILHITE: Sure, thank you. [LR455]

SENATOR LARSON: And next we do have another special invited guest, Michael Tubman, from the Center for Climate and Energy Solutions. Welcome to the Nebraska Legislature. [LR455]

MICHAEL TUBMAN: Yes. And I can send those electronically also. [LR455]

SENATOR LARSON: Mr. Tubman, welcome to the Nebraska Legislature. Please spell your name and who you represent and then continue on. [LR455]

MICHAEL TUBMAN: Sure. My name is Michael Tubman, M-i-c-h-a-e-l T-u-b-m-a-n, and thanks for the opportunity to speak here today. I am the director of outreach at the Center for Climate and Energy Solutions, or C2ES. C2ES is an independent, nonprofit, nonpartisan organization. Our mission is to advance strong policy and action to reduce greenhouse gas emissions, promote clean energy, and strengthen resilience to climate impacts. Our work is

informed by our Business Environmental Leadership Council, which is a group of 30 major companies that work with C2ES on climate change and energy risks, challenges, and solutions. BELC companies active in Nebraska, for your reference, include Berkshire Hathaway Energy, CBRE, GE, LafargeHolcim, and NRG Energy. The views I'm expressing, however, are those of C2ES alone and my presentation this morning will focus on state climate action plans, which are simply a set of strategies to minimize the risk of climate change to a jurisdiction. It should include both ways to reduce greenhouse gas emissions and ways to build resilience to changes. In particular, I'd like to discuss the reasons to pursue a climate action plan, how some other states are doing so, and the components of such a plan. So first, looking a little bit at the reasons to pursue a climate action plan and overall the need to confront climate change is increasingly clear. Climate change poses a significant risk to a broad range of human and natural systems. Some impacts, such as heat waves and heavy downpours, are already taking an economic and human toll on our country and our world and state climate action is critical to ensuring a response that is appropriate for local needs and takes advantage of the opportunities in each state of our country to lower our national and global emissions. Now as Dr. Wilhite explained, here in Nebraska the National Climate Assessment expects significant climate-related challenges. The impacts in the Great Plains will include more frequent and severe rain events, droughts and heat waves, and those will cause a number of challenges for this region, including: increasing competition among land, water, and energy users; developing and maintaining sustainable agricultural systems; conserving vibrant and diverse ecological systems around the state; and enhancing the resilience of the region's people to the impacts of climate change. Luckily, coordinated planning between the public and private sectors can overcome these challenges and this is the goal of a climate action plan. At the same time, many states view policies to reduce greenhouse gas emissions and become resilient as an economic opportunity. These states are positioning themselves as leaders in new markets related to climate action, such as producing and selling alternative fuels, increasing the production of renewable energy and exporting it to other states, and attracting new businesses. Economic issues are just one motivator for state policies that address climate change. You should also consider policies to improve air quality, reduce traffic congestion, and develop domestic clean energy supplies as all of them could have climate benefits. So looking at some of the other states, 34 states have completed climate action plans or are in the process of revising or developing one and many are now focused on implementing those plans. I put a map of those plans in your packet. The origins and structures of those plans, however, is as varied as the states,

as you might expect. Some start with an executive order, others begin with legislative action. Most, however, include some role for the executive branch and some role for the legislative. A look at some of Nebraska's neighboring states demonstrates this variety of approaches. To the west in Colorado they've taken an agency-led approach; it began in 2007 when then-Governor Ritter first issued a climate action plan. But in 2013 the legislature then passed a law requiring the state to undertake a new planning effort led by a new position in the governor's office responsible for developing and periodically updating a plan in collaboration with numerous state agencies and outside stakeholders, some of which were spelled out in the legislation. The law also required regular reporting to the legislature on the progress and outcomes of the plan and the most recent of those updates was provided in 2015. Now in Iowa it was a little different tact, the state relied more heavily on expert councils. The legislature created the Iowa Climate Change Advisory Council in 2007, which was charged with identifying policies and strategies for Iowa to respond. It included 23 voting members from business, industry, environmental groups, academia, and government who presented the governor and legislature with scenarios and policy options for reducing greenhouse gas emissions and preparing for climate change. Now other states have used a variety of approaches. C2ES has worked very closely with the Maryland Commission on Climate Change, which was first tasked with evaluating and recommending state emission goals in 2007. The recommendations of that climate action plan led to the establishment of statutory goals for the state in 2009. After its initial expiration, the commission was reestablished in 2014 by an executive order by current Governor Larry Hogan and was codified by the Maryland General Assembly. This was a bipartisan process. The commission issued its first report in December 2015, which detailed the current science of climate change in Maryland, along with recommendations for action. C2ES provided significant research assistance to the commission as it undertook all of this analysis. One of the keys of a successful climate action plan is getting input and buy-in from stakeholders. Climate change mitigation and resilience will affect numerous sectors of the economy, including energy, agriculture, health, transportation, water, and manufacturing. It is important to include diverse perspectives when creating climate action plans to assure mutual understanding and ambitious but achievable goals. The role of the private sector must be included in climate action plans. Over the last 18 years, C2ES has worked with big business to find practical, economically efficient approaches to reducing emissions, and they've shown a lot of leadership in this respect. Alongside our work with the Maryland Climate Commission we've also conducted outreach to medium and small

businesses to include them in the process as well. So looking a little bit more detailed now at what are the components of a climate action plan, a successful climate action plan takes a comprehensive approach to the full suite of climate challenges facing a state; it should examine both mitigation and resilience, and it will include several components. First, it will help policymakers and those affected by climate change understand the risks. The first impacts of climate change...sorry, the impacts of climate change will vary by time and place, of course, and different impact scenarios may occur based on the ambition of global efforts to reduce total emissions, as Dr. Wilhite was explaining earlier, and also because there is some underlying uncertainty about the exact impacts of those certain magnitudes of emissions. Many states turn to the National Climate Assessment, in-state universities and research institutions, such as the University of Nebraska, and state scientific agencies to understand their vulnerabilities. Second, states should establish baselines for both greenhouse gas emissions and resilience. Many states have developed a greenhouse gas inventory that accounts for the emissions of gases, including carbon dioxide and methane from all sorts of sources. Knowing the emissions profile of your state in particular will help all stakeholders identify the opportunities for reductions and track progress as reductions are made. This knowledge can also be important in helping all citizens in a state and their businesses understand their particular role in emission reductions. Similarly, states should create a baseline for climate resilience. All states manage emergencies, of course, and I'm sure in Nebraska you have a very sophisticated approach to handling natural disasters operationally. But as the risks associated with extreme weather change due to climate change, state agencies must also be prepared for changing circumstances. Levees and drought preparedness are some areas in Nebraska that probably require particular attention over the long term. Third, once baselines have been established, goals and targets must be set. Quantitative goals for emission reduction are important for transparency and accountability. Goals or targets may be set using a variety of different metrics. You could use the quantity of emissions, which is the most commonly used metric, energy use or economic value potentially; they can also be set sector by sector or for the state economy as a whole. And goals and targets should have a baseline year on which you're working, as well as a target date by which to achieve results. Four, states must identify and evaluate policy options to achieve those goals. A variety of policies can reduce emissions and build resilience to climate change, including voluntary programs, market-based policies, and command and control regulations. Voluntary programs are certainly a great way to start. Over the long term, market-based policies are able to reduce emissions at the lowest

cost by incentivizing private sector action. The cost and benefits of policies should be analyzed completely and that includes the cobenefits of policies that may accrue to health, energy savings, and energy security. Finally, a climate action plan should recommend action, as you might guess by the name. Each state will need to have a different suite of policies to reduce emissions based on its economy, government structure, and political priorities. A climate action plan should set the executive and legislative branches down a long-term path to emission reductions and greater resilience while still being flexible for future needed changes. So climate change is increasing the risk of all Americans from extreme weather and other impacts. Our actions now, both to reduce emissions and to become more resilient, will affect our communities for years to come. And thank you so much for your efforts here in Nebraska to try to reduce the risks for current and future generations. Happy to answer any questions you might have. [LR455]

SENATOR LARSON: Thank you so much for coming, Mr. Tubman. Questions from the committee first, before I start. Senator Haar. [LR455]

SENATOR HAAR: Lots of questions. Thank you very much for coming. A big question I would have, and I really liked the order in which you laid down the four necessary steps, how do we engage your group? [LR455]

MICHAEL TUBMAN: Well, you've started. I'm here; you know, we've worked with a number of different states and communities for a variety of different reasons. We work on a national basis but have, you know, as I mentioned with the state of Maryland, the environment commissioner asked us, reached out to us, to try to help them get started with some research for the Maryland Climate Commission. We've been working with cities around the country. We've done some in-depth studies with Anchorage, Kansas City, Providence, Phoenix, Miami Beach to help them figure out how to engage their communities, their businesses on areas of specific concerns to them with resilience and even to do some baselining of resilience in the community and taking a holistic approach looking at, you know, where is Kansas City now in its resilience for long-term planning. And then we may be able to help them in the future to try to, you know, overcome the vulnerabilities that they've assessed. So we're happy to work with you on a variety of different issues. We have some expertise in climate action plans, as I said with Maryland. My personal history, I worked on a climate action plan in Alaska; Governor Palin at the time established a

climate change subcabinet in Alaska and had a number of working groups that required industry and nonprofits and civil society and researchers to confront a number of different areas of resilience and mitigation. So we have a lot of different areas of expertise. I don't know if you have something in particular that you're thinking of. [LR455]

SENATOR HAAR: Well, you know, obviously there is a price tag connected with this. [LR455]

MICHAEL TUBMAN: Sure. [LR455]

SENATOR HAAR: And that's one of things, as we make recommendations from this committee, we'll have to include that. So could you give us some idea of what states are spending on climate action plans or perhaps what your group... [LR455]

SENATOR LARSON: This isn't a quote. [LR455]

SENATOR HAAR: No, this is not official, but just to give us a ballpark. [LR455]

MICHAEL TUBMAN: Well, I mean, I don't...I think climate change is a crosscutting issue so it's difficult to say, okay, a climate action plan is going to cost you X dollars and then you'll be done because that's not really how you can approach climate change. What you should be doing is setting up a system whereby when your transportation department is looking at how to build a new highway or repaving they're not just looking at what the needs might be to have the road survive a 10-year flood event, they're looking at a 500-year flood event or a 1,000-year flood event, if that's the type of event that we might see on a more frequent basis in the future. Same thing with your water infrastructure, for agriculture, are you planning now for an agriculture infrastructure project? Maybe you need to spend a little bit more money now on that project so that it is not just viable for the next 10 years, but it's viable for the next 60 years. That's the type of investment you might look at. The cost of the actual...I think the cost of an actual group to study that is pretty minimal compared to the cost savings that the state would see over the long term, being able to avoid some of the costly benefits of climate change, because the cost of inaction are increasing while the cost of action are actually decreasing with the price of renewable energies and infrastructure development technologies. [LR455]

SENATOR HAAR: But could...I guess a questions at some point for us will be we need to make a recommendation, so are you available to help us make a budget recommendation? Because that's not one of our...not only do we have to pass a law, but we have to appropriate money if there's money. [LR455]

MICHAEL TUBMAN: Sure. That's absolutely something we could do. [LR455]

SENATOR HAAR: Okay. Then how do you deal and how have states dealt with the politics? Because, you know, sometimes you can't say climate change but you can say resiliency and so and so forth, so talk a little bit about the politics that you have run into. [LR455]

MICHAEL TUBMAN: Yes, I think that's certainly something that differs from state to state and across time. I think resiliency is certainly a way to begin the conversation with communities. Everyone understands the threat of certain natural disasters to their community, whether it's flood, drought, extreme heat, in some places--not Nebraska--sea level rise, and so they're happy to be able to have a conversation about that. And it's important to not just engage individual citizens but the organizations that they work with. The business community, especially big business and organizations like utilities, have a long-term planning horizon that they should be looking at with regards to climate change. So resiliency is certainly a way to look at it. The other opportunity I think is to not think about climate change preparedness as a cost on society, because I don't think it has to be. There are lots of opportunities for you to grow your economy and look for low-carbon solutions that can have economic benefit. Actually, just yesterday I was down in Hallam at the groundbreaking for the Monolith project, which is taking natural gas, a fossil fuel, and cracking it, creating carbon to be used to produce carbon black and hydrogen, which will be then used to refire a coal-fired power plant with hydrogen, which is zero emissions...well, it emits water which is, as emissions go, not really that bad. So this is a clear example in Nebraska how you're increasing manufacturing jobs while lowering emissions. And I think there's lots of other opportunities to do that, I'll be explaining some of those in the afternoon session. But I would look at the positive opportunities, the opportunities perhaps to look at different types of agricultural practices that could increase production over time. It's not about just losing and about cost; it's about improving your economy. [LR455]

SENATOR HAAR: So, what I guess what I'm hearing is that by involving the stakeholders, which we've been talking about all along, is really the way to make this sort of thing happen. [LR455]

MICHAEL TUBMAN: Yes. I think what Dr. Wilhite talked about within the university's approach is definitely a great start and that mirrors in a lot of ways what other states have done. I know from my own experience in Alaska, working with the climate change subcabinet there, we established a number of working groups--oil and gas working group, mining group, fishing group, Alaska Native group--to try to understand what the priorities were for each different aspect of the community and also to try to narrow down what the vulnerabilities were. You need to find something that touches each individual community and inspires them to want to take action, not feel like it's being imposed on them from outside. And I think in Alaska we did accomplish that to some extent and were able to have a climate strategy that was released. That's pretty similar to what other states are doing. Some are much more advanced in their planning; you know, as I mentioned, Colorado and Maryland are really on their second or third iterations of climate action plans because it's not as though you're ever done planning for the future. The future is always ahead of you and it's always changing so there needs to be constant updating and constant rethinking. But by engaging enough stakeholders, you can hopefully make that an ongoing and productive process. [LR455]

SENATOR HAAR: One of the things I have liked about being a state senator is I have to keep looking at my biases. And I was surprised when you said that Alaska is approaching that and mentioned Governor Palin. What role did she play in...I mean, that kind of surprises me, but I'm glad to hear that. What role did she play and the administration play in Alaska? [LR455]

MICHAEL TUBMAN: In 2008, she issued an executive order requiring the establishment of the climate change subcabinet which, among other things, I believe asked for a climate action plan. So I think we've seen over the years quite a bipartisan approach to climate change. That's definitely something that's been challenged in the most recent of years, but I'm hopeful that that is turning a corner again. As you mentioned, public support, and even in rural Nebraska, is moving again towards looking towards constructive approaches to address climate change. With every year that goes by, and we hear that this year was the hottest year on record, there is an

increasing urgency for people on both sides of the aisle to work together and come up with solutions for their states, for their cities, and for the nation. [LR455]

SENATOR HAAR: And of course, in Alaska and so on, the temperature is changing more quickly, right? [LR455]

MICHAEL TUBMAN: It is, it's probably one of the warmest places...most warming places in the country, definitely not one of the warmest places. But, you know, it's not just warming that affects it. I'd point to Maryland, has been quite active in recognizing the risks of sea level rise to its communities. That's really important in the state of Maryland and affects their economy in a number of different ways, not just fishing but tourism, all sorts of maritime infrastructure and logistics planning. So every state is finding something that's really important to them in climate change and making appropriate local actions. You know, I think you see across the west, for instance, drought preparedness and water planning are often the most central parts of climate action plans and planning. I would expect that would be fairly similar in Nebraska. And those states are also very politically diverse. [LR455]

SENATOR HAAR: One of the things I really started to get interested in is the health effects of climate change. Is that kind of a rising awareness? I've felt, even talking to some health professionals, they've not really recognized that as an immediate threat. [LR455]

MICHAEL TUBMAN: I think that's definitely an issue that is of increasing concern, not just the health effects from extreme heat, which cause a number of problems. Next month we'll actually be in Phoenix, helping them think about how to confront even more extreme heat, if you can imagine that. But there's also new disease factors like mosquitoes that might come into various parts of the country that weren't there before. So health is an increasing area of concern but, you know, again, it's not like there's one day when we will have a health impact that's climate change related. It's about making sure the infrastructure that we have, our health infrastructure, is prepared over the long term for a changing climate. What are the needs that if you're building a new hospital, what are the needs that Nebraska will have, not just in the next 10 years but in the next 50 or 100? How do you prepare for that? What are the frameworks for your public health

infrastructure that you want to have laid down so that the state is well-prepared for the future. [LR455]

SENATOR HAAR: And then finally, one term I've learned in this, my learning about climate change, is "stationarity," that you can't plan the future looking at the past, as we've done for so long. Will you comment a little bit on that? [LR455]

MICHAEL TUBMAN: You know, I think one of the things that we're discovering as we work with states and communities across the country is that a lot of local planning and state planning has been done around 5-year, 10-year, 100-year events; extreme rainfall events or droughts. And the infrastructure that we've built, the government frameworks that we have in place for those all are prepared for those types of events. But we're seeing increasingly the 1,000-year events, 500-year events are happening at a more frequent rate and communities haven't planned for those types of events, which means that the damage, both human and economic, is greater than we'd expect. So as we move to planning future activities, we can't just look at the climate that happened before, the weather events that have happened in the past 100 years as prologue; we have to look at what the science tells us we might expect in the next 100 or more years. [LR455]

SENATOR HAAR: Great. Thank you very much. [LR455]

SENATOR LARSON: Thank you, Senator Haar. Good thing Senator Mello is coming in the afternoon. He's our Appropriations Chair, soon to be former Appropriations Chair. And I've always said dynamic modeling will help this state, but as Senator Haar knows, we only have static modeling. So it's really just a number on the line; we don't get to realize how much we'll save in the future. [LR455]

MICHAEL TUBMAN: That frequently happens in legislatures. [LR455]

SENATOR LARSON: So I guess, quick, a few questions. First, so Alaska does have a climate action plan. I noticed this is just the...the 48... [LR455]

MICHAEL TUBMAN: They have some reports with recommendations from mitigation and resilience working groups. [LR455]

SENATOR LARSON: I was also going through some of the folder, are you going to talk a little bit more about this one in the afternoon? [LR455]

MICHAEL TUBMAN: Yes. [LR455]

SENATOR LARSON: Okay, then I'll leave that alone, because I found that one as I went through and looked at some of the folder. I thought that was an interesting slide, but I'll save that for sake of time. You kind of mentioned, and Senator Haar brought it up, each one is different but you learn from other states. And you talk about like Colorado and Iowa and some of these states are getting into the second and third generation of their climate action plans. Does that give Nebraska an opportunity to not have to go through those growing pains necessarily or see what has worked a little more effectively and pinpoint off of that or is it still anticipated to kind of have the same type of growing pains? [LR455]

MICHAEL TUBMAN: Well, I think it can always be a challenge to start but once you've started and thought a little bit about what your end goals are, there's a lot to learn from other states. You could look at however many dozen different structures have been put together, how they've framed their reports, how they've framed their working groups, their technical groups. There's a tremendous opportunity to learn from others and learn not just about what was substantively successful but also what was maybe most cost-effective, what are the ways that other states have learned to leverage some of the expertise of the private sector and things that already exist. You know, for example, if you look at Pacific Gas and Electric, which is a large utility in northern California, they're on our business council and they've actually done quite a bit of analysis on their own of what sea level rise and extreme weather will do to their infrastructure over the next coming decades. And so they've in a sense done some of the work that the state might have wanted to do. So how could you take opportunities like that to leverage some of the expertise that certainly your business sector has to further the goals of a climate action plan? [LR455]

SENATOR LARSON: Climate action plans and charter schools, we have a lot to learn. It's very similar in my eyes. All right, I appreciate that. I think it was very...I appreciate you coming in and I think there's obviously, as Senator Haar said, a relationship to be built moving forward with recommendations from the committee and how we go about that and finding a number of different paths. We'll make sure we get all this into the record and then we'll see you back this afternoon to talk a little bit more on the carbon reduction side of things. [LR455]

MICHAEL TUBMAN: Sure. All right. Thanks for the opportunity to be here. [LR455]

SENATOR LARSON: Thank you. [LR455]

SENATOR HAAR: Thank you. [LR455]

SENATOR LARSON: Next, Elizabeth Miller, is she...welcome to the LR455 Committee. Please make sure you spell your name. [LR455]

ELIZABETH MILLER: Good morning, Chairman Haar and Larson, and members of the LR455 Special Committee. My name is Elizabeth Miller, E-l-i-z-a-b-e-t-h M-i-l-l-e-r. I'm a policy analyst with the North Platte Natural Resources District in Scottsbluff. I'm here today to offer testimony on behalf of the board of directors on LR455, specifically relating to the development of a climate action plan for the state. The North Platte NRD has statutory responsibilities for the management of ground water quantity and quality and for the protection of the natural resources in our area. To fulfill those obligations, we recognize the importance of planning for the long-term effects of a changing climate, including the prevalence of drought in our region. Drought, as we all know, is a frequent occurrence in Nebraska and past droughts of recent memory have hit the Panhandle especially hard. The 2014 UNL report assessing the climate change implications for Nebraska shows that the frequency and severity of drought will escalate in the future, making longer and harsher drought periods more likely. Given these projections, we see an opportunity right now to formulate and implement mitigation strategies to enhance the resiliency of our communities and citizens as climate patterns shift by identifying and addressing the possible impacts of drought on the environmental, social, and economic health and welfare of our district. The North Platte NRD will be kicking off our drought planning efforts with an invitational

drought tournament, to be held in Scottsbluff on November 18. This event will be facilitated by the staff from the National Drought Mitigation Center housed at UNL, as you've already heard this morning. They will be bringing together stakeholders from across the district and include participants from a wide range of environmental, social, and economic backgrounds. These stakeholders will work in teams to identify community vulnerabilities to and impacts of drought, as well as to devise response and mitigation strategies to deal with those impacts. The information we gather from the tournament will directly inform the district's drought plan itself. The strategies we develop for the plan, in collaboration with our stakeholders, will focus not only on what can be done during a drought, but what can be done to prepare before drought even occurs. In addition, we look forward to building relationships with diverse stakeholders so that we are able to access real-time feedback regarding local experiences and challenges of climate change and, as a result, are better able to adapt our efforts to meet evolving needs as the local effects of our changing climate become apparent. The North Platte NRD cannot be the only driver in the climate planning process, however, in order for our communities to be successful. The district encourages other stakeholder groups to collaborate on their own plans and strategies for which the district will offer any support we can. Our drought tournament will provide one opportunity for developing conversations between people with varying perspectives that we hope will spur additional planning tailored to address vulnerabilities and impacts across the community. The district, however, can plan only within its own borders and for its own circumstances. Additional comprehensive climate planning is needed at the state and regional levels to encompass...sorry, the vulnerabilities and impacts of changing climate that reach across local jurisdictions. For example, each of the river basins in our state is shared across NRD, county, and sometimes interstate boundaries. The effects of climate change at a basin scale may expose critical vulnerabilities of the water users within each basin and local entities will need the support and framework of a statewide climate action plan to be better equipped to address those vulnerabilities over the short and long term. The North Platte NRD strongly supports the development of a statewide climate action plan as contemplated in LR455. We suggest that such a plan should provide for state, regional, and local adaptation strategies for the effects of climate change, including long-term and severe droughts. The state plan should also include concrete objectives for addressing not just economic impacts but also social and environmental impacts of climate change. The environmental and social health and welfare of every part of this state are equally crucial to ensuring that Nebraska as a whole is well placed to be successful into the

future, no matter what climatic circumstances may arise. The North Platte NRD urges this committee to develop a robust and comprehensive climate action plan framework to support the resiliency of this state and its communities. Thank you for your time, I'd be happy to answer questions. [LR455]

SENATOR HAAR: Question. [LR455]

SENATOR LARSON: Senator Haar. [LR455]

SENATOR HAAR: Well, thank you very much for coming across Nebraska. And of course, Senator Stinner, who represents your district, is on the committee and just couldn't be here today so. [LR455]

ELIZABETH MILLER: Sure. [LR455]

SENATOR HAAR: What's really neat is that you come as the North Platte NRD, so my question is, when you discuss climate change at the NRD, do you find the political divide that we see on a national level or are people open to talking about the concept in the nonpolitical fashion? [LR455]

ELIZABETH MILLER: I think there's some of both. Currently, with the drought tournament specifically, we've sort of approached it as a topical matter now and using that as a sort of segue into maybe larger conversations about climate change, but first addressing something that people have experienced, they've seen it, they've lived through it, that that can sort of facilitate a conversation that then later we're hoping could develop into broader conversation. [LR455]

SENATOR HAAR: Great. And I don't know, this is really a broad question, but to what extent do you think there should be...because a state climate action plan will probably include, I would imagine, some mandates. To what extent do you think mandates are appropriate or acceptable in this area, and then maybe some suggestions on where we need state regulations. [LR455]

ELIZABETH MILLER: As far as mandates, again, I guess we've taken the trying to collaborate and build trust and build relationships with people first and foremost. And so I think that just having the plan in the first place and having that framework available for people to approach and begin functioning that way would be best. [LR455]

SENATOR HAAR: And to make sure that if and when there's a plan it includes stakeholders from across the state, right? [LR455]

ELIZABETH MILLER: Sure, at various levels, not only at the state level, state departments--the DNR, DEQ, maybe Health and Human Services--but also a variety of economic, environmental groups, and then more local-level municipalities, districts, irrigation districts, sort of, I mean, really as diverse as you could possibly get but still keeping in mind logistics and then how it would be facilitated. [LR455]

SENATOR HAAR: Great. Well, thanks for helping us chart our way forward, I appreciate that. [LR455]

ELIZABETH MILLER: Thank you. [LR455]

SENATOR LARSON: Thank you. We have one last invited testifier, Stephanie Enloe, from the Center for Rural Affairs. Welcome. Please spell your name before you start. [LR455]

STEPHANIE ENLOE: Sure. Great. Well, thank you so much for taking the time this morning. My name is Stephanie Enloe, S-t-e-p-h-a-n-i-e E-n-l-o-e, and I represent the Center for Rural Affairs. I work out of our office in Iowa. The Center for Rural Affairs is a private, nonprofit organization established in 1973 and now based in Lyons, Nebraska. We work to promote social and economic justice, foster environmental stewardship, and strengthen rural communities. So first I want to applaud the Nebraska Legislature and especially this special committee for considering putting together a climate action plan for the state of Nebraska. And I want to speak today about some of my experiences in Iowa with stakeholder engagement around a sector that will be very important to climate mitigation and adaptation efforts, which is the energy sector. Before I get too deep into that, though, I also want to talk about some of the benefits that we've

seen in Iowa from energy. And, Senator Larson, you asked before about rural economic development and in Iowa the energy sector has been a big part of that, right. So we now get about over 30 percent of our electricity from the wind sector, which has created over 7,000 jobs, created billions of dollars of investment in Iowa, and by 2030 we're projected to see about $3.6 billion in electricity savings to Iowa consumers. So what does that look like in a Nebraska context? If you think about the Broken Bow projects, which are about 80 megawatts each, some studies have shown that projects of that size are projected to bring about 400 construction and maintenance jobs, which will create about $30 million in earnings over the lifetime of the project--or about 20 years--and about $50 million in additional local spending. So there are big economic benefits to be brought to rural areas through wind, also energy efficiency, solar, etcetera. There are also environmental benefits and health benefits of renewable energy, as we all know, but we need to get it right. And we've already referenced stakeholder engagement several times this morning and heard about some examples of that happening in Nebraska, as well as other states. I've been privileged to have the opportunity to engage in two different stakeholder engagement processes in Iowa over the past couple of years, one of which has been helping to put together the state implementation plan for the Clean Power Plan. Now regardless of whether you support or oppose the Clean Power Plan, stakeholder engagement is an absolutely vital part of looking forward to how states will implement the plan or comply with the regulation depending...assuming that the plan is upheld. So the Iowa DNR, which is the agency who has been in charge of stakeholder engagement and planning for the Clean Power Plan, has been convening stakeholder meetings since July of 2014. The stakeholder meetings have been open to the public, we've reviewed the draft rule and then the final rule, reviewed different analyses and modeling about available compliance pathways, what that might mean for Iowa's economy and different sectors of Iowa. We have had participants come to those meetings from each of our different types of utilities, so that would be investor-owns, municipal utilities, rural electric cooperatives. We have a slightly different utility system than you have here in Nebraska. Nonprofit groups from low-income representatives, environmental groups, energy advocates, rural and urban advocates are showing up to those meetings. And the Iowa DNR has also provided the opportunity for stakeholders who attend those meetings to weigh in on the agendas for upcoming meetings and to request different kinds of modeling and analysis and have made all of that information available through e-mail or other types of shared documents at the public meetings. So it's been a very transparent process. The DNR continues to reach out, despite the

stay, to various stakeholder groups who are interested in helping to put together the state implementation plan and send updates to groups, again, who are interested. So those, I think what the DNR has been doing, create some examples for best practices for how to involve diverse stakeholders. Now concurrently, the state has been working on an Iowa energy plan, which the impetus for the Iowa energy plan has been to continue to build on the economic success that we've seen through investing in renewable energies in Iowa. And this is not necessarily connected to the Clean Power Plan but will rather offer objectives and recommendations for how Iowa moves forward with their energy sector over the next 20 years or so. Again, I have the privilege of serving on one of the working groups for the Iowa energy plan. There were four working groups put together as a stakeholder engagement effort, as we were putting together the plan, dealing with four different types of the energy sector: so job growth, infrastructure, types of energy resources, etcetera. And each working group was comprised of 12 different people from across the spectrum in Iowa: utility representatives, farm groups, energy advocates, low-income advocates, environmental groups, business, etcetera. And our job was to put together SWOT analyses, raise objectives for the plan, put together a vision statement for the plan, determine what our goals should be, etcetera. The Iowa Economic Development Authority, which was the convening body for the planning process, also held six public meetings across the state of Iowa and hosts a Web site where they post resources, post notes from the working group meetings and public meetings, invite public comment, post updates, etcetera. And so again, I think this process really offers some insight in best practices into how stakeholder engagement might work here in Nebraska around a climate action plan. So finally, again, I want to applaud your decision for considering how you might move forward with a climate action plan here in Nebraska. And thank you for your time and I'll be happy to answer any questions. [LR455]

SENATOR LARSON: Thank you so much. Are there questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: Of course. Thank you very much. I like the message that the Iowa Economic Development Authority was the one that put these stakeholders groups together, it's a real opportunity. And then you say near the beginning $3.6 billion in total energy bill savings for Iowans. [LR455]

STEPHANIE ENLOE: Yes. [LR455]

SENATOR HAAR: We often hear that going to renewable energy is going to cost everybody a lot of money, it doesn't sound like that's happened in Iowa. [LR455]

STEPHANIE ENLOE: Right. If you consider wind energy and also solar energy, which is tracking down very quickly in prices as we reduce some of those soft costs, the up-front price is higher because of that investment in infrastructure but then there are no associated fuel costs. And so while there may be some level of maintenance costs overall, as we're seeing coal track up in price, natural gas is now down in price, but those fuel costs can fluctuate. So, yes, there's a projected $3.6 billion in electricity bill savings to Iowans by 2030. [LR455]

SENATOR HAAR: So even though the wind doesn't always blow and the sun doesn't always shine, 40 percent is coming now from wind energy, just from wind energy? [LR455]

STEPHANIE ENLOE: Yeah. I think for 2016 it was 30 percent, but within the next five years, with the announced MidAmerican and Alliant wind projects, will be up to at least 40 percent, if not higher. [LR455]

SENATOR HAAR: Well, one other question because it's kind of been dogging us, it's called NIMBY. [LR455]

STEPHANIE ENLOE: Yes. [LR455]

SENATOR HAAR: And the reports we get from Iowa, for example, that NIMBY has been a smaller factor, but how do you deal with NIMBY in terms of sight and sound and let somebody else do it, you know, everybody loves wind energy but it should be somewhere else? [LR455]

STEPHANIE ENLOE: Yes. Yeah, that's something we work with a lot. And my colleague, Lou (phonetic), who is also in the room today, attends public meetings in Nebraska for wind projects and works a lot with landowners in thinking about siting best practices for handling noise or other kinds of nuisance, best practices for compensation, etcetera. So I think good compensation

models are a big part of fighting that battle. Landowners should not be the only beneficiaries of a local wind project, also the community needs to benefit, right? And part of that can come from property taxes, part of that can come from jobs to the local area, but really emphasizing those benefits and working with local stakeholders on the ground to address their concerns in a transparent way and find ways to reduce any potential negative impacts. [LR455]

SENATOR HAAR: Do you think the people of Iowa, since you're talking about that here, understand the connection between renewable energy and climate change or is it just mainly a good economic opportunity? How do you see that? [LR455]

STEPHANIE ENLOE: I see it as green meets green, right? So there are plenty of Iowans who believe we need to be taking vast action to reduce our carbon emissions and to gain the other environmental benefits that come with renewable energy. But across the board Iowans understand the economic benefits. We have polls that show that we have very strong bipartisan support for all types of renewable energy in Iowa and a big part of that is that it's just good economic sense. We don't produce any fossil fuel resources in Iowa so all of those dollars leaving the state as we purchase coal or natural gas or other types of fossil fuel resources could be invested in local infrastructure, local jobs, local resources, and Iowans get that. [LR455]

SENATOR HAAR: And of course in Nebraska we have a lot of money leaving to buy energy when we have the third-greatest wind potential. And Iowa's is number 12 or something, right, in terms of potential? [LR455]

STEPHANIE ENLOE: Right. [LR455]

SENATOR HAAR: Well, thank you very much. I'm sure we'll be talking to you more. [LR455]

STEPHANIE ENLOE: Great. Thanks so much. [LR455]

SENATOR LARSON: Thank you, Senator Haar. Senator Pansing...no, I'm just double checking. It looks like you're all right, thank you. [LR455]

STEPHANIE ENLOE: All right, thank you so much. [LR455]

SENATOR LARSON: That will open it up. I know there's a number of other testifiers that want to come up, so just come up and we'll work through you from this until about...we'll go till about noon, unless we finish earlier. At this point we will be using the lights, five minutes. And like I said, the morning session will go till about noon, we'll take an hour...do we come back at 1:30, I think? [LR455]

KEN WINSTON: 1:30. [LR455]

SENATOR LARSON: One-thirty, so we'll take about an hour-and-a-half break. So I will, like I said, I will push us pretty hard on the lights to make sure that we get through these from here on out. [LR455]

SENATOR PANSING BROOKS: And I just want to add, Senator Haar, that...looking at you, sorry. [LR455]

SENATOR HAAR: We do look alike, that's true. (Laughter) [LR455]

SENATOR PANSING BROOKS: Yeah, you guys look so much alike. Sorry. [LR455]

SENATOR LARSON: Same age. [LR455]

SENATOR PANSING BROOKS: Yeah. Senator Larson. Chairman Larson, that I have to...I'm sorry, I had to rearrange some things to even be able to be here today, but I will be flying out of the state this afternoon, so I will not be able to be here. But my staff is going to be watching out. [LR455]

SENATOR LARSON: We appreciate that. Senator Mello will be joining us. [LR455]

SENATOR PANSING BROOKS: Okay. All right, thank you. [LR455]

SENATOR LARSON: So, not to your level of many things but... [LR455]

SENATOR PANSING BROOKS: I'm sure, yeah. (Laugh) Funny. [LR455]

SENATOR LARSON: Welcome to the LR455 Committee. [LR455]

JAMES CAVANAUGH: Thank you, Senator Larson. And thank you, and particularly Senator Haar, for proposing this important study. We appreciate the opportunity to come and testify. My name is James Cavanaugh, I'm an attorney and registered lobbyist for the Nebraska chapter of the Sierra Club. And we would like to speak to a couple of aspects of the climate action plan theme here tonight. To paraphrase, I think it was Martin Luther King, climate change accelerates when good people do nothing. And you saw from the previous excellent testimony of Dr. Wilhite that if we do nothing, climate goes up 5 degrees by the end of the century. If we do a lot of nothing, it goes up 10 degrees by the end of the century. Well, I have children that are going to be around at the end of the century and that concerns me because things are going to change rapidly and not for the better, as you see from Dr. Wilhite's study. We have a climate action plan that was entertained and in part enacted by the Legislature in the last legislative session. The LB1082 by Senator Schilz regarding fracking was part of a climate action plan and basically the part of the bill that did pass established some minimal regulations for people who are importing fracking waste to Nebraska and burying it in our aquifer. But it did not include an important aspect that would require those individuals importing fracking waste into Nebraska to have insurance for things that could go wrong with that waste in our aquifer. We need to come back with that bill in the 2017 Legislative Session, that's an action plan point. We did some good work on wind energy with LB824, Senator McCollister and others on this committee, that helped exempt private wind energy developers from application of Nebraska Power Review Board regulations. That's a good thing, an economic incentive to people to do development of renewable energy in Nebraska. And those two things are flip sides of the same coin. We should be disincentivizing people who are helping to accelerate climate change. Oil, gas, coal should not be incentivized in any way to further emit CO2 gases into the atmosphere. On the other hand, wind, solar, and other renewables should be incentivized. And so by the use of what we were trying to get at in LB1082 and what we did get at in LB824, you have a carrot and a stick approach that will over time be effective. But we need to come back year after year after year

and make sure it's implemented by the Legislature. This is your action plan, it's on your table. You can go down and get a copy of it from the Bill Drafters Office right now. We need to grow our economy by converting from these carbon-based energy sources to solar, wind, and other renewable energy sources starting yesterday. We can't do enough for that conversion and in the process of that conversion, this goes to Senator Larson's point, we're going to create millions of jobs in the nation and thousands of jobs in Nebraska. Every windmill that goes up in Holt County to generate electricity by a private developer is going to pay property tax to Holt County, to the school districts in your district, Senator Larson. This is hugely effective economic development and it is the future of this state on a number of different levels. LB802 by Senator Haar to create the Health and Climate Risk (sic: Resiliency) Task Force is something that also needs to be revisited and enacted. We need to hardwire what we're doing to effectuate this transition into our statutes in Nebraska. We need to do it nationwide but you act locally and you think globally. So this is an action plan that already exists, we don't need to have any other consultants, we don't need to have any other hearings, we need to just enact this legislation. Thank you very much. And I'll be followed by Dr. David Corbin from the Public Health Association of Nebraska who will talk some more about the health implications of what we're addressing today. Be happy to answer any questions you might have. [LR455]

SENATOR LARSON: Thank you, Mr. Cavanaugh. Questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: First, kind of a statement. You mentioned incentivizing and there are people who don't like that concept, but just for the record, and you're aware of this: Coal, oil, and gas are heavily incentivized in our economy, not just in terms of literal incentives like tax breaks and so on, but also the health costs. And I'm sure Dr. Corbin will talk about that later. I want to ask you real quickly, and I've been on the state board for the Nebraska Sierra Club and so on, and so even within the environmental community, though, everybody likes renewable energies but this NIMBY thing comes in of build it somewhere or don't tread on me. How do you deal with that? Do you have any suggestions? [LR455]

JAMES CAVANAUGH: Well, we need to understand, you know, what we're facing. We're like the individual standing on the beach and there is a huge tsunami wave about five miles off

coming our way. If, you know, we do nothing, that tsunami wave is, you know, 50 feet high; and if we do everything that we can, it's 25 feet high. But it's still coming and it's going to hit us, you know? We're not going to have this discussion I don't think so much about not in my backyard in 15 or 20 years because it will be in everybody's backyard. And what we're looking at is, you know, trying to do a few smart things now that will mitigate what's going to be, if we don't, an unmitigated disaster for Nebraska, for our future. You talked about the incentive...disincentive and one of the things that we attempted to do this year, and with your help was proposed, was redirect the hundreds of millions and billions, really, over time, dollars that the state of Nebraska invests in the stock market for various retirement funds and other state funds from carbon-based investments to renewable investments. This is not only, you know, good public policy, it's smart economic sense. I mean, the oil, gas, and coal industry are dinosaurs and they are facing extinction. And in 100 years they are not going to be the top traded companies on the New York Stock Exchange. Wind, solar, and renewables are, that's the future. So we need to get out of investing in the "buggy whip" economy of carbon-based investments and invest in the Space Age economy of renewables for no other reason than we owe it to our shareholders from an investment point of view. These are the investments that are going to generate big returns, not the 19th century carbon-based investments that we're heavily invested in right now. So we need to have that legislation reintroduced. We've done it before, we have divested from South Africa in the 1970s and 1980s, we've divested from Northern Ireland in the 1980s and 1990s, there's ample precedent for us using our public investments for public policy purposes and we should do it again. [LR455]

SENATOR HAAR: I kind of plan to be alive at the end of the century but maybe that's... [LR455]

JAMES CAVANAUGH: (Laugh) Well, I wish you luck with that. [LR455]

SENATOR HAAR: That's it. Thanks. [LR455]

SENATOR LARSON: First of all, I appreciate your testimony, Mr. Cavanaugh. I know there was a lot of bills that you mentioned that have been introduced and whatnot and I guess one thing that I want to make clear to everyone, there are certain...the structure of this committee is to...we

may be recommending certain types of legislation but at the same time I think, as Senator Haar and I have talked about as cochairs, we understand that, and in the afternoon session we'll talk about this, we want to focus on cutting carbon across the board and we understand that we can't just get out of everything all at once. And so I guess I really want to be mindful of that as we move forward, that we have to be very mindful of where we are on the investment side. Again, that will be one that I disagree with my cochair on that bill that he introduced and we have to be very careful and mindful as state senators when we're making recommendations such as that, that we do have a fiduciary responsibility, as Mr. Cavanaugh said, of those in the pension fund. But in 100 years the wind energies and solar companies might be the ones offering dividends, but right now they're not the ones offering dividends. The returns and our shareholders are still actually best where they are currently. And so this committee has to be very careful, and my own personal warning, of what we're focusing on and we are focusing on longer sustainable climate action plans that the state can move forward and create planning on and incentivize all sectors to cut carbon emissions so we're hitting those targets and those goals. And I think we've put together a very diverse, bipartisan committee that will be able to do that and focus on all different aspects. So I'm looking forward to it. This Legislature hopefully, and the next one, will be able to do a lot moving forward. And I appreciate, again, Senator Haar and everything that he's done, and hopefully that the Sierra Club can be on-board with the recommendations that I undoubtedly think we will make that will have a big benefit to the state of Nebraska. So thank you, Mr. Cavanaugh. [LR455]

SENATOR PANSING BROOKS: I just have one more (inaudible). [LR455]

SENATOR LARSON: Yeah, Senator Pansing Brooks. [LR455]

SENATOR PANSING BROOKS: I appreciate your testimony. I think it's so disheartening to me that--I think about Senator Haar's work for eight years and way beyond that--to look at these statistics and to look at what the graphs that have been placed to us and we're in this like whole zone of people without...of states without action plans, of states without credits. It's just, I think, I don't know. I'm so grateful for the people that continue to work all the time on these issues. And, you know, when I was running for office a few years ago, the Bluestem report was something that I really researched and tried to work with and tried to talk to people about. And I

look at what's happening and we're still not any farther, really. I mean, it's...people really...it's incredible the work that's being done at the university and what a leader we are. And yet, it just seems to fall on deaf ears across our state. I don't really have...I feel like we're just taking from our future, we're not providing anything positive for our kids. I appreciate the continued advocacy and the continued work that so many people are doing. But I feel so discouraged because I think, gosh, Senator Haar is leaving and, you know, if he couldn't get done any of this stuff, who is going to do that? And... [LR455]

JAMES CAVANAUGH: (Laugh) I think you answered your own question. [LR455]

SENATOR PANSING BROOKS: No, I... [LR455]

KEN WINSTON: Talk to me afterwards. I think there's a lot of reasons for hope. [LR455]

SENATOR PANSING BROOKS: Okay, I'm going to try to be hopeful. So I guess it's just my comment about I'm discouraged about where our state is, I'm discouraged about the fact that we're still talking about, gosh, is there climate change or isn't there climate change and, gosh, we can make some money off of this and, gosh, this is really positive for our future. It just feels like we're still back in kindergarten on this and I'm trying not to be totally discouraged by it. But, you know, if Senator Haar is leaving, who...I don't know. I mean, we need a champion and I'm not offering myself up on that because this is not my area. [LR455]

JAMES CAVANAUGH: Well, Senator Pansing Brooks, if I could just, you know, briefly interject here. You know, if not you, who? If not now, when? I'm trying to implore, impart a sense of urgency. The house is on fire here and we need to start, you know, getting the hoses out and doing it. [LR455]

SENATOR PANSING BROOKS: I get that. It's been on fire. [LR455]

JAMES CAVANAUGH: When you look at these graphs, that is the fire and it is raging. [LR455]

SENATOR PANSING BROOKS: Right. [LR455]

JAMES CAVANAUGH: This summer, we take our children to a different national park every summer, so they'll see stuff that their children aren't going to see. They're not going to see Glacier National Park like we see it. [LR455]

SENATOR PANSING BROOKS: Right. [LR455]

JAMES CAVANAUGH: They're not going to see Yellowstone like we see it. And we took them to Hyde Park, which is Franklin Delano Roosevelt's home, and they have a magnificent museum there. And one of the things that he said in a very tough time for our nation was do something, "try something." Everything you try isn't going to work but do something. When we're talking action plans here and we're talking specific legislation that already exists, let's try it. And if it doesn't pass, let's try it again and let's keep trying it. It's going to come, because the fire that's raging is going to be so apparent to everybody very shortly that they will be clamoring for, you know, action and we need to start doing that now. [LR455]

SENATOR PANSING BROOKS: I totally agree. [LR455]

JAMES CAVANAUGH: And you're right, Senator Haar has been a great advocate and we salute him and his service and future generations will thank him for what he did. But as they say, the torch is being passed to a new generation and you're one of those people and we look forward to your leadership on this issue going forward. Thank you in advance. [LR455]

SENATOR LARSON: Thank you, Mr. Cavanaugh. Senator Haar has one last thing. [LR455]

SENATOR HAAR: Yeah, just one brief comment. I am hopeful. It took eight years but we got...we finally have wind development on a level playing field with Oklahoma and Kansas and that took about eight years to happen. And I just look at my cell phone and I...you know, how quickly we've all put these in our hands. And as I look in my crystal ball, I think that we're going to see dramatic changes in the next five, ten years in how we not only produce electricity but how we use it, and so... [LR455]

JAMES CAVANAUGH: You're absolutely right. And you've been a prophet on this and I think history will look back very kindly on your actions. [LR455]

SENATOR HAAR: But we have to just keep working our butts off. [LR455]

JAMES CAVANAUGH: That's right. [LR455]

SENATOR LARSON: Thank you. Senator Pansing Brooks, me and you and Senator Kuehn and Senator Stinner on this committee are all returning. I have no doubt, as we move forward with LR455 in the next session, hopefully we'll all be able to take and fill in and move forward... [LR455]

SENATOR PANSING BROOKS: I hope so. [LR455]

SENATOR LARSON: ...if you're willing to stay on the committee. [LR455]

SENATOR PANSING BROOKS: We'll talk. [LR455]

JAMES CAVANAUGH: And, Senator Larson, just in closing I'd like to say that you're exactly right, this is going to take all hands on deck. Democrat, Republican, Independent isn't going to make any difference. And fortunately we have a proud tradition in the Nebraska Unicameral Legislature of that doesn't make much of a difference and you're a good example of that. And we look forward to you as one of Nebraska's rising young leaders to take a leadership position on this and on a bipartisan level working in good faith. We can get some really good stuff done, so thank you. [LR455]

SENATOR LARSON: I appreciate it. Thank you, Mr. Cavanaugh. I think we'll take who's next. Welcome to the LR455 Committee. [LR455]

SENATOR HAAR: Patty, I won't be in the Legislature but I'm not going away, I don't think. [LR455]

SENATOR PANSING BROOKS: That's good. [LR455]

SENATOR HAAR: I hope. [LR455]

DAVID CORBIN: Hello, my name is David Corbin, D-a-v-i-d C-o-r-b-i-n. I'm pleased to be before this committee today on behalf of the Public Health Association of Nebraska. I'm also an emeritus professor from UNO in health education and public health and I'm the chair of the legislative and policy committee of the Public Health Association of Nebraska. I'd like to just say that we're well on the way to a climate action plan because of the work that Dr. Wilhite has done and the publications that he's already presented us that do have some action items in there, that we do not have to start form zero. And of course, I do think that we've made progress and that LES and OPPD have purchased much more wind, so we have gotten a lot further than we were. So in public health, you know, if you're...you're only worried about climate change if you're worried about air, food, and water, and vectors like tics and mosquitoes that cause disease. So that means all of these are public health issues. From the American Public Health Association, the Canadian Public Health Association, the American Academy of Physicians, Lancet Commission, study after study talks about the public health. And rather than talk about them now, I do have an infographic that just kind of summarizes all the health aspects of climate change. So today I'd like to just focus on some possible legislation. And the first one, and I put in bold those, is we should have a renewable energy goal. The majority of other states have a renewable energy goal and we could add energy efficiency to that as well. That doesn't take a lot of work to establish a goal. Goals are aspirational. We should have high aspirations, we should set high aspirations for renewable energy and for energy efficiency. There's an article in the Bloomberg press right under that bold called "Wind is the New Corn" and in that they talk about...the whole title is "Wind is the New Corn for Struggling Farmers." It summarizes how wind energy has helped revitalize rural America, especially those that are already financially suffering. The second thing that I'd like to bring out is just to talk about divestment again. You don't have do divestment across the board but one thing that...it is a tactic that can work and, you know, maybe it's time for Nebraska because of what you heard earlier. We don't have fossil fuels in Nebraska and it's our turn. It's our turn to be the leaders, it's our turn to be the new generation. Just like cell phones, you mentioned in China they skipped landlines. They didn't have them, so they're basically way ahead of us in the use of mobile phones because they didn't have to go

through that. We can be the leaders and so we can be the leaders in saying if we make it a part of our economy we can invest in those resources that we already have, which would make it easier to divest and would make it...it's not across the board divestment all at once any more than we can convert to all renewable in a few months. And then finally on the...we are the only state that has a Department of Roads and if I could quote from the round-table discussions that Dr. Wilhite was talking about, it says, it offers this advice, "Transform transportation infrastructure," a great user of fossil fuels right now, "Greater infrastructure is needed in public transportation since transportation is a large component of the overall greenhouse gas emissions in Nebraska." So one example was electrification of forms of transportation. So one step to that would be to change to a department of transportation. Why don't we have a department of transportation? Transportation then includes public transportation, what we call in public health active transportation: walking, cycling, all of those other things that cut down greenhouse gas. And it opens the door. When you talk about a Department of Roads, you start thinking only roads. So I'm urging you to look at that transportation sector and in public health that's a major emphasis. And as we move to driverless cars and driverless vehicles and everything else, we don't know the half of what the future holds in that. But we do know that there's things that we can do right now and that can help cut down on greenhouse gases and improve the health of the public. Thank you. [LR455]

SENATOR LARSON: Thank you, Dr. Corbin. Questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: So it just affects water, food, and air? [LR455]

DAVID CORBIN: Soil, I left that out. [LR455]

SENATOR HAAR: And soil--I forgot soil--and certainly our health. In the same Nebraska poll that we talked about earlier, the 2015 poll, which focused--and that's, by the way, on the Web, anybody can look at that--which focused on climate change and energy, one of the questions that they asked, and it was a multiple choice, but who do you trust for information on climate change? [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR HAAR: And the first was the university and I think it's because of the leadership that Dr. Wilhite and others took and the risk of becoming public with something that is not always...you know, they can draw deniers and so on. But then the second one was scientists and the third one was doctors and public health, the third most trusted source of information on (inaudible). [LR455]

DAVID CORBIN: Fortunately, I'm all three of those. [LR455]

SENATOR HAAR: You are and so I'm going to, and we've talked about this, you and I, but I also fire the challenge back the Public Health Association of Nebraska, since they are one of the top trusted sources of information on climate change that, number one, I think public health officials have to become really familiar with climate change and especially the effects on human health, and then to add climate change to the context of the recommendations that public health makes. For example, in Lancaster County when it came to talking about wind development, the sound and stuff was mentioned, but not climate change, from the Health Department. And I think that since they are a respected source of information, that health departments have to add climate change to the context of all the discussions that they have and all the recommendations they have. [LR455]

DAVID CORBIN: The theme of the next American Public Health Association, not the one that's happening next week, but next year, is climate change and public health. So it's a major emphasis. And the aspect of "not in my backyard," as you know, we've talked a lot about compared to what? There isn't an energy source that exists that doesn't have pluses and minuses but if you compare the pluses of one to the pluses and minuses of the other, then you come out why so many public health officials are supporting renewable energy and energy efficiency: because of those pluses versus the bad air, the polluted water, all of those things. So when it was mentioned earlier about it's affecting everyone, it's in all of our backyards now. So not in my backyard, the air is in your backyard, the water is in your house, it's already affecting us. But because we don't immediately associate it with what fossil fuels can do, we tend to think it's not there. [LR455]

SENATOR HAAR: And often it's said that if like a power plant meets EPA regulations that means it's safe. [LR455]

DAVID CORBIN: Well, like any regulation, it's kind of like "use before" date, you know? There's leeway about what those ranges mean but at some point it becomes problematic. And so from time to time you have to change those because we learn new things that say, remember, we're talking about things that are measured sometimes in parts per billion or parts per million, so it's small amounts that can cause a lot of harm. [LR455]

SENATOR HAAR: Thank you very much. [LR455]

SENATOR LARSON: Thank you. First, I'm sure whatever climate action plan we develop, if that's the recommendation of the committee, and I hope it will be, we will have goals and we will move forward with those. I'm sitting here and I was kind of...I heard you talk a lot about like moving, you know, a recommendation is change Nebraska Department of Roads to a department of transportation and it's one that I started to think about a little bit in my head. And it was an interesting concept and one that as I start to work through isn't necessarily bad, but I have a few questions for you because, just the way you presented it,... [LR455]

DAVID CORBIN: Okay. [LR455]

SENATOR LARSON: ...because you talk a lot about like plus and minuses. And obviously I've spent time, I went to school in D.C. and lived in New York, and so I'm very adept at public transportation and that's something that, you know, Nebraska struggles with. But then it...and that's something that we can focus on. But then I also got to thinking about the way that, you know, turning more back I represent a very rural district and transporting goods and whatnot, and also with us being a public power state and the cheapest energy available, and I supported LB824 and work with wind projects and stuff like that, and so I understand those roles. But it got me to thinking, you know, a department of transportation can also look at things of working to get more, you know...we still burn fossil fuels but working to get more trains carrying grain instead of whatnot. Really, and I think maybe we touch that in the afternoon session of it sounds to me you're in support and have, as Senator Haar does, at least a knowledge we can't just turn off the

fossil fuels right away. And so we need to look at ways to cut the carbon and that's something that you and... [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR LARSON: Or, I don't know, you said you weren't representing the Sierra Club but probably like that's kind of something that you guys would be supportive of. [LR455]

DAVID CORBIN: Yeah, I'm the board of the Sierra Club as well as... [LR455]

SENATOR LARSON: But understanding that we can't just cut off the fossil fuels, just looking at ways if we can find a better way to effectively transport them or reducing our carbon emissions, that's something that you guys would be supportive of then. [LR455]

DAVID CORBIN: Yes. Yeah, my point about transportation, there's people that I know in public health that apply for grants, federal grants, for transportation and when they say Department of Roads, they kind of already automatically, rightfully or wrongfully, think, well, this isn't the transportation department, all they do is build roads. So it's that. [LR455]

SENATOR LARSON: Um-hum, interesting. [LR455]

DAVID CORBIN: The next thing that I point...I would make out is from the government point of view, as some government entities have started doing, is to say let's regulate our own fleet and cut down. So when we can have electric vehicles and charging station, let's be the leaders for the rest of the communities, so it's... [LR455]

SENATOR LARSON: And that's something...yeah, and I understand that and I think not only with our own fleet. You know, Senator Haar and I have already bounced ideas off one another how we fund those types of things and how we get more of those types of things. I guess my question, like as I said, I was just trying to get, like dive down into and get your feeling of when we look at these...I mean, reducing carbon is one of the things that we want to continue to focus on. And I'm really, and I think Senator Haar as well, given the political nature of climate change

and whatnot, want to build consensus across all fields and all sectors, because in a state such as Nebraska that's what it's going to take to get anything done. And I think we both kind of realize that we need to build a consensus to where all the groups are agreeing or all the groups can find common ground and understand that there's not only a benefit for their group but there's also a benefit, you know, for the state as a whole and the economy as a whole. So I guess I just kind of wanted to clarify that because I think that's something that we're going to focus on is what can we do to reduce carbon. And I just kind of wanted to get your guys' commitment, like if we're working on those ways and we are finding ways to reduce carbon in Nebraska, that you guys are going to be on board as we move forward. [LR455]

DAVID CORBIN: Right. Thank you. [LR455]

SENATOR LARSON: Thanks. [LR455]

SENATOR PANSING BROOKS: Just to add a little bit? [LR455]

SENATOR LARSON: Yep. [LR455]

SENATOR PANSING BROOKS: Thank you for being here and for all your help. I think, again, if you can get your information and Dr. Wilhite can do so to all the other senators I think that in a way you're talking to the choir and that's important. And I know that this is now a public hearing, so everybody is supposed to read all this information, but I think...you know, there's only 49 of us, it's not like another state where there are 365 representatives. [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR PANSING BROOKS: We have that good fortune of having relatively few to reach out to across the state. And I think it's so important for people like you to get to the other senators and to start pointing out the advantages, the tax advantages, the change of view that wind is the new corn--I like that idea--or the additional supplement to corn. [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR PANSING BROOKS: If we can start talking in those terms and getting the people, our colleagues, on board in that regard, it's really helpful. I helped on the wind energy trying to take votes last year and really trying to marshal all the people together and it's just...it's so amazing some of the things that I've heard from people. And again, I'm not the expert, so the point is that the experts obviously need to get to my colleagues and obviously need to get the facts. [LR455]

DAVID CORBIN: We will endeavor to do that. [LR455]

SENATOR PANSING BROOKS: Pardon me? [LR455]

DAVID CORBIN: I can guarantee you we will endeavor to do that. [LR455]

SENATOR PANSING BROOKS: Okay, that's just the...I just want to make sure that that is reiterated again and again that having it fall to one or two of us is not enough. [LR455]

DAVID CORBIN: I agree. [LR455]

SENATOR PANSING BROOKS: We have got to get the information out. It's factual information, it's not that hard. There are lots of groups here that could take certain senators and move along and hand-hold and really help them understand what is happening. And so I would just ask everybody here to do that and not just expect two of us to carry all the water in... [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR PANSING BROOKS: It's not enough. And we aren't that cumbersome here in Nebraska. We need that information to everybody. This should be something that we all understand. And we're just talking nuances, not, gee, is it important? [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR PANSING BROOKS: And I ask that all of you help do that and make that happen because I am not an expert, it's not...I can't be the one that's convincing my colleagues until you've laid the groundwork. [LR455]

DAVID CORBIN: Well, I couldn't agree more and I thank you for that. [LR455]

SENATOR PANSING BROOKS: I appreciate your work. Thank you very much. [LR455]

SENATOR LARSON: Welcome to the LR455 Committee. Please state and spell your name before you start. [LR455]

TIM RINNE: My name is Tim Rinne, it's T-i-m R-i-n-n-e. I am the state coordinator of Nebraskans for Peace and I live here in Lincoln. And I'm here today to talk about lunch. Specifically, I'm here today to talk about our food supply. On the first page of this handout that I have just distributed here, you have a picture of what we are calling the convergence of climate science and political science. Modern climate science, as Dr. Wilhite will tell you, has been around since the 1950s. But it really wasn't until 1988 when senator...not senator, but when climatologist James Hansen came and testified before the Senate's Natural Resources and Energy Committee that you really brought climate science into the political science domain and made this a discussion for the broader public. We'd taken it out of the laboratory, we had now put it into the U.S. Senate. Here's the thing--that was 1988. Jump forward 20 years, 2008. This is the first reference that I can find to any scientist with national reputation talking about the fact that climate change was going to have an impact on our food supply. Twenty years have gone by, we've been talking about rising sea levels, we've been talking about rising temperatures, we've been talking about more extreme weather, we talk about the fact that, you know, oh, this is going to have an impact on agriculture. But nobody is really closing the loop to talk about the fact this is going to impact food. Look at this, okay? Two thousand eight, in Budapest climate change will cause more floods in the Northern Hemisphere and droughts in the south and there will be water shortages in the western U.S. Next page, if you jump all the way forward to 2014, now the intergovernmental climate...now the Intergovernmental Panel on Climate Change, six years later, is now saying throughout the twenty-first century climate change impacts are projected to further erode food security. All aspects of food security are potentially affected by climate change. On

the next page I actually give the Food and Agriculture Organization's definition of what they call food security. And food security is "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." So here's what the National Climate Assessment, which impacts the United States, is talking about in May 2015 in their report, "Climate disruptions to agricultural production have increased in the past 40 years and are projected to increase over the next 25 years. By mid-century and beyond, these impacts will be increasingly negative on most crops and livestock." Then, as Dr. Wilhite referenced, "by mid-century," and now he's talking not 2050 but 2041 to 2070, "this increase for Nebraska would equate to experiencing typical summer temperatures equivalent to those experienced during the 2012 drought and heatwave...which was the driest and hottest year for the state based on the climatological record going back to 1895." That it's not just Al Gore that's talking about this stuff. Doug Bereuter says in May of 2014 in a report that came from the Chicago Council on Global Affairs that, "Climate change will bring hotter temperatures." He said at that point that they were looking for a 2 percent slowdown in food production by decade for the rest of the century. A year later he changed that to the fact that he thought by 2050 we would be seeing a 16 percent reduction in yield in agriculture at the same time that we were looking at a 60 percent increase in demand because we have more people on the planet and they want to eat more meat. He gets down to farmers everywhere will be affected if these changes are not addressed. Consumers will need to be prepared for higher food prices and potential food shortages. Then, Henry Paulson, who was George W. Bush's Treasury Secretary, and George Shultz, who was Ronald Reagan's Secretary of State, they formed this group called the Risky Business Coalition (sic: Project) and they reported in June 2014, "Our research shows that under the 'business as usual' scenario and assuming no significant adaptation by farmers...the (Midwest) region as a whole faces likely yield declines of up to 19 percent by mid-century and 63 percent by the end of the century." Six months later they came out with a follow-up report called "Heat in the Heartland: Climate Change and Economic Risk in the Midwest." "Over the next 5 to 25 years, without significant adaptation by farmers, some counties in Missouri, Illinois, and Indiana will likely see average commodity crop losses up to 18 to 24 percent due to extreme heat each year." The Department of Defense is seconding all of this. Way back in 2010 they said that, "Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration." Chuck Hagel, former Nebraska Senator, a Republican, when he was the Secretary of Defense reported just

before he stepped down, "Among the future trends that will impact our national security is climate change. They will likely lead to food and water shortages," and then "pandemic disease, disputes over refugees and resources, and destruction by natural disasters in regions across the globe." The former official oceanographer and navigator for the U.S. Navy, retired Admiral David Titley, said in 2014, "The changing climate is already serving as a catalyst for conflict. Consider, for example, the severe drought in the years leading up to the civil war in Syria. The drought didn't cause the war, but it certainly served as a destabilizing factor." That drought was the worst that they had in 900 years in Syria. "Struggles for control of food, water, and energy supplies escalate tensions between ethnic groups, religious groups, and nations. And as we're seeing in Iraq, ancient tensions can flare up in deadly conflict." So here last September, in 2015, this is what the Office of the Director of National Intelligence for the United States said on global food security, "Bottom line: We just judge that the overall risk of food insecurity in many countries of strategic importance to the United States will increase during the next 10 years." And then he talked about this going to amplify concerns for the availability of food. Finally, Nestle, the world's largest food company, they say that "On present trends...one-third of the population will be affected by fresh water scarcity in 2025," less than ten years from now, and a third of the population "will face a cereals shortfall of as much as 30 percent." So six things that anyone who likes to eat should know about our food supply: The average bite of food on our plate travels 1,346 miles to get there, but that was from 47 years ago. That's what the Department of Defense concluded then. Today, the average bite of food on our plate is traveling over 2,000 miles to get there, all right? A fifth of our food is coming from outside of the country. Where do we get most of our fruits, our vegetables, and our nuts? We get them from the California Central Valley, which is now entering into its fifth year of historic drought. Then... [LR455]

SENATOR LARSON: Please wrap up. And we'll have questions if (inaudible). [LR455]

TIM RINNE: Okay. All right. Ninety percent of the food that Nebraskans eat, the money that we spend on it, it leaves the state. That's because we don't grow food that we can eat here. We have to buy food that's imported. We grow feed in Nebraska, not food. Then I just want to get back to the final line here. Your typical grocery store stocks just three days' worth of inventory on the shelves. The head of the British Parliament's food committee says that that means that advanced industrial nations like the United States and Britain are "nine meals from anarchy." If our global

food system breaks down, even a state like Nebraska is not safe because we're not growing food here that we can eat. We're growing for the export market. The takeaway in all of this is the farther away we are from our food supply, the more food insecure we are. There are some good reasons to support local food. One of them is food security. And I would urge that food security and growing local food and encouraging local food production becomes part of our climate action plan here in the state. Thank you. And I apologize for running over. [LR455]

SENATOR LARSON: No, I understand. Thank you, Mr. Rinne. We've, again, this is something that Senator Haar and I have talked about in terms of looking at ways to invest in agriculture and local types of things like that. Questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: Well, thank you for the PowerPoints here. Actually, the first scientist to predict global warming was in the mid-1800s and I can't remember the name, but the science behind CO2 raising the Earth's temperature has been known for a very long time. And when we look at people who deny climate change, there's no other explanation really that's come forward and we've known this other one since 1850, so. But you grow a lot of food in your yard I know and so if our grocery stores run out, Tim, I know where you live. [LR455]

TIM RINNE: Yeah. But that's the thing, is we don't even know how much food we can grow. So in my neighborhood, what we call the Holly Hamlet, we're trying to really seriously practice urban agriculture. We have no idea how much food we can actually grow. What kind of food should we grow in the city, what's appropriate, what's going to make sense? We don't have answers for any of this stuff because we're not concentrating on it. I myself was freaked about climate change for 20 years, but it took me 20 years to figure out that climate change was going to have an impact on our ability to have lunch. I noticed that Senator Larson this morning, I was jealous, okay, was eating a cookie or something like this, right? [LR455]

SENATOR LARSON: Cheese danish. [LR455]

TIM RINNE: Okay, all right. All right, but to make it through the morning, okay, before we even get to that second meal of the day, most of us have to snack. We eat constantly and yet somehow or the other we have compartmentalized the issue of food security into some other zone where

somebody else has to worry about that. Our idea of getting food is to go to the store. That's what we do now. Where's your food come from? It comes from the store. Well, where does the store get it? We have no clue. [LR455]

SENATOR HAAR: Good. And for more on that, Tim actually has a TEDtalk that you can go out and watch about growing food locally, which is very interesting, so. [LR455]

SENATOR LARSON: Sounds good. [LR455]

SENATOR HAAR: Thank you very much. [LR455]

SENATOR LARSON: Questions? [LR455]

SENATOR PANSING BROOKS: Thank you for this information. Of course we should be on high alert. And please, get this information out to more people. I know that you all are trying, but we have got to work even more efficiently at getting this to... [LR455]

TIM RINNE: I guarantee you that once we understand the whole issue of food security you will never look at your plate in the same way again. You will start asking yourself where did this come from, how far did it travel, how can I get this on my plate reliably. It will change your world-view. So thank you very much. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR LARSON: Thank you. Next testifier. Welcome to the LR455 Committee. Please make sure you spell your name. [LR455]

PENNY GREER: Sure. Reverend Helen L. Greer, that's my legal name, but most people know me as Penny. That's my nickname. I come to you today... [LR455]

SENATOR LARSON: Spell your name, please. [LR455]

PENNY GREER: I'm sorry. Helen, H-e-l-e-n, initial L, Greer, G-r-e-e-r. But you can put Penny down because that's how people know me, P-e-n-n-y. I was given both at birth. It's weird but it's true. I'm here wearing several hats today. I didn't know about these hearings until last night, so I didn't have a lot of time to prepare an eloquent testimony. I'm a student of applied climate at the University of Nebraska-Lincoln in a program that Dr. Wilhite started; was one of those who started. I'm studying extreme precipitation events. My interest is to see not just what we think is going to happen but what is now happening. And the first study I made was a study of a series of cities in east central Nebraska over a period of 50 years to see what kinds of extreme precipitation events were occurring. And they definitely are increasing, the data is there, particularly in Omaha and Lincoln, among the larger cities in east central Nebraska. I'm now looking at a variety of different kinds of extreme events, looking over larger Corn Belt states. But there certainly will be relevant data for Nebraska to see what's been happening and then we'll begin to look at the kinds of causes of these events meteorologically. I also wear the hat of being a new board member of the Interfaith Power and Light organization here in Nebraska, and that's an organization that is committed to taking this entire agenda to the faith communities, and that happens through local church dialogues and talks. It also happens through conferences, it happens through legislative advocacy, a variety of areas. My concern, as now my other hat is that I am a part-time interim pastor, I'm a trained professional interim and I'm currently serving the New Zion Presbyterian Church in Clarkson, Nebraska. My concern is as I deal with the farmers in our congregation, there are about 15 of them, as I talk to the people in the church, climate change is a moral issue. There are no two ways about it. It has to come as something that people of faith address. And Senator Pansing Brooks is right, it takes a long time for people to get on that bandwagon, but many of us need to be devoted to making sure that happens through careful, slow, thorough, sure conversation again and again and again. What would help us considerably is if the state made the clear objective in putting together a climate action plan. I have given out the university's climate study for Nebraska to several different entities over the months and years...months I should say. It hasn't been out that long. But we need to see an action plan. I think that would help practical Nebraskans a tremendous amount and would help me in my work of speaking to Christians about this very strong, obvious moral issue that we've got to deal with. That is the end of my testimony. [LR455]

SENATOR LARSON: Thank you, Ms. Greer. Questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: Well, if you have a plan or something, we'd like to get a copy of that. We'd like to see that. [LR455]

PENNY GREER: I just talk to people. [LR455]

SENATOR HAAR: Okay, good. I just want to give a really good example of where disaster has been averted, and that's the thing we all take for granted now, is the opening up of Antelope Creek through downtown Lincoln, which wasn't done because of climate change. And there was a lot of criticism when that...because it cost a quarter of a billion dollars to do that. But because of that, in the recent rain that Nebraska had in the spring, I think 10 inches or something like that,... [LR455]

PENNY GREER: Right, 8 to 10. [LR455]

SENATOR HAAR: ...a lot of downtown Lincoln would have been underwater without that. And I think that's the kind of thing that a climate action plan is all about, to look at those kinds (inaudible). [LR455]

PENNY GREER: You need to show the way for mitigation in all kinds of communities. I've had long talks with the mayor of the community I'm now serving and he doesn't see this as a pressing issue. And I hope to continue to talk with him to convince him otherwise. But an action plan I think would make a great difference in people realizing just there are more warrants out there that suggest this is a serious issue that people need to deal with. [LR455]

SENATOR HAAR: Well, thank you very much. [LR455]

PENNY GREER: You're welcome. [LR455]

SENATOR LARSON: Thank you. Welcome to the LR455 Committee. Please spell your name first. [LR455]

KIM MORROW: My name is Kim Morrow, K-i-m M-o-r-r-o-w. I am a senior associate with Verdis Group, an environmental sustainability company owned and operated here in Nebraska, and I'm here to talk to you today about doing a greenhouse gas inventory. First, I want to say a couple words about our company. We were started seven years ago to identify and implement sustainable solutions for our clients here in Nebraska who are...oh, excuse me, I was going to say it might interest you to know that we have many large and well-known clients here in Nebraska who are implementing a wide range of real-world sustainable solutions. Some of our clients include the University of Nebraska Medical Center, the University of Nebraska at Omaha and at Kearney, Omaha Public Schools, Kearney Public Schools, and the Henry Doorly Zoo, among others. At these organizations we have created and implemented sustainability master plans, which help them save money, reduce energy usage, decrease waste, conserve water, encourage alternate transportation modes, engage their employees, and reduce greenhouse gas emissions. And I mention these not to put a feather in our cap but just so you know about some of the leading organizations already in Nebraska who are moving forward and implementing solutions. And they're not just window dressing. They save real money and demonstrably improve employee engagement. To give one example, over the last five years the University of Nebraska Medical Center in Omaha cut its energy usage by 25 percent and saved $15 million by doing so. Employees are so excited about helping to roll out sustainability initiatives that applications to a sustainability ambassador program exceeded expectations by more than threefold. So companies, universities, and healthcare facilities across the country are embracing sustainable initiatives because they know that taking action on climate change demonstrates their commitment to healthy and vibrant communities. Nowadays nearly all leaders understand that climate change poses significant risks to their operations and they are taking forward-looking steps to plan for these risks. We all know that climate change poses significant risk to Nebraska. If we do nothing, parts of our common "good life" are at risk. It is imperative that we undertake a climate planning process to protect a thriving Nebraska. In any sustainability project, whether for an organization, a municipality, or a state, the first step is to set a benchmark on usage and emissions data against which future improvements can be measured. What we need to know now is how much greenhouse gases are being emitted by the state of Nebraska. Such an assessment is called a

greenhouse gas inventory. My company has created greenhouse gas inventories for several of our clients and we have the expertise to create one for the state. This inventory is crucial for climate planning and could be used by a host of state agencies and organizations. This data would show the sources of our greenhouse gas emissions and would then allow us to set a goal to reduce those emissions. The data would show where opportunities lie to make the biggest reductions with the least amount of impact. It would allow industry, ag, utilities, agencies, and individuals to work together to make our state a healthier place to live, work, and play. To create a greenhouse gas inventory we would utilize tools provided by the EPA and by national standards organizations to create a comprehensive accounting of the greenhouse gases emitted in the state. We would account for large emitters, like coal-fired power plants, but also the individual impact of automobiles, agricultural emissions from our cattle industry, and much more. We would work with colleagues like those at the Lancaster County Health Department who have already successfully created greenhouse gas inventories for several years. They have already offered to share best practices and resources with us to assist with a successful outcome. The end result would be a report that captures Nebraska's greenhouse gas emissions in a snapshot of one year. This report would then be updated with regular periodicity so that progress toward a goal could be measured. We offer our expertise as a resource to the committee and we would be happy to talk further with any one of you about how we can create a greenhouse gas inventory to assist with climate planning efforts. We thank you for all the work you are doing to ensure a healthy future for Nebraska. [LR455]

SENATOR LARSON: Thank you, Ms. Morrow. Questions from the committee? Senator Haar. [LR455]

SENATOR HAAR: Yeah. Basically what you're talking about, you can't manage what you don't monitor. [LR455]

KIM MORROW: Exactly. [LR455]

SENATOR HAAR: So if we have a plan that we want to be able to measure, we're going to have to monitor and we're going to have to start with a benchmark. I think that's... [LR455]

KIM MORROW: Exactly. [LR455]

SENATOR HAAR: The other is just kind of an observation and you've probably seen this. When Jimmy Carter, bless his heart, came on television when I was still a young man, I think it was, and he had a sweater on and he said, turn down your thermostat. And the whole idea was that saving energy was going to make us sort of uncomfortable. We'd have to put more covers on our bed and everything. But we're finding, and do you see this in some of the work that Verdis has done, that we don't have to give up, you know, with energy efficiency. And in fact, it makes things more comfortable and it makes our living better. [LR455]

KIM MORROW: Uh-huh. There is a lot of low-hanging fruit right now to fix because we have not, in general, taken energy efficiency into account in the way that we have been using energy for the last several decades. So the first step is to simply tighten up how we use energy to make our homes and buildings more energy efficient, to improve insulation, tighten windows, all of that kind of thing. New equipment is much, much more highly efficient than it was in the past. In fact, here the Lincoln Electric System recently released data that showed how their electricity usage has fallen so dramatically in recent years, far more than was expected even with population growth, which has largely been due to increasing energy efficient appliances. So absolutely we can make these gains without sacrificing comfort or economic prosperity. And I appreciate Senator Larson's prioritization of that. Any successful plan has to include a successful economy and we can do both. [LR455]

SENATOR HAAR: And we had a hearing about a month ago now on some of the tools that the Legislature has passed that will help people finance energy efficiency, the PACE program and so on. [LR455]

KIM MORROW: Yes, absolutely, PACE legislation. Uh-huh. [LR455]

SENATOR HAAR: We hope that those will...that cities like Lincoln and Omaha and smaller cities will rush to putting those into effect so that people... [LR455]

KIM MORROW: Yeah. [LR455]

SENATOR HAAR: ...can take, you know, take advantage of the low-hanging fruit. [LR455]

KIM MORROW: Yeah. There are a lot of great programs out there, great sustainable solutions that are being implemented in communities all over the country. And it's exciting that we have the opportunity to take advantage of some of those here in Nebraska. [LR455]

SENATOR HAAR: Thank you very much. [LR455]

KIM MORROW: Thank you. [LR455]

SENATOR LARSON: Thank you. Welcome, Mr. Hansen, to the LR455 Committee. Just a sec. How many more testifiers do I have? Three, four, all right. [LR455]

JOHN HANSEN: Thank you, Senator Larson, Senator Haar, Senator Pansing Brooks. Good morning. I am going to take some of the points that I put together for a presentation on a national conference: The Implications of a Changing Arctic on Water Resources and Agriculture in the Central U.S. And I was on a panel discussion with former-Congressman Bereuter and North Platte NRD manager John Berge, among others, to sort of focus on what does ag want and need relative to this part of the process. So I'm going to try to focus my comments on that. Well, for starters, we need reliable and understandable information on which to make both short, medium, and long-term management decisions. It's the basis of how we think about things and where we need to go and how we need to plan and what we need to do. And so the university we think needs to play a really important and dynamic role in helping get good, clean, reliable information on the table so that agriculture can look at it and say, what are we facing and how do we deal with all of this. Two, we need help processing the information and the management options. It's hard to take that information in and really understand as you look at things over time because the rate of which change is going on is speeding up. And so what does this information then mean? Well, when you boil it down and you say, okay, in 40 years 2012 will be a typical year, then all of a sudden the wheels turn differently and people look at that and go, oh my, well, that's...we can't do that, we can't have a typical year like that where we have five, six years out of ten in that range. That changes everything. So helping make things real. Agriculture, we're a high-risk, low-margin operation. We don't pass costs of production on to anyone. Everybody who knows

agriculture knows that. So we need financial incentives to help adapt to changing weather patterns including cropping, equipment, markets, and water use. And if you just think about that alone, that is a huge list of big-time things. So in the case of ag, we're not going to do like one change in management or tillage or one management thing and then we're going to be done. It's going to have to be incremental and it's going to have to be one right after the other. So it's a series of rolling incremental changes. So we need help. We need financial incentives to be able to do that. And we certainly, number four, we need private and public sector research. And here's just a few of the things on the starter list: stress-tolerant crops; crops that sequester more carbon. It makes a big difference what crop we're using. Are we emitting carbon or are we actually sequestering and storing carbon from the air? Water use and efficiency. All the things that we've done are really good indicators of what we're capable of doing. We have a long way to go on water use and efficiency. Changing weather patterns; soil building to increase water-holding capacity; and management systems research. According to the data and the research that we've gotten from Dr. Jerry Hatfield, who is the head of the United States Department of Agriculture's Agricultural Research Service at Ames, Iowa, that if we are able to change the cropping patterns in production agriculture as we think about how do we try to make our soils more productive and more resilient under this changing weather system is that you can increase the water-holding capacity of the soils if you make those changes by about seven times. That's enormous. So as you get more high-frequency rainfall events farther apart, you need to be able to absorb more of what comes down when it does come down and have the ability to do that. And you need to be able to store it so it's there when you actually need on down the road. So a lot of our focus right now as an organization is on that. Livestock production challenges for more heat and stress and weather patterns, it's going to dramatically change what we can grow and how we do it. Five, federal farm programs that encourage and support crop shifting needed to deal with climate change. And so if we need to be out growing more small greens, we have to rethink our price support structure and how we incent things. We need to be able to make those changes so those crops are economically viable. Federal supports to harness the carbon sequestration potential of agriculture and forestry, this is absolutely essential. We can take about a fourth of the carbon that's in the atmosphere today and we could sequester it in the soil if we just harnessed good conservation practices and tillage practices and cropping practices. We have enormous potential. But if agriculture isn't engaged, we're not doing our job, because we can take carbon out of the atmosphere and put it in the soil. Seven, we have to rethink the whole federal crop insurance

products that help agriculture manage the growing weather-based risks from climate change. What are we insuring; how do we do that? Eight, societal recognition of the enormity of the challenges production agriculture faces as a result of changing weather conditions. This is a partnership between the folks who grow food and the folks who eat it and we need to know that this is not gotcha. This is we're working with you and we want to partner with you in order to do what needs to be done. Nine, the tools needed to make ongoing incremental management changes that head in a general direction, and that is really essential to ag. We have to have those incentives. And last, changing the climate change dialogue towards practical problem-solving and solutions, which means that the whole conversation changes when we focus on remedy. And when we do that, we get a very different conversation. We put different brain cells to work, and we have a much more productive conversation. [LR455]

SENATOR LARSON: Thank you, Mr. Hansen. [LR455]

JOHN HANSEN: Thank you. [LR455]

SENATOR LARSON: Questions from the committee? Thank you for coming. [LR455]

SENATOR PANSING BROOKS: I have a question. [LR455]

SENATOR LARSON: Oh, yeah, Senator Pansing Brooks. [LR455]

SENATOR PANSING BROOKS: Thank you for coming. So are you here on behalf of the Farmers Union? [LR455]

JOHN HANSEN: Yes, I am. [LR455]

SENATOR PANSING BROOKS: Okay, I didn't hear that when you first sat down. So I don't know if the Farm Bureau is here, but I'm just interested in what your perception is across the state of farmers understanding and farmers' support of the idea of protecting and preparing for this kind of a future. [LR455]

JOHN HANSEN: Well, I come out of the NRD system. I come from the conservation...soil and water conservation family. I've been doing this a long time. So Nebraska has a very strong conservation ethic. We really do believe that it's important to leave our natural resources in as good or better shape than we found them. And so we have a very strong conservation ethic in our state. When you look at our state, thanks to our NRD system but also that conservation ethic, we're the only state in the nation that actually spends more local, state dollars on conservation programs of one kind or another than we get in, in federal cost-share dollars. That makes us a national leader in those things. And so, you know, the fact that 60 percent, 61 percent of rural Nebraskans think we need a state climate plan, that says that...if you deal with agriculture and natural resources, you're all about the weather. And the changing weather patterns change how you live, what you produce, how your world works, and so there's a very strong ethic there. And would tell you that when we gave farmers in Nebraska the opportunity to voluntarily participate in a cap and trade system in our state that we were a national leader. We had over 3 million acres signed up in Nebraska; we had 1.2 million in the Nebraska Farmers Union program. And they were willing to change the way that they graze their grass, the way that they grew their crops to practice basic good soil conservation in order to sequester carbon and be able to have the opportunity to market that stored carbon on a...in a voluntary marketplace. And so that tells me that if we properly incent and we educate and we partner, that I think agriculture in the state of Nebraska is going to step up and do what they need to do. [LR455]

SENATOR PANSING BROOKS: Okay. To continue that, so without incentives you don't think they'll step up to do this? [LR455]

JOHN HANSEN: I think it's really hard to spend more money when you're going broke... [LR455]

SENATOR PANSING BROOKS: Okay. [LR455]

JOHN HANSEN: ...and so incentives are key. And so what we know in conservation programs, in our experience of programs, is you educate and you incent. And that has a very different level of acceptance of participation on conservation than when you mandate and you tell. So that doesn't work well. Everybody who is from rural Nebraska knows that, it doesn't work well. And

so you educate and you incent, and that's how we've gotten conservation practices. But in a lot of cases, when you make changes in your operation, the crops you grow, the equipment you use, the practices you use, most of these cost money. And so if agriculture is in a tough financial shape, which we are now, it's the third year in a row of low-cost production, commodity prices, our bankers are very clear on one thing when you sit across the table and borrow money from them. They want to know how you're going to pay the money back. And the business of looking long-term is not on their...I've never had that conversation with my banker. [LR455]

SENATOR PANSING BROOKS: So of the...you said 60 percent of rural farmers support... [LR455]

JOHN HANSEN: Rural residents is what the real poll measured. [LR455]

SENATOR PANSING BROOKS: Okay. So do you have a feel what the 40 percent believe? Do they not support it because they don't believe it or because they don't want...they think it will cost too much? [LR455]

JOHN HANSEN: It's all over the map. We certainly have climate change deniers. We have, you know...and it's a very different question. If you ask the very same question about do you think climate change is going on, they'll say, no; but, do you think that our weather pattern is significantly changing in a material way, they'll go, oh, sure. (Laugh) You know, weather over time is climate. But it's...so part of it is how you ask the question. And then our experience is that when you get to the point of saying, okay, how do we go about trying to protect our natural resources so that it's in as good or better shape for future generations and how can we go about doing that, you get an altogether different reaction and a more positive reaction than you do then when you just have, quote, the climate change conversation up-front. [LR455]

SENATOR PANSING BROOKS: And you're so familiar with all of this and I'm grateful for your decades of work. Do you have an idea how to incent when we're in this slash-and-burn economy? [LR455]

JOHN HANSEN: Well, we're certainly...our national organization had a conference call yesterday on this issue. I'm the vice chair of the legislative committee. Conservation and climate we link together in terms of farm bill titles. And so, you know, we're trying to help provide tools at the national level. But there's a lot of things that Extension and other folks at the state level can do to also help and partner with farmers so they don't feel like they're being told what to do or that they're out, you know, on their own. This needs to be a collaborative effort. It makes a lot of difference whether or not folks are making these changes, doing these things, that they feel like people understand and appreciate the effort and the expense that it takes. Once you finally get your operation set up and you have your equipment set up and you're producing what you want to produce in a particular way, the idea that you should change that is not...people go, well, I'm already set up for this, I already have grain bins for this, I already have. So for example, soybeans, we're going to have to take a look at soybeans. Soybeans does not sequester carbon, and so it goes. So these are changes, fundamental changes in your cash flow. [LR455]

SENATOR LARSON: Thank you. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

JOHN HANSEN: Thank you. Thank you, Committee. [LR455]

SENATOR LARSON: Welcome to the LR455 Committee. [LR455]

SHIRLEY NIEMEYER: Thank you. And thank you for the opportunity to talk about climate change and possible policy. I wanted to, as he's passing that out, talk a little bit about... [LR455]

SENATOR LARSON: Oh, please spell your name first. [LR455]

SHIRLEY NIEMEYER: Oh, Shirley Niemeyer, N-i-e-m-e-y-e-r. And I am a professor emerita from the University of Nebraska-Lincoln. I worked there for 40 years and I was in the area of housing and the environment. Not a climate scientist, but I'm speaking as an independent retired faculty member, but not for the university. I have something here that I think might be of interest to those of you that are working on thinking through how to do the policy itself, because I

understand that's a focus of this, and I can share that with Senator Larson or Senator Haar to share with your colleagues. It is some notes I took off the Internet about policy, policy recommendations, and adapting policy. And so one of the things I want to draw your attention to is some of the steps they talk about when they say develop a greenhouse gas inventory. And I understand, and I know some of our people here have talked about that, but there is a tool on the Internet that does help you do a carbon emissions inventory. And I do have a copy of that later on, so I can share that with you. And then the reach out and educate, communicate, to me, to help with policy development and to get buy-in, education almost has to come first, and I mean massive education across Nebraska, including Extension, including all the organizations here, including the religious community, because it's going to take a lot to educate and have them to buy into what you want to do. And that is a really important part. And then you go to set goals and such actions, obtain resources. Don't forget that the people that can buy-in in public-private funding. There are people in Nebraska that I believe would invest in the environment and I think we ought to think about some of that as incentives. Take action and then tracking reports, so that inventory is really important and I'll share that with you. The other thing I wanted to share with you, is you've talked about perhaps using plans and adapting them instead of creating. At least get some guidelines from other states. And this map I've given you, you can see it's of the United States and it shows where other states are. And there may be more recent ones that have been handed out, but this one shows you where Nebraska is in comparison to the other states and which states might have a plan in progress. And perhaps if we looked at Kansas, Iowa, states that are somewhat similar in some ways to Nebraska, that we would be able to have information that might help in the planning. So it just talks about who has what kind of plans. The third thing I'm sharing with you is the Climate Change 2014 Synthesis Report. It's a summary for policymakers. And so this is the gold one and I just...I'm not going to talk about that, you probably all have read it, but I think it's interesting, that it might be something to share with the rest of your colleagues throughout the Legislature in an electronic form. I didn't know how this was the process so I had to use paper. So that's something I really encourage you to share with your people. But what I want to really talk about is a couple of things that I have highlighted in this handout. And it's a couple of things as charts, and I'm going to go through them really quickly because I want to get to some of the policy suggestions that are more detailed. I believe in extreme efficiency, and a book by Hawkings (phonetic) out of Colorado is a good example of extreme incentive. Okay, so we see the opinion of a published scientist on the first page and that 95 percent, probably, or

higher that this warming is predominantly caused by humans. Sharing that information with others might help in helping them understand. There's one on carbon dioxide concentration, temperature and sea level continue to rise, there's a look at the ocean temperature index...and there may be more recent charts than these...the variations in temperatures from year 1000 to 2100. And what I explain when I talk with people is the difference of prior global warmings was more like a gentle curve whereas this one that we're experiencing is a spike, more like a spike. So I think that helps. And then carbon dioxide in records. But in turn...and then I talk about tree loss. We haven't talked about the relationship to agriculture and replanting windbreaks so that if the soil does dry out we have control of some dust, helping our retree Nebraska. And there's statistics in there about how many trees we've lost worldwide, how many trees we've lost in Nebraska, what we may need to...we've lost about 40 percent. And then policy suggestions. [LR455]

SENATOR LARSON: Yeah, please give very quick. Are they anywhere in your handouts so we can go... [LR455]

SHIRLEY NIEMEYER: Yes. [LR455]

SENATOR LARSON: Okay, where specifically? [LR455]

SHIRLEY NIEMEYER: They're highlighted in red and I'm just going to go to this, it's on page 13...I mean, excuse me, page 8. [LR455]

SENATOR LARSON: Of this one? [LR455]

SHIRLEY NIEMEYER: No, of this one. This is the one. Sorry, this one. [LR455]

SENATOR LARSON: Okay. Very...we'll go another minute, but I have three people. [LR455]

SHIRLEY NIEMEYER: Okay. [LR455]

SENATOR LARSON: So please be very, very quick. [LR455]

SHIRLEY NIEMEYER: Okay. Policy suggestions: Reduce coal and other fossil fuel emissions, lowering the speed limit, enforcing the speed limits, and reducing emissions from coal-fired Nebraska plants. In terms of their efficiency, increase vehicle efficiency through education and through policy to provide incentives for purchasing vehicles that get higher gas mileage, or through taxing or initiating a fee. For those of us that are one-person drivers and we buy huge cars, like...well, I won't mention, but perhaps those could have a fee charged because of using more gas and not the efficiency. Work with the Department of Roads to include planting trees along the roadside and to avoid removing trees unless absolutely necessary and obvious safety concerns. Sometimes they remove the trees along the steep banks and no way a car could get there. Provide education and incentives to replant trees and Retree Nebraska. We have the ash borer and the pine wilt coming. Limit tree removal, encourage planters and contractors to avoid removing trees when they do developments, work around them. Encourage farmers to replant trees and windbreaks. And increase adoption of advanced energy efficiency and reduction methods. Educate local zoning and code officials in energy efficient and educate Nebraska in energy efficiency. I have a lot more, I'll save it. [LR455]

SENATOR LARSON: Yeah. We will make sure that we always scan everything in and put everything into the record and we'll go through it. So I appreciate your time. And I'm sorry, we're just trying to make sure we're...as the day is... [LR455]

SHIRLEY NIEMEYER: I know. [LR455]

SENATOR LARSON: ...going to go just a little bit over. Do I have questions from the committee? Seeing none, thank you. [LR455]

SHIRLEY NIEMEYER: Thank you very much. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR LARSON: Welcome to the General Affairs...or LR455 Committee. That's a habit of mine, I'm sorry, especially in this room. [LR455]

SENATOR HAAR: That's okay. [LR455]

SENATOR LARSON: This is my hearing room. [LR455]

DUANE HOVORKA: Well, good morning. I'm Duane, D-u-a-n-e, Hovorka is H-o-v-o-r-k-a, with the Nebraska Wildlife Federation. And thanks for the opportunity to provide some comments. The handout, and I will send it to electronically, I apologize for the paper, is an analysis that we had completed earlier this year with an update. And basically the takeaways from this are that what Nebraska utilities do does matter. When our utilities invest in wind, solar, and energy efficiency, even if they do nothing else, the net result is that somewhere in the Southwest Power Pool a coal or gas-fired power plant is turning down or turning off in response. And the converse is also true. When Omaha Public Power District retires its nuclear power plant Fort Calhoun at the end of this year, if they do nothing else, starting in January somewhere in the Southwest Power Pool a coal or gas-fired power plant will be kicking on in order to replace that power. And so the bottom line there is that Nebraska utilities do have to do some careful planning. And on the last page of that handout we've got one alternative, a recipe for replacing that power from the Fort Calhoun with some clean energy sources of wind, solar, and energy efficiency. That will give you an idea of the scope and scale that we're dealing with. Our utilities do a good job right now, a thorough job of planning and resource planning looking at the future and they do, can and do, identify those trade-offs between emissions and costs and the other factors. What they could use is more direction from the Legislature about how to weigh those costs. And right now the weight is all on cost. And so weighing the costs and benefits and risks in the future is something that a climate action plan at the state level could help provide that direction. And so we strongly support a state climate action plan that includes analysis of some of those risks, some of the opportunities, and the right direction for Nebraska moving forward. And one thing we'd urge you to build into that plan is to ingrain the process of planning into our state agencies so every agency, as they're doing planning and decision making, is, to the extent it's relevant, considering the climate change science and the changes that are coming in the future, especially true with Agriculture, with Natural Resources, with Health, with Game and Parks Commission. But not just our state agencies. We're also looking at communities that make flood control decisions at our natural resources districts. So building that planning process in as part of the action plan I think is pretty important. And our third point is that climate change is a

global problem but the impacts tend to be local and they tend to be very different local. And from a wildlife perspective, that's pretty important. So the 2012 drought really highlighted the vulnerability of our white-tailed deer herd to epizootic hemorrhagic disease, EHD. And in one year, because of the drought, because you lost water on the landscape, concentrated the white-tails in the few watering holes. Stagnant ponds were great breeding areas for the midges that carried the disease, and in one year we lost 25 to 30 percent of the white-tailed deer herd in a single year. As we look forward and we think about having more of those 2012s more regularly, that's a pretty big risk to our deer population and to all the people who hunt deer in Nebraska. The trout streams in Nebraska, those are cold-water fish, there's other cold-water fish that rely on those cold water temperatures in those streams. And as you look forward in air temperatures in those parts of Nebraska, northern and western Nebraska, summer temperatures increase 4, 5, 6 degrees, that's going to increase those temperatures in those streams. And so our trout streams are definitely at risk, the other cold-water fisheries are at risk. You've heard the Platte River, certainly climate change will change the flows coming out of the Rocky Mountains. We're going to see changes in the timing, we may see changes in the volume of Platte River flows, critical for wildlife, as well as for farmers, and for communities like Lincoln and Omaha that depend on the Platte River for their water supplies, and our duck populations. The Prairie Potholes are the duck factory of North America and the recent signs we've seen is that the drying up of those wetlands because of higher summer temperatures and earlier snow melt means that we could lose half of the duck nesting habitat in the Prairie Potholes. That means roughly we could lose half the duck populations in Central and North America over the next 30, 40, 50 years. So those are some pretty huge changes on the landscape. They're very local impacts here in Nebraska and that's why we think what you're doing is so important. [LR455]

SENATOR LARSON: Thank you, Mr. Hovorka. Questions from the committee? Senator Pansing Brooks. [LR455]

SENATOR PANSING BROOKS: Just thank you for this information. You should go around with the University of Nebraska guys with all their facts and...I mean, tourism is so huge and hunting and fishing and everything like that that's so near and dear to the hearts of many of the Nebraskans, especially in the rural areas. So please, go around and talk to our colleagues, it would really help. [LR455]

DUANE HOVORKA: We are and we've got a report in the works that will highlight some of the climate change impacts on wildlife that we think will help make it local. [LR455]

SENATOR PANSING BROOKS: Thank you for coming today. [LR455]

DUANE HOVORKA: Thank you. [LR455]

SENATOR LARSON: Thank you, Ms. Senator Pansing Brooks. Thanks for your time. [LR455]

DUANE HOVORKA: Thanks so much. [LR455]

SENATOR LARSON: Two testifiers left, is that what I...raise our hands. One, two, please. [LR455]

JOHN ATKEISON: Would you like me to come back at 1:30? [LR455]

SENATOR LARSON: What are we...is it focusing on carbon or climate actions plans? [LR455]

JOHN ATKEISON: Climate action plan. [LR455]

SENATOR LARSON: I'll take you right now. [LR455]

JOHN ATKEISON: Okay. [LR455]

SENATOR LARSON: We'll have a time limit then too so. [LR455]

JOHN ATKEISON: Luckily I had planned to be brief. [LR455]

SENATOR LARSON: Good. Please spell your name first. [LR455]

JOHN ATKEISON: My name is John Atkeison, J-o-h-n A-t-k-e-i-s-o-n, representing EnergyLinc, a local grass-roots educational organization focused on global warming and the

climate changes it causes. This is a huge issue which needs to be approached from a number of directions, especially the more fundamental ones. We have to ask why we're planning and what we're planning for. As has already been quoted, the university report says that under the low or high emissions scenario, which I read as no matter what we do immediately, the conditions of the summer of 2012 will become typical. Now what happens after mid-century, I think we do have quite a bit of impact on so I've said to people, you know, this sounds like a prescription for a new Dust Bowl and of course this is the conditions that we have in this bit of geography, that it's dry. We have seen things before and we can expect to see them again, with or without climate change, where we have a dry period. In fact, we've been in a wet period. So we can say that if we're making things more extreme perhaps we're looking at a mega drought or mega Dust Bowl. I think it's important to look at that side of things because we need to know what we're planning for that's already in the pipeline and we need to have a very realistic point of view about what we're facing. And I can certainly sympathize with a bit of discouragement because I agree that we're not moving nearly fast enough to deal with the reality that we do face. We can deal with it. There is not...it's climate science; it ain't rocket science. And what we have is easily identifiable first steps to take. The two primary sources of greenhouse gas pollution are the making of electricity and the transport sector. If we can encourage our public power districts and municipal utilities to move away from fossil fuels, away from greenhouse gas producing and towards clean energy, that will make a big difference. If we electrify then transportation and everything else we can get our hands on, that's a twofer because we got clean electricity and therefore more clean transport. It's already happening to some degree, in fact, occasionally to a great degree. If you look at the Southwest Power Pool, the regional power pool that we are a part of, they have had over 40 percent of the electricity in this section of the grid more than once. And that's...sometimes it's very low as well, sometimes it's 7 percent, sometimes it's 10 percent. But in terms of being able to integrate these resources, we are learning very quickly. So my main point is that we need to focus on reality, not our political philosophy or the way we wish things were. Yes, there's a lot of opportunity here but only if we pursue this very, very seriously. So we've been delayed for the 40 years that Exxon has been sitting on its groundbreaking research from the '70s and '80s and before, where they basically sketched out what we know today about climate. And so we're sitting on the mountain of fossil fuel-produced greenhouse gas pollution that was generated in the interim. So we can do what we can do. I hope to see in this Legislature, like others, not just one or two senators focusing, but perhaps a climate caucus because it's a

statewide issue, it's a worldwide issue. It's a very, very important issue and we need to have more science. But the picture is already very clear. We need more tech, but we have basically what we need to do. What we need to generate is the political will and for all of us to show the inventiveness and the guts that's required to face this and work through it. Thank you. [LR455]

SENATOR LARSON: Thank you. Senator Pansing Brooks, any questions? Seeing none, thank you. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR LARSON: And we will close up the morning session with... [LR455]

JOHN ERIXSON: John Erixson. [LR455]

SENATOR LARSON: Please spell your name. [LR455]

JOHN ERIXSON: It's J-o-h-n E-r-i-x-s-o-n. Good afternoon, Senators, my name is John Erixson. I'm the deputy director for the Nebraska Forest Service. Adaptive planning requires us to respond to climate change both proactively and reactively. To date, most of our effort in Nebraska has been reactive in nature. Adaptive planning includes preventative measures to slow the rate of change and to mitigate the effects of climate change. We must recognize that climate variability poses a threat to Nebraska's trees and forests, as well as all of our natural resources. With increasing damage due to wildfires, floods, droughts, heat, and severe weather, there is no doubt that we are seeing changes in the health and vitality of our forests due to climate change. The spread of mountain pine beetle into Nebraska, a direct result of warmer winter temperatures, has caused widespread mortality in pine trees across the west. Unprecedented weather events have cause extensive mortality of trees in cities, towns, windbreaks, and in natural forests. Nebraska has seen a substantial increase in the frequency and number of large, intense wildfires over the past 50 years. During most of the twentieth century, the state saw large fire seasons approximately every 25 years. Since 1990 the time between such large fire events has decreased to about every six years. The scale of these events have also dramatically increased. Fifty years ago, a large fire season was considered 150,000 acres; in 2012, Nebraska experienced its worst

fire season on record, burning nearly 500,000 acres. The Nebraska Forest Service has worked with partners to be proactive in preparing for climate change in helping our state prepare to respond to larger catastrophic events. To do this, Nebraska Forest Service is working with landowners throughout the state to reduce wildland fuels, thinning dense forests on nearly 9,000 acres over the past three years. We have placed 770 pieces of wildland fire equipment, worth nearly $70 million, at 265 different volunteer fire departments. We have trained nearly 1,400 firefighters in wildland firefighting techniques and we are working with NEMA and other partners to implement and approve the single engine air tanker program, which flew 32 sorties this year alone, saving the state and landowners large sums by extinguishing fires while they were small and manageable. Taking action through planning is a critical first step to identify and prioritize the distribution of resources and to ensure decisions address potential climate change impacts on a statewide basis. Considering these impacts on our communities and our wildland is critical in order to protect the state's investments and assets and to protect life and property. Through such actions, our homeowners, landowners, communities in our state will become better prepared for a changing climate. Thank you and I'd be happy to answer any questions. [LR455]

SENATOR LARSON: Thank you for coming. Any questions? Senator Pansing Brooks. [LR455]

SENATOR PANSING BROOKS: Okay. Thank you for coming, Mr. Erixson. I have really enjoyed working with you regarding the emerald ash borer and other important issues, so I appreciate that. I'm just trying to figure out why you are coming in a neutral position. [LR455]

JOHN ERIXSON: Well, actually that's a policy of the university that we present our material as in a neutral position. [LR455]

SENATOR PANSING BROOKS: Okay. So the Nebraska Forest Service is through the university? [LR455]

JOHN ERIXSON: We're housed within the university, so we're a state agency housed within the university. [LR455]

SENATOR PANSING BROOKS: Yeah, but if you're housed with the university but you're a state agency why is the university directing how you would come forward on something? I mean, I'm sorry, and I admire you and what you're doing. But this to me is indicative of where we are and the problems we have, where the Nebraska Forest Service, which is dealing with incredible costs on the...we had the wildfires before, which had to do with the pine blight, I believe, or something. The red pine blight or something. What was the...those forest fires that were going across the state... [LR455]

JOHN ERIXSON: Yeah, the fires, or at least the health of the trees in the Pine Ridge, etcetera, you have a drought situation like in 2012. And you see... [LR455]

SENATOR PANSING BROOKS: Okay. I just don't get why you're coming forward in a neutral position. I understand that you think that because you're housed at the university, but this is the whole problem. I mean, we have groups that are actually working in these areas that cannot come forward and take stands because of whatever the politics are of, oh my gosh, we have to do something. And then it rests on just a couple senators. I'm sorry to sound aggravated about this, but this is part of the problem is that we have agencies that can't take stands for certain reasons. So the newspapers then don't capture the information that these major entities who study climate change and who work in this area and who fight our fires believe this is so. And so it's just incumbent on a couple of us to move forward and save the world on climate change. This is inappropriate for agencies to come forward and not take courageous stands about facts they know. And the university would never criticize for coming forward on climate change because they've been a leader in this area. So I'm sorry to be aggravated. I'm not aggravated at you. I'm aggravated at the entire issue of this whole thing. People are scared to take stands, people are...and I have to leave this afternoon, so I can't even talk about this later, but the fact that people are scared to take stands and people are worried. We're talking about our future and our kids' future, so I just would hope you rethink that in the future on something so important for our future as this. So anyway, sorry, I'm not aggravated with you. I know you're doing what others say. But it's not a correct thing for the university to be pressuring you on this at all. You're a state agency. We should be informed according to a state agency what your thoughts are and you should be supportive of a climate change plan. That's nothing. If you were coming forward and

saying, here's what you should do, then I can see not, but we're just talking about a plan. Okay, I'm sorry. [LR455]

JOHN ERIXSON: Yeah, and I guess, if I may, you know, I think you, if you go back to the round tables and you look at all the people that have been involved in that process, there was a lot of good work that came out of those round tables. And those were led by the university, they were led by different agencies as well. And I think there's, you know, 30, 40, 50 very interested parties in each one of those lists of participants in those round tables that are out there everyday, you know, sharing the science behind... [LR455]

SENATOR PANSING BROOKS: Right. [LR455]

JOHN ERIXSON: ...climate change, the science behind what's happening in our forests. And in fact, I'm sure that all of our staff are out there sharing, you know, here are the facts that are out there. And they're not trying to influence anybody on their necessarily their position, but they're trying to give them the information so they can draw their conclusions based on the science, if that makes any sense. [LR455]

SENATOR PANSING BROOKS: Well, I appreciate it. Thank you. [LR455]

SENATOR LARSON: Thank you. That will conclude our morning session. I'm sorry, we went about 20 minutes late. We'll meet back here right around 1:30. Senator Pansing Brooks, sorry to lose you this afternoon. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR LARSON: Senator Mello will be joining us this afternoon. Thank you. [LR455]

BREAK

SENATOR LARSON: Welcome back to the afternoon session of the LR455 Committee. I am Senator Tyson Larson of O'Neill, the cochair of the committee. Senator Ken Haar, the other

cochair, is to my right with Ken Winston, the legal counsel. I have Aaron Bos, the committee clerk, to my left and Senator Mello will be joining us shortly. There are two different...two sign-in sheets, one on each side of the room. If you plan on testifying, whether you're invited or not, please make sure you fill that out before you come up and give that to Aaron, our committee clerk. For the invited testifiers, I have five invited testifiers today. Please, they will be given, as in the morning session, a little more leeway in terms of time to talk about their issues. After that we will take open testimony, at which we will try to run for a five-minute light system and then questions from the committee. When you come up to testify, please speak clearly into the microphone, please tell us your name, and please spell your first and last name. Also please tell us who you're representing, if anyone. Please turn your cell phones to silent so they do not make noise and please keep your conversations to a minimum or take them into the hallway. The LR455 Committee will take handouts and give those to the committee members present if you have them, or feel free to email them. We do scan everything in electronically and distribute it to the committee members that way. Thank you for your cooperation, we'll move forward and hopefully it doesn't take us too terribly long. Our first testifier today was also here in the morning, Doctor...or not Doctor, just Michael Tubman from the Center for Climate and Energy Solutions. Welcome back. [LR455]

MICHAEL TUBMAN: I appreciate the temporary promotion. [LR455]

SENATOR HAAR: It's an honorary degree. [LR455]

MICHAEL TUBMAN: Well, thank you again for the opportunity to join you again on this second panel today. My name is Michael Tubman, M-i-c-h-a-e-l T-u-b-m-a-n. I am the director of outreach at the Center for Climate and Energy Solutions, C2ES. C2ES is an independent, nonprofit, nonpartisan organization devoted to strong policy and action to reduce greenhouse gas emissions. A key objective of ours is a national market-based program to reduce emissions cost-effectively. We believe that a sound climate strategy is essential to ensure a strong, sustainable economy. This afternoon, I would like to discuss a couple of things with you. First, the reasons why Nebraska should pursue state leadership on greenhouse gas emission reductions. And I'd also like to talk a little bit about some of the policies that you might pursue in this effort, including carbon capture, power sector policies, agriculture policies, and transportation policies.

It will be a high-level interview, I realize you have limited time. But first, if we could look at why a state should pursue leadership on climate change, over the history of environmental law, federal programs have been built on the foundation of state leadership and innovation. For example, national ground water protection laws followed Nebraska's lead. Likewise, when it comes to addressing climate change, federal policy is also following state action. State leadership on climate change achieves many of the same benefits of state action in other areas of public policy. Being close to your citizens, you can find solutions tailored for your residents and businesses. The economic and energy circumstances of Nebraska are unique and policies originating here can be responsive to your local and statewide needs. Now leadership by Nebraska now can change the course of future policy at other levels. If we take it a step higher, last year in Paris the United States committed, as part of a global agreement including China, India, Europe, and other major emitters, to reduce our emissions 17 percent below 2005 levels by 2020 and 26 to 28 percent below those levels by 2025. Like all other parties to the Paris Agreement, the United States has committed to set further goals in the years ahead. In 2020 the United States will be required to put forward a new set of contributions running through 2030. As the federal government continues to commit to reduce emissions and to find ways to reach those goals, it will look to the states for examples of policy success and technology deployment. By finding solutions that work for Nebraska you have the opportunity to influence the ongoing national and global debates as you did with ground water protection. Now regardless of emission reduction goals, there are several policy options Nebraska may examine as no-regrets steps that will benefit the state, particularly policies that use market-based incentives. Certain policy choices can improve other aspects of life, including economic growth, consumer electric bills and choice, energy security, and health. Let's look at carbon policies as an example. The one promising technology that you might look is called carbon capture, use and storage or CCUS, which, as the name explains, uses a combination of technologies to capture the carbon dioxide released from fossil fuel combustion and industrial processes, transport it to some place for use or a suitable underground storage site where it would not enter the atmosphere and contribute to climate change. Geologic storage options include saline formations and depleted oil reservoirs. There are also ways to use the carbon for economic purposes: changing a waste product into a valuable commodity. One example of that again would be the project at Monolith south of here, that was just had a ground breaking yesterday. Currently carbon capture has been deployed at commercial scale, natural gas processing, fertilizer production, and hydrogen production

facilities. The first commercial-scale coal-fired power plant with CCUS, the Boundary Dam plant in Saskatchewan, became operational in 2014 and the Kemper County CCUS plant in Mississippi is planned to open later this year. The first commercial-scale ethanol plant with CCUS is likely to come on-line in the next few months at the ADM facility in Decatur, Illinois. In an adaptation of a process used in the Permian Basin of Texas for over 40 years, these plants will take carbon emissions from coal plants and pump them into existing oil wells to increase production through a process called enhanced oil recovery. In this way, fossil fuel plants reduce emissions to the atmosphere and oil fields produce more oil. It also has the potential to increase oil-based tax and royalty payments to local, state, and federal governments, create jobs, and improve U.S. energy security. With all of these benefits, carbon capture and enhanced oil recovery have attracted diverse support. For the last five years, C2ES has co-convened the National Enhanced Oil Recovery Initiative to support the technology through awareness and federal and state policy. Initiative members include many of the major coal companies in the United States, other industrial producers, carbon--such as ADM, support industries including Lincoln-based LI-COR Biosciences, national environmental groups, and labor unions. To help states find specific policies that can work to encourage enhanced oil recovery using carbon dioxide, the governors of Montana and Wyoming are co-convening a work group on the topic that currently includes 14 states, including your neighbors Colorado and Kansas. Nebraskan participation in this group could help develop new policies for use here. If we turn to the power sector, states have considerable authority over how electricity is generated and used within your borders. The two major options for reducing emissions from the power sector are energy efficiency and low-carbon electricity generation. Increasing energy efficiency is often the least-expensive way to reduce greenhouse gas emissions to meet energy needs. It also has the benefit of reducing consumer energy bills. Energy efficiency policies come in many forms, including requirements for energy-efficient products, buildings, appliances and transportation and utility programs that reduce consumers' energy demand. Twenty-six states have an energy efficiency resource standard, or EERS; or an energy efficiency target, which is a mechanism to encourage more efficient generation, transmission, and use of electricity, and in some cases natural gas. You'll find a map of these states in the packet that was distributed. An EERS does not mandate a specific efficiency measure or a set of measures. Rather, it sets a minimum amount of savings and allows utilities to choose how to best achieve those savings--private sector-led or utility-led in the case of Nebraska. These savings can be in a percentage form or in megawatt, gigawatt, or

kilowatt-hour form. Some states specify cumulative savings by a certain period; some establish incremental, such as annual savings targets; and some states specify both an incremental and a cumulative savings target in their EERS. The options available to electric and natural gas utilities include, for example, demand-side management incentives, peak demand reductions, building code changes, and consumer self-direction and choice. In some cases, distribution system efficiency improvements, combined heat and power systems or CHP, and other high-efficiency distributed generation systems are also included. Some states have the flexibility to use a market-based trading system of energy saving certificates to meet these standards. Another option for the power sector is a requirement for electric utilities to deliver a certain amount of electricity from renewable or alternative energy sources. Twenty-nine states, including South Dakota, Iowa, Missouri, Kansas, and Colorado, have a renewable portfolio standard or an alternative energy standard. They require a certain percentage of a utility's power plant capacity or generation to come from renewable or alternative generation sources by a given date. The standards range in their level of stringency and qualifying energy sources may vary as well. Some states include carve-outs, those are requirements for a certain percentage of the portfolio to be generated from a specific source--could be biomass, wind, or nuclear power--or another incentive to encourage the development of particular energy resources. States have many reasons for implementing these standards. Job creation, energy security, clean air, and kick-starting a particular industry are all reasons states have energy standards. And then that's of course on top of the benefits from greenhouse gas emission reductions. Of course agriculture has other opportunities to reduce emissions. The use of biomass resources, such as crops and residual matter from agriculture, forestry, or animal waste, as a low-carbon energy source offer an opportunity to that sector to address climate change in a profitable way. Biomass can be burned directly for electricity or it can be converted to other usable fuels, including biofuels. If done properly, the use of biomass can reduce greenhouse gas emissions. States can promote the development and use of biomass resources in a variety of ways. It could be an eligible resource under state renewable energy standards, as it is in some other states, and a variety of grant, tax incentive, and other incentive programs do exist for biomass. The agriculture sector can also help protect the climate by promoting certain farming techniques, including low-till and no-till farming, which naturally increase the amount of carbon stored in soil. In addition to this climate benefit, these practices have other beneficial effects such as improved soil quality, reduced erosion, and improved water quality. State policies promoting conservation practices come in a variety forms, including no-

interest loans, and tax and other incentives. Finally, to look at transportation policy, because transportation is now actually the largest emitting sector in the United States and there are a variety of opportunities to reduce emissions from this sector that also typically reduce criteria air pollutants. And they also increase energy independence and save money by looking at incentives for alternative-fuel vehicles, including electric and natural gas vehicles. Electric vehicles in particular offer a number of benefits, including less air pollution and lifetime savings for consumers based on fuel and operating costs. These vehicles though are held back in deployment by a number of factors, including charging infrastructure network deficiencies and high up-front costs. State policy can help incentivize electric vehicle purchases through tax incentives on vehicles and charging equipment purchases or nonfinancial incentives. States can also encourage and enable utilities to develop charging networks. In neighboring Missouri, Kansas City has become one of the nations most attractive places for electric vehicles and the local utility is planning on deploying 1,000 charging stations in the coming years. The Volkswagen settlement on emissions testing will also provide states with dedicated funds to accelerate deployment of electric vehicles. C2ES is now working with stakeholders in Kansas City to find ways to increase access to electric vehicles in low-income communities and would be happy to work with you on opportunities here. Natural gas vehicles are particularly attractive for heavy-duty vehicles because of the limited fueling infrastructure they need, as well as the higher energy density of natural gas when compared to electricity. State municipal vehicles with centralized fueling systems may be good targets for natural gas and I understand Lincoln has taken the first steps into buying a fleet that will have some electric vehicles in here. So states can choose a number of energy policies that reduce greenhouse gas emissions while spurring economic growth, lowering consumer bills, increasing energy security, and improving public health. Nebraskans can use state-level leadership to build a no-regrets policy that provides multiple benefits while also reducing greenhouse gas emissions and increases your stake in the national and global debates on how to reduce emissions. Thanks again for the time to share with you today and I'm happy to answer any questions you might have. [LR455]

SENATOR LARSON: Thank you, Mr. Tubman. Senator Haar. [LR455]

SENATOR HAAR: Yeah, well, again, thank you very much for coming. You've given us some insights. I want to go back to what we talked about this morning for just a minute. Obviously this

hearing, we're people that can vote and make decisions at the top level. On the other states you've worked with, where does the grass-roots movement fit in and how have you seen that starting from the bottom? I'm going to be out of here in three months. [LR455]

MICHAEL TUBMAN: Well, you know, I think like any major issue that touches all sectors of the economy and our society really, it requires constituencies to be activated at all sorts of different levels and everyone is going to have a different role to play. There are certainly environmental groups that can just increase awareness about the issue, but when it comes down to some of these policy specifics for instance, there are roles for maybe unexpected constituencies to play a role. For example, I point to our project on carbon capture and storage. That project involves involvement from Arch Coal, Peabody Coal, Cloud Peak Coal, ADM. These are not companies usually associated with climate change efforts but they've come to see that there is a future of the United States economy that is carbon constrained and so they're looking to advance technologies and policies that help them make an economically viable path for their industry in that carbon-constrained world. So they're looking at carbon capture and storage and how can we move the technology forward now on that. I think you have to be able to activate the private sector, you have to find ways that they can be part of the solution. And that may require not just small businesses to be activated but large companies here as well. How can utilities find something to benefit? You know, we talk about electric vehicles. That's a potential load, electric load, that utilities could carry and find profitable. And that would reduce emissions here in Nebraska. It would also potentially reduce our dependence on oil, much of which is imported. So there is a variety of different benefits to private sector engagement on policies that help the climate but also help them economically. [LR455]

SENATOR HAAR: Good, thank you. [LR455]

SENATOR LARSON: One of the...I'm looking at the financial incentives for carbon capture and whatnot and I see Kansas and New Mexico have tax incentives; and Colorado, Florida, and Virginia it looks like utility cuts would cover like recovery mechanisms; and then Texas, Mississippi, North Dakota, Wyoming, Montana, Illinois have multiple policies. Is this...are the ones with multiple policies, are they...I guess how far...how long have these been in place and have we seen certain ones that work better than others? Are the, you know, is it the multifaceted

approach? Are they the ones that are succeeding the most? I know you talked about carbon capture and ADM, they're taking the carbon they're capturing, and then or other companies as well, and I'm assuming sending it to Oklahoma and Texas if they're sending it to oil fields. Is that through pipelines? How are, I mean, how are those things happening? [LR455]

MICHAEL TUBMAN: So the carbon capture and storage industry is actually quite long when it comes to the idea of putting carbon underground for oil production, and the Permian Basin has been doing that for many years. So there's actually hundreds, I think thousands of miles of CO2 pipelines that exist in the United States already to take carbon from naturally occurring sources and from natural gas fields and move it around and put it into oil fields. One of the interesting things about this opportunity is that it can reinvigorate existing oil wells. So there's a lot of potential to use carbon capture and EOR in fields in Ohio and Pennsylvania and Michigan and places that were actually oil-producing states more at the turn of the last century than at the turn of this century. It could reinvigorate some of those fields without increasing, you know, the footprint of an oil well because no new drilling is necessary. And you also in a lot of cases have nearby industrial facilities in places. So some of those, traditionally we've used carbon that was naturally mined from sites in the west, as well as when you drill for natural gas you need to separate the methane, the pure natural gas, from other things that come up with it, including CO2. So a lot of the CO2 that was used in CO2-EOR in Texas at the very beginning came from natural gas processing facilities in that area and then took it out, took the natural gas and CO2 out, sent the natural gas to market, put the CO2 back into oil wells for production. What we're seeing now is an opportunity to increase the geography and the types of facilities that we're capturing carbon from. The Mississippi plant for instance, the Kemper plant, will actually put the oil into...put the CO2 into oil wells in Mississippi nearby, some smaller ones, not Permian Basin, but still very relevant, and it would store that carbon. [LR455]

SENATOR LARSON: And so the overall, by doing that, not only are they capturing the carbon, which lowers the overall footprint, but pumping it back into the wells that it's not going into the atmosphere and, you know, essentially just we're lowering our carbon footprint in a number of different ways. [LR455]

MICHAEL TUBMAN: Yes. Immediately from those... [LR455]

SENATOR LARSON: Because you're not having to...the wells aren't having to work as hard or not have to drill new ones. [LR455]

MICHAEL TUBMAN: Well, you are still taking oil out of the ground and you're going to combust that oil. So there would be emissions from that. [LR455]

SENATOR LARSON: But the overall footprint is (inaudible). [LR455]

MICHAEL TUBMAN: The overall footprint is about a net negative, but what's also important is that over the long-term we are putting a value on the waste product of CO2 and that's, you know, you're putting a price on carbon into an existing economic structure, the oil market. In addition to that, we're driving down the cost from CCS on all sorts of different facilities. We know how to do it cheaply from natural gas plants, or natural gas processing plants, because we've been doing that for 40 years. But now we're learning about how do you do that on coal plants, how do you do that on ethanol plants, what other types of facilities might we be able to use this on? And the revenue that those facilities get from selling the CO2 is an added incentive for them to try. It reduces the costs of that type of innovation and the more of those plants that we do, of course, we drive down the cost curve as we learn more about how to deploy the technology. And so over the long term, that's very important because we will have coal-fired power plants in Nebraska and India and China in the future. So if we're starting to learn in the United States, or even in Nebraska, about the best ways to capture carbon from coal plants or from ethanol plants or from other industrial facilities, you can take that technology and sell it to the rest of the world. So there's an economic opportunity for leaders in this field as well. [LR455]

SENATOR LARSON: Excellent. That's kind of where I was, for you, that's where my questions were. I appreciate you making the trip out here. [LR455]

MICHAEL TUBMAN: No, very glad to do it. [LR455]

SENATOR LARSON: And being (inaudible). I'm sure we'll be in touch on a number of things moving forward, but I think you've given the committee a lot to look at. And also kind of in the spirit of what we were looking for, a multifaceted approach to ensure that we are reducing the

carbon footprint overall. So thank you. Do you have any further questions, Senator Haar? Thanks for coming and we'll be in touch. [LR455]

MICHAEL TUBMAN: Thank you very much. [LR455]

SENATOR LARSON: Next, Dr. Moe Alahmad for the NCEA, I think. Welcome to the LR455 Committee. Please spell your name. [LR455]

MOE ALAHMAD: Yes. My name is Moe, M-o-e, and the last name is Alahmad, A-l-a-h-m-a-d. Should I start? [LR455]

SENATOR LARSON: Yes, please. [LR455]

MOE ALAHMAD: Yes. So I'm here as a member of the Nebraska Community Energy Alliance and I'm also an associate professor in the Durham School of Architectural Engineering and Construction in the College of Engineering of the University of Nebraska-Lincoln on the Omaha campus. I would like to thank you, Senators, for inviting NCEA to present its project findings to date. As the research lead for this project, I will discuss the economic and environmental benefits for initiatives that has been carried out by NCEA. When NCEA embarked on its initiative to build a statewide refueling infrastructure for electrified transportation at the community level first, an important element of the project was to provide the benefit of electrified transportation for city councils and governing bodies throughout Nebraska in order to justify any public expenditure in this new global industry. What our research has proven is that substituting electricity as a transportation fuel has profound beneficial environmental and economic benefits. To state it simply, at today's gasoline and electricity prices in Nebraska, you can spend $50 on gasoline and drive 454 miles or you can spend $50 on electricity and drive 1,666 miles, cutting the carbon emissions in half or more. So it's my privilege today to share our research finding and discuss the multiple benefits associated with transferring our transportation fuel to electricity. First, I would like to tell you more about NCEA and its mission. The Nebraska Community Engineering Alliance was founded in June 2014 as an interlocal cooperative agency. Today it includes 25 members that span the entire state of Nebraska. The mission of NCEA is to build and promote advanced technologies for housing and transportation that save energy, reduce CO_2

pollution, and cut costs. This mission is clearly articulated by city administrator for South Sioux City and the founder of NCEA, Lance Hedquist. He said communities have a choice to simply exist or to lead. Our projects demonstrate leadership and help motivate and excite our citizens. NCEA believes demonstrating these benefits of electric vehicle at the local level is the best way to accelerate the market in Nebraska. This mission is being realized using grant funding from the Nebraska Environmental Trust, NET, and its own mission to conserve, enhance, restore the natural environment of Nebraska. NCEA is in the process of implementing its second NET grant cycle. When completed, a total of 24 electric vehicles and 35 charging stations will be deployed across communities in Nebraska. The UNL role in this initiative as a member and as a lead research entity is to collect, process, and analyze data from alternative-fuel vehicles through network charging stations and information from the participating communities to document the environmental and economic benefits. A detailed data analysis can be found on the project's main Web site and that Web site is http://engineering.unl.edu/evehicle. In addition to data analysis, the team is involved in educational initiatives to disseminate our findings and to further promote alternative-fuel vehicles and charge infrastructure, including attending, speaking, and participating in all dedication events and in the development of workshops and statewide public events to promote this technology throughout Nebraska. So I am here speaking today to discuss the information at the legislative level. I will now distribute one of our monthly reports, specifically detailing our calculation finding and analysis. So I would like to have this report be...so as the report being distributed, the report consists of an executive summary that highlights the NCEA mission and provides a summary of the findings, and a detailed analysis of each NCEA member participating in the alternative-fuel vehicle initiative. I would like to start by identifying the NCEA members on the map. So what I'm going to do next, I'm just going to highlight some specific location in the report and give you the page number so that you can follow as I discuss. I would like to start by identifying the NCEA members on the map as shown in figure 1 on page 14. So if you look on page 14 you will see a map of Nebraska showing the members, the NCEA members, of this organization. The members who are part of the Alternative Fuel Vehicle Initiative and their involvement is shown in table 1 on page 15. So if you go to page 15, these are the specific members who are participating in the two grants that we have received that we are implementing as part of the process. So you can see the name of the participating community, its involvement in promoting alternative-fuel vehicle and charging infrastructure either through using electric vehicle, CNG vehicles, or the installation of charging

stations. This data is also shown on page 16 in figure 2 in a map format. As can be seen, the member's involvement varies. For example, the city of Lincoln will install 10 charging stations by the end of this second initiative, while South Sioux City is involved by deploying 4 electric vehicles, 2 CNGs, and 3 charging stations. Again, with all of the participating member involvements, they are contributing to the deployment of 24 alternative electric vehicles, 9 compressed natural gas, CNGs, and 35 charging stations. Each of these charging stations have two ports, for a total of 70 ports. A table summary of this...so now let's talk about the economic and environmental benefits. I know that's why we are here. So a table summary of this information in shown in table 2 on page 17. So this table provides economic benefits and environmental benefits for each of the participating communities and show and details the type of savings in terms of the emissions and the reductions of such emissions. If you look at the last row of the table, it shows for the entire initiative thus far, from the day that this project was started back in November 2014 until this data that was collected in August 2016. So thus far, we have a savings, economic saving, of $11,792.69 and we also have a total of 87,333.88 pounds of CO2 emission reductions. I'm only highlighting the CO2 but the other reduction, the other greenhouse gas emissions are also highlighted, such as the CO2, the SO2, the NOx, the CH4, and the VOC. Now I would like to describe how we calculated the benefits, so let's start with the economic calculation as described on pages 5 and 7 of the report. We wanted to compare different type of vehicles, so that what we did is we looked at the conventional vehicle, that's the internal combustion engine running on gasoline fuel, we looked at the cars that's running on diesel fuel, we looked at compressed natural gas, we looked at the pure battery electric cars, and we also looked at the plug-in hybrid electric vehicles. To develop this cost we looked at both average and specific fuel information for each participating member. Table 1 on page 5 provides this information. For example, the cost to drive one mile is shown by the third row on table 1 and the cost per year is showing in row 4. For example, if we are looking at that table we see that if I...the cost to drive one mile using a conventional vehicle would be 11 cents and the cost per year would be $1,320. Whereas if you look at the battery electric vehicle and the cost associated with that, we needed to look into which utility company is serving the community or the city of interest. And therefore, if we look at the cities that are served by LES, then we see that the cost per mile is $0.24 and the cost per year is $288. Table 2 on page 6 shows the estimated cost saving when compared to the conventional vehicle. So now what we did is we looked at the conventional vehicle and we used it as the base and we compared all the other fuel type to that.

So if you look at the table 2 on page 6 you see how much savings are there. So for example, for that same electric, the pure electric vehicle in the LES serving area, we see that there is a savings of $1,032. In addition to just the fuel savings, we also looked at other savings associated with that, such as maintenance, such as changing the oil, such as filters, and so forth, and we calculated that into our overall savings. So we can see that the costs, for example, for a given year, if you look at table 6, that's also on page 6, it shows that the cost for the BEV is going to going to be about $217 in saving when you compare that to the cost of the conventional vehicle. So when we add the maintenance savings and we add the fuel savings we end up with table 5 that is on page 7 and shows again for the LES serving area we have an estimated savings of $1,249.20. For the actual economic savings for each of these communities that are participating in our project, what we did is we looked into both. We looked at the data that we gathered from the charging station that had been installed. If a charging station were not installed, we looked at odometer readings of the electric vehicles that they are using or the compressed natural gas that they are using and we used that specific data. In addition to that, when calculating the price of gas we looked at the average gas price in that specific community, so we did not take an average. We only did the average for the table calculations, but when we wanted to document each of these communities we looked at the actual gas prices in those communities. Now just look at that, the environmental benefit calculations. And so what the specific greenhouse gases evaluated in the study are defined on page 12. So on page 12 what we provide in the report is a definition of what the greenhouse gases and how they are contributing to the environment. Now to calculate these greenhouse gases, we need to look at the various fuel types. And so if we are interested in the electric vehicles we need to see what is that electricity makeup for the utility that is serving that electricity that is being used for by that electric car. And so for the interest...in the interest of time, I will only discuss the LES-serving area calculations. So we know that as utility transition to more renewable energy sources in their electricity mix, the environmental benefit for driving BEV improves substantially. We looked at published data for the LES electricity makeup for 2015 and 2016, as shown on page 29 of the report. So this is supplemental data, so I put it in the appendix. So if you just look at page 99 of the report you're going to see the electricity mix for LES and you can see a substantial change between 2015 and 2016. In 2015 you see that the percentage of renewable that was used to generate electricity was 17 percent, whereas if you look at 2016 that number has increased substantially to 47 percent renewable. And this substantial increase has a major impact on driving electric cars, as you will

see in the tables to follow. And so now we use this data to calculate the specific greenhouse gas emission as detailed on page 100 to 103 of the report. So table 4 shows that greenhouse gas emission factors, which is grams per mile for the LES-serving utility. So if we just look at the CO2 emissions from table 5 we see that when we are driving one mile in an LES-serving area, if I'm driving a conventional vehicle I will emit 411 grams of CO2. However, if I drive a diesel vehicle, I will emit 377 grams; if I drive a compressed natural gas vehicle, I will emit 334 grams; and if I am driving a battery electric vehicle, I will emit 241 grams based on the 2015 data of the electricity mix and 129.29 grams using the 2016. So you can see just in going from one year where the renewable energy mix went from 17 to 47, we cut the CO2 emissions in half for driving the electric cars. So you can see that the battery electric car in 2016 data only emits 129.29 grams in comparison to 411 grams for the conventional vehicle. So now if you look at this data for one year, based on driving an average of 12,000 miles, the emission savings are...or the emissions, actually the emissions for the CV are 10,779 pounds if I'm driving a conventional vehicle and 3,208.78 pounds if I'm driving an electric car. So that is a, if you look at the difference in the two and saying I'm going to drive an electric car instead of a conventional car, that is a reduction of 7,770.22 pounds in one year. To calculate the actual emission reduction for each community we have detailed these calculations in the report. For example, for the Allen Consolidated School that's shown on page 20, we find that the CO2 saving thus far is a reduction of 18.88 pounds of CO2. And the reason why the number is very small is because the Allen Consolidated School was part of the second phase of the grant which started in April. So I would like to conclude. And in summary, the future of BEV is bright and BEV are here to stay. Market signals are pointing to this fact. For example, in 2015 a total of 116,099 battery electric vehicles are sold in the U.S. This year, as of the end of September, there has been 109,702 schools that are sold in the U.S. In September alone, an estimated...this number is an estimated 16,794 plug-ins were sold. That is a 67 percent increase over a year ago and well higher than the previous record month, which was June of 2016 where 15,063 cars were sold. In addition to that, auto manufacturers are targeting not just light-duty vehicles but also they're starting to target heavy-duty cars, including trucks and buses, to be battery electric or hybrid electric vehicles. In addition to that, charging infrastructure manufacturers are developing technology to reduce the charging time to about 30 minutes for light-duty vehicles and for charging infrastructure for the forthcoming heavy-duty vehicles. As stated earlier, NCEA embarked on its initiative to build a statewide refueling system for electrified transportation at the community level and to prove the

economic and environmental benefit of electrified transportation throughout Nebraska in order to justify any public expenditure in this new global industry. NCEA will look forward to continue to continue to promote BEV and to see actions for the deployment of BEV, which is the battery electric vehicle and charging infrastructure. Our environment will benefit from these stations. Thank you again for giving us this opportunity to share and disseminate our findings. Thank you again. I'm open for any questions. I'm sorry if I bore you with all the details. [LR455]

SENATOR LARSON: No, no. We have some...I know I have a question or two. Are there any other questions? Senator Haar. [LR455]

SENATOR HAAR: Okay, on page 17 you give the list of communities and some are like a school or a city or whatever. Why do people or cities step into a leadership position like this? [LR455]

MOE ALAHMAD: That's a great question and that's exactly what the founder of the NCEA is the fact that what we need to...we either need to be either a follower or be leaders. And so what these communities in participating in the NCEA and being a part of this NCEA community, they want to lead, and you need to lead by example. And to lead by example you need to drive the electric car that you say is good for the community and also you need to provide for that infrastructure. So that's why that I believe that they are participating and being part of this, part of the NCEA, so that they are leading by example and providing the benefits to their community members and following in their footsteps. [LR455]

SENATOR HAAR: So the state could step up and be a leader in that same way, right? [LR455]

MOE ALAHMAD: Yes. [LR455]

SENATOR LARSON: Senator Mello. [LR455]

SENATOR HAAR: Thank you. [LR455]

SENATOR MELLO: Thank you, Chairman Larson, and thank you, Doctor. The question is, and we had this discussion I guess earlier in my time in the Legislature regarding compressed natural gas vehicles, which is whether or not the infrastructure is needed first to be able to build the market for an alternative-fuel vehicle. Are you seeing a similar kind of assessment with, I mean, I know this is a very lengthy report and I know we'll be able to get through it after today's hearing. But is that at all the discussions that's happening on the battery electric vehicles is that for the market truly to be able to take off in a state like Nebraska is that there needs to be more public infrastructure regarding charging stations to be able to build enough critical mass to be able to...for consumers to purchase and utilize them? [LR455]

MOE ALAHMAD: Yes. So to answer this question the way I would answer it, because I would look at it this way, is that, you know, we, through the research that we have conducted, we found that there are three elements that are impeding the deployment of and the utilization of electric vehicles. And those three are, one, there's the fact that there's what's called the range anxiety: the fact that if I am driving an electric car, will I run out of energy; and if I do run out of energy, is there a nearby charging station that will allow me to, you know, to recharge my vehicle and continue driving to my destination? So that's the first element. The second one is the fact which leads to the first one in terms of the charging infrastructure, the fact that there is a lack of the charging infrastructure, whether it's in the city or in the state. And the third part, and that's an important part, is the fact that it's related to public awareness. And therefore...which means that, you know, the public need to be aware of what electric vehicles are. And so I'll just give you an example, you know, from my own experience. I leased an electric car, the Nissan LEAF, back in 2013 and it was a 2013 model. And when I started driving it people would stop me in the street or in the parking lot when I'm driving and they say, is that the electric car? How does it work? Are you afraid you're going to run out of gas? And how do you charge it? Do you have to buy a charging station? Can you charge it at home? And so they asked me all these questions because that's one of the elements, which is the public awareness, and the fact that not all the public are aware of the fact that, you know, about this type of alternative-fuel vehicle, one, and how it works. And therefore, our role, you know, as leaders, is one is we need to educate the public. And how do we educate the public? You know, the best way to educate the public is to stand in the front and to talk about this alternative-fuel vehicle, one; second is by having this charging infrastructure. So as people drive around they start to see this new station that's sitting in front,

you know, that's installed, whether it's in front at city hall or in front of public...you know, a government building or within the university or in front of Baker's or in front of Hy-Vee and so forth. So when they start to see that then they start to inquire about what it is and, again, ask some questions. So these are the three elements that we need to address in order for us to see the next spheres of this deployment of the alternative-fuel vehicles, which is the fact that we want to make sure that the people who will purchase these cars, they're not afraid that they're going to run out of energy. The fact that we, and this is going to be a collaborative effort, whether it's at the state level, at the government level, at the private level for the deployment and installation of charging infrastructure, and then the third part, which is the public awareness. [LR455]

SENATOR MELLO: And if I could ask kind of a follow-up, I know this may sound a little anecdotal, too, Doctor, so please forgive me, is that in a recent trip to visit my in-laws in Des Moines, Hy-Vee, which is the largest grocery store chain in the state of Iowa, two different Hy-Vee grocery stores we went to in the city of Des Moines had electric vehicle charging stations and I'd never quite seen that before at a grocery store, obviously nothing I've ever seen in Omaha or Lincoln. Are you seeing at all, in any of the research, seen private investment coming from...whether it's coming from shopping malls, whether it's coming from grocery stores, other private development that's putting out private investment to build this charging...this electric vehicle infrastructure that's needed or is it purely kind of at the whim, so to speak, of our public power districts or our public utilities that would be the drivers that wanted to see that occur right now? [LR455]

MOE ALAHMAD: So the way I would answer that is the fact that, you know, if you look at the charging infrastructure, and if you look at it in terms of if you're trying to generate money or an income, that's not really...at this present time you're never going to recoup that cost that you're going to pay for to install that charging infrastructure. So you don't see a lot of the private, so it's really more of the, you know, at the state level, the government level, and then the public entities. Now if you ask the question, why is, you know, why is Hy-Vee is doing that then, because they're a private entity? And then why do they want to provide, you know, for charging infrastructure? Well, so one is the fact that they know that they're not going to be able to recoup the cost by charging for the price of electricity when you plug in your electrical vehicle for an hour, for example, or if you go there for half an hour and you just go inside and shop. The cost of

that electricity is going to be, you know, very (inaudible), is going to be less than a dollar cost. However, the way I see it from Hy-Vee is the fact that if you say, well, I'm going to wait another 10 minutes while my car is being charged then that's more time spent inside the store, which is more time more likely that they're going to end up buying more stuff that way. And as a result, you know, it's going to be a net gain for this private entity, Hy-Vee, to that, in that. Yeah, we are providing this, you know, infrastructure, and as a result the fact that you're going to end up spending more time inside waiting for your car to be charged; the fact that you're going to spend more money. And one of the...actually the outcome of this research is we want to look into if we do install charging stations at, you know, at public places, whether that's the mall or at some other entity downtown, will that drive more customers? Because if you, again, if you have a charging infrastructure, you're going to have some people who are going to come in and, you know, have to wait because the type of charging stations that are available in today's market, there are three levels. So there's the level one, which is the one that you can charge your car at home. So what I do is when I get home I just plug in my charger into the 120-volt outlet that's in the garage which is sharing the same as my refrigerator. That's level one, it's going to take me about, you know, anywhere from 8 to 10 to 12 hours, depending on the type of the charging infrastructure that I have in the car that I purchased. The level two, which is what you see in most of the places right now, is the one that's going to take about 4 to 6...it will take about 4 to 6 hours to charge. So therefore, you're not going to sit and wait for 4 to 6 hours waiting for the car to charge. And the purpose of that charging station at Hy-Vee is then for that one person who just wanted, you know, to charge their car for half an hour so that he can get five to ten miles of range. And then there's the level three, which is that you can charge your car in half an hour. And that's the most expensive, it cost about approximately $40,000 to install one charging station. And that will recharge your car from 0 to 80 percent in half an hour. We, as part of these initiatives that NCEA has taken, is actually we're going to be installing one of those level three charging stations at Gretna at the Nebraska Crossing. And we will document the benefit of that. Are people who own electric cars, are they spending more time there? And if they're spending more time there, are they spending money as a result because they're waiting, they want to get their car charged 100 percent and so forth? So, I know, this is long-winded. I maybe went in so many different directions, but hopefully I answered your question. [LR455]

SENATOR MELLO: Do you see at all the possibility, and I know this is obviously speculative, but if what you're seeing just with the pilot that you're hearing at the Nebraska Crossing mall, if that's kind of where we're starting to see possible pilots like what I saw in Des Moines with Hy-Vee, that it needs to be private development where people can go and spend more time, so to speak, possibly, you know, and buying or purchasing something else for half an hour to an hour? Is that at all an option for local governments or the state to encourage private development that's being built, whether a new mall is being built, whether a redevelopment is being built to encourage that kind of electric vehicle charging stations being part of those redevelopments if you know it's going to be able to generate foot traffic or in this case consumer spending that's going to be kind of focused on that redevelopment or that new development area? Is that something at all that's been discussed anywhere with the research report or is that just more of an anecdotal issue that kind of what I saw in Des Moines with what you just explained happening at the Nebraska Crossing out in Gretna? [LR455]

MOE ALAHMAD: So, no, I think actually it need to be an approach that's addressed by all levels. Not just, you know the government, it has it be addressed also by...when we are, like I said, building a new strip mall and so forth, that should be part of the...it should be part of the infrastructure and should be talked about. But you need to have the right, you know, you need to have the right people who are discussing though. So if, you know, if you think about, the way I look at it, if you think about the contractor, the owner. And the only thing that's been discussed, you know, what's going to be the least-expensive cost for me to get this building built. And therefore, what needs to be done, is that the government...levels maybe the government needs to take...or state, I keep saying government, not state. At the state level, the state needs to take some maybe legislative action. For example, in the state of California right now, you know, if you build a new home it's required that in the garage you need to put the infrastructure for a level two charging so that in the future if you do have an electric car then you have that infrastructure to put in the electrical outlet that would support that level two charging infrastructure. So you see that California is starting to, you know, at the residential level, they're starting to say, if you build a new home, well, you have to put that in the garage. And so they made it the mandate so that now every new home that's built does have that. At the same time, you know, we are taking a lead. NCEA is taking a lead in the fact that if you look at table 1 as shown on...table 1 on page 15, we see that a lot of these, you know, we have a lot of the communities throughout the state of

Nebraska, they are helping in promoting alternate-fuel vehicles and they are installing charging stations. I mean, you look at Lincoln. [LR455]

SENATOR MELLO: Uh-huh. [LR455]

MOE ALAHMAD: By the end of the second phase of our grant, which is going to end in June of next year, we're going to have ten charging stations that are part of NCEA, funded in part by the Nebraska Environmental Trust, so that we can promote alternate-fuel vehicles. So again, I don't know if I answered your question fully but I think it's an effort that needs to be across all levels and should be...we should have some, you know, as this special task force. There should be special, you know, I would recommend maybe a special task force to look into the alternative-fuel vehicles. And actually, I'm working on another project with the Nebraska Department of Roads. And what we are trying to do with that project is we are doing a study where we try to document the need and the benefit for charging stations. And so as part of that study what we are determining or documenting or developing is what we call an index, a city-ready index, meaning that if we were to deploy the level three, which is the fastest of the EC chargers, is the city of Lincoln ready for the deployment? What's missing in order for that deployment to take place? And so we got to look into each city in the state of Nebraska and we got to develop an index to say whether it's ready or not. And if it's not ready, what's needed in order for a charging infrastructure to be placed in those places. So that's an ongoing research that we just started in July. [LR455]

SENATOR LARSON: Great. Thank you, Dr. Alahmad. [LR455]

MOE ALAHMAD: Sorry, long... [LR455]

SENATOR LARSON: No, no, we appreciate it. And Senator Mello took the question I had. Any further questions? Seeing none, thank you. Next we have Michael Whatley from the Consumer Energy Alliance. Welcome to the LR455 Committee. [LR455]

MICHAEL WHATLEY: Thank you. [LR455]

SENATOR LARSON: Please spell your name. [LR455]

MICHAEL WHATLEY: Sure. Michael Whatley, W-h-a-t-l-e-y. I am the executive vice president for Consumer Energy Alliance and I'd like to thank you and the select committee for holding this hearing and inviting me to testify today. I appreciate the opportunity to speak on this important matter. Consumer Energy Alliance is a national, nonprofit, nonpartisan trade association with more than 300 affiliates, including the Nebraska Chamber, Nebraska Rural Electric Association, Nucor, Spectra, and dozens of others who have operations in Nebraska. We also have more than 300,000...400,000, excuse me, individual members, including more than 33,000 here in Nebraska. CEA's mission is to work with local, state, and federal policymakers to develop and implement sound and rational and balanced energy policies which will ensure access to affordable, reliable energy for all energy consumers. We strongly believe the goals of responsible energy development and protecting the environment are not mutually exclusive. Rather, we believe they are two sides of the same coin and that policymakers such as yourselves have both the ability and the duty to do both. We also believe that no country in the world has the capacity to move forward on both of these fronts better than the United States. As a perfect example of this is the fact that while the population of the U.S., energy consumption, and energy production have all risen dramatically since 2007, our national carbon footprint has fallen by more than 12 percent, more than any other country in the developed world. We've also seen significant decreases in other types of pollution and increases in both air quality and water quality over the same time period. CEA applauds the committee for its approach to the opportunities and challenges that increased population and energy demand will be presenting to Nebraska over the next several decades. Taking a holistic look at the options for meeting your energy needs and considering options for ways to reduce or mitigate carbon emissions is a constructive dialogue that should serve as a model for other states that are dealing with the same set of issues. Today, I would like to raise two particular points for the select committee's consideration as you work to develop a framework for an energy and climate policy. First, pipelines have a much lower carbon footprint than trucks and trains to move liquid products. Pipelines are the safest, most efficient method to move oil and natural gas resources from their extraction points to consumers nationwide. Indeed, federal data and agencies repeatedly confirm that pipelines are by far the most economical, environmentally responsible way to move energy products to markets and provide families and consumers the vital services they need to get to work, school, and power

their lives. Not only are pipelines exceedingly safe, delivering 99.9999 percent of crude oil and petroleum product to their destination safely, they also have a significantly lower carbon footprint than other means of moving liquid products. For example, a medium-sized petroleum pipeline would remove as many as 750 trucks from the roads or up to 225 rail cars per day. Building the Keystone XL pipeline, which is designed to carry 830,000 barrels of oil a day, would replace 1,165 rail cars per day and 4,150 tanker truckloads daily, which would reduce the carbon emissions nationally by as much as 40 percent, according to the Obama administration's environmental analysis of the project. So not only do pipelines significantly reduce the strain on our existing roads and infrastructure. They also significantly reduce greenhouse gas emissions. The second point I would like to highlight is that natural gas pipelines are needed to allow the construction of new natural gas electricity plants. The face of modern electricity generation has changed dramatically in recent years, with increasingly strict environmental regulations on coal-fired electricity and steep decreases in the price of natural gas due to increased domestic production. Natural gas has surpassed coal as the primary fuel for electricity generation nationwide and natural gas plants are projected to generate an average, a record average, of 3.8 million megawatt hours per day in 2016. This has had a dramatic impact on our national carbon footprint. According to the U.S. Energy Information Administration, CO2 emissions from the power sector in 2015 were 21 percent lower than they were in 2005, driven by the "shift of electricity generation mix, with generation from natural gas and renewables displacing coal-fired power." In addition to reducing phased out, or replacing phased out coal facilities, and meeting new demand loads, new natural gas facilities are also needed to provide backup generation for renewables such as wind and solar, which do not operate 24/7. The greatest challenge to new natural gas electricity generation in several regions is the lack of necessary pipeline infrastructure to connect gas production with new natural gas-fired electricity generation plants. Pipeline capacity restraints have been named as the single largest factor explaining why New England electricity and natural gas prices are the highest in the country. As Nebraska contemplates new natural gas facilities to meet demand growth, replace phased-out coal facilities, and provide backup generation for new renewable facilities, the state needs to ensure a transparent, efficient, and timely permitting process that will foster the development of the infrastructure needed to serve these new facilities. Again, I would like to thank the select committee for the opportunity to speak with you today. CEA is happy to serve as a resource and

provide any other documents to which the committee...to which may be helpful for your deliberations. And I'd be happy to answer any questions that you may have. [LR455]

SENATOR HAAR: Question. [LR455]

SENATOR LARSON: I'll start with Senator Mello. [LR455]

SENATOR HAAR: Oh, there. [LR455]

SENATOR MELLO: Thank you, Chairman Larson, Chairman Haar. Michael, thank you for your testimony today. I'm just, I was looking through the front page here and you talked a little bit about some of the reductions in CO2 and reductions in greenhouse gas emissions. Could you give us a little maybe bit more, any kind of more about any initiatives maybe your trade association has been engaged in or anyone else in the overall industries that you're working with that have been focusing on trying to reduce greenhouse gas emissions or carbon emissions? [LR455]

MICHAEL WHATLEY: Yes, and that's a great question, you know. And when we look at energy-intensive industries, which would make up a bunch of our members at CEA, and we included the iron and steel manufacturers, chemical manufacturers, the trucking industries, farmers, agriculture, as well as small businesses and others; they have over the last 20 years really moved on several private sector initiatives, you know, through sustainability programs like energy efficiency programs and how they can save that. I'll give you four examples. The first is iron and steel manufacturing. Obviously Nucor has major facilities here. And Jennifer Diggins with Nucor is a former chair of ours. In order to reduce costs and improve its competitiveness, the iron and steel industry of the United States has reduced its energy intensity by 31 percent and its greenhouse gas emissions by 36 percent by 1990. In fact, the U.S. Department of Energy has indicated the steel industry in the U.S. has the lowest energy intensity and second-lowest carbon dioxide emissions intensity of any major steel-producing country. Chemical manufacturing, managing energy efficiency in chemical manufacturing facilities is a key part of the industry's commitment to sustainability. The American Chemistry Council has created a responsible care program through which its member companies report on their progress towards energy-related

performance measures. Since 1974 the U.S. chemical industry as a whole has improved its energy efficiency by almost 49 percent. The energy efficiency of the responsible care companies has improved by more than 25 percent since 1992 and also since 1992 ACC members have reduced their GHG intensity by more than 29 percent. The chemical manufacturing industry is that the heart of many efficient and renewable solutions that help society save energy and reduce GHG emissions as well. High-performance insulations for windows, solar panels, wind turbines, as well as lightweight packaging, auto parts, and more efficient fuels that reduce energy needs, and shipping and transportation all start with chemistry. An ACC analysis found the products of chemistry helped to save up to 10.9 quadrillion BTUs of energy annually, enough to power, heat, and cool up to 56 million households or run up to 135 million vehicles per year. A groundbreaking study demonstrates that on a global basis the products, the chemistry, save twice the GHG emissions than are emitted making their products. The trucking industry, the American Trucking Associations have adopted a six-pillar sustainability plan. That plan, which was adopted in 2008, has a target of reducing the trucking's fuel consumption by 86 billion gallons a year and carbon emissions by 900 million tons over a ten-year program. The plan's six key pillars include reducing national speed limits for all vehicles to 65 and govern truck speeds at 65 for trucks 1992 and newer, reduce needless truck idling, and promote increased use of higher-productivity vehicles, and eliminating congestion on the nation's highways by addressing identified top-congestion bottlenecks. ATA, the American Trucking Associations, was a founding charter partner of the EPA SmartWay program in 2004 and continues to work with the EPA and members in advancing and growing the program, which now has over 3,500 industry partners and is a voluntary public-private partner program aimed at providing the resources and information to the freight transportation industry in order to reduce freight transportation-related carbon emissions and criteria pollutants as well. This program is supported by major transportation industry associations, environmental groups, state and local governments, international agencies, and a corporate community. Finally, the farming and fertilizer manufacturing, the manufacturing of ammonia, which is the basic building block for nearly all nitrogen-based fertilizers used in Nebraska and across the country, relies on natural gas as both a feedstock and a fuel. And as such, market fluctuations and the volatility of natural gas prices affect the production of ammonia. Since 1983, the amount of natural gas needed to create one ton of ammonia has declined from 36 million BTU to less than 33 million BTU and, according to a 2016 EPA report, GHG emissions from ammonia production have decreased by 28 percent

since 1990. Earlier this year, USDA released a ten building block framework that spans a range of technologies and practices to reduce GHG emissions, increase carbon storage, and generate clean, renewable energy. USDA expects the use of voluntary program to reduce net emissions and enhance carbon sequestration by over 120 million metric tons of CO2 equivalent emissions, about 2 percent of the economy-wide greenhouse gas emissions by 2025. [LR455]

SENATOR LARSON: Any further questions, Senator Mello? Senator Haar. [LR455]

SENATOR HAAR: You make a point on natural gas: The greatest challenge is lack of necessary pipeline infrastructure. I've had numerous talks with my friends at NPPD, for example, and, you know, asking when are you going to switch Gerald Gentleman to natural gas. And the response comes back, well, we don't have any natural gas pipelines running there. Who provides for that? Is it the natural gas companies or is it...would it have to be NPPD? Or who builds that infrastructure? [LR455]

MICHAEL WHATLEY: Sure. So there are private pipeline companies that build natural gas pipelines and there are a number of them here in the United States. And they will build basically a highway-type pipe, so without any off-ramps or anything like that, that will go from the natural gas source and put that into a terminal. At which point, off of that trunk line, you will have natural gas distributors that will be able to take that natural gas and sell it to various customers. Now when you talk about a major utility, or in this case here the public power districts, they would have the ability to contract either with the major trunk pipeline for, you know, an off-shoot that's going to go to their facility or to work with distributors themselves. So there are currently dozens of major natural gas pipeline projects that are working through, you know, permitting and construction all across the United States that, you know, being able to match up the resource base with those utilities and plants is something that they would want to work out. And I know that the pipeline companies themselves have ongoing dialogues over hundreds of potential projects before they kind of select down which ones are going to be the most economically viable. [LR455]

SENATOR HAAR: So in other words, it's not an issue of we can't do that, but how do we do it. [LR455]

MICHAEL WHATLEY: Yes, and you know, one of the major things that we've seen in terms of an impediment to that, particularly over the last, you know, three, four, five years, is that the permitting process at FERC, the Federal Energy Regulatory Commission, is at this point in time, through objections that have been raised, through protests that have been lodged against various pipelines and lawsuits that have been filed against various lines, the permitting process is actually now longer than the construction process for most of these lines. And so a number of companies are starting to build those horizons into their planning in terms of where they want to go and where they want to engage. [LR455]

SENATOR HAAR: Sure. Thank you very much. [LR455]

MICHAEL WHATLEY: Yes, sir. [LR455]

SENATOR LARSON: Thanks for coming in, Mr. Whatley. And I appreciate that and your testimony. Obviously the afternoon session is focused on carbon footprints and you did a good job of outlining, you know, pipelines and how they're...they can be a carbon reduction standard versus diesel or, you know, tanker trains and cars. And I think as this committee continues to move forward, obviously with the natural gas infrastructure, I think Senator Haar hit on that excellently, if we want, in our case, public utilities to move forward on these other more carbon-friendly technologies, this Legislature has to recommend or incentivize certain things to ensure that happens. And in the end, that reduces our overall carbon footprint. Is that kind of what you're saying? [LR455]

MICHAEL WHATLEY: That's exactly right. And I think, you know, one thing that's worth mentioning to you as legislators is that in the FERC process one of the most important stakeholders that they listen to are state governments, governors, and state legislators in terms of whether the state sees a need for this as a project that would be developed. So, you know, you sit in a really important seat in terms of working with FERC to make sure that they understand the value and the utility of having these types of projects permitted in the state. And of course you'll have ancillary state permits that will go through the Public Service Commission and making sure that you have, you know, a transparent and reasonable and timely permitting process is critical for getting these projects done. [LR455]

SENATOR LARSON: Yeah, because obviously we can't...we understand the American Truckers Associations then trying to cut down on idling times and all those things, but those aren't things necessarily a state can mandate. Or, you know, we don't want to make it against the law they can't, trucks can't sit there in idle. But they're obviously emitting and we can encourage electric vehicles and things of that nature. But as we move forward, I think we are looking at, you know, ways to reduce our carbon footprints. And I think we obviously need the transportation. We heard, I think we had a testifier this morning, that talked a lot, that said change the Department of Roads to the department of transportation and actually, you know, look at things such as that. And then we heard from Mr. Tubman. He talked about kind of the same infrastructure problems with pipelines but he focused on CO2 pipelines. I think you were here for that and you're on natural gas. And, you know, I think he...hearing both of you talk about that has...in terms of reducing overall carbon emissions is interesting so. Oh, yeah, Senator. [LR455]

SENATOR HAAR: Could we have copies of those other documents you were reading off of? [LR455]

MICHAEL WHATLEY: Yes, absolutely. [LR455]

SENATOR HAAR: Okay, and then again, I've heard the coal industry sort of saying that natural gas and oil are throwing them under the bus. But is there...do you see it as a problem? One of the things I hear is that coal can be stockpiled for days and days, whereas if you run short on gas in the middle of the winter you're in trouble. [LR455]

MICHAEL WHATLEY: I think that's absolutely right and I think from Consumer Energy Alliance's perspective when you look at a manufacturer, and I'll use Nucor as an example because they have a footprint here, or Caterpillar or any of the other groups that we work with, they don't care whether the electrons that are coming through the lines and working in their plants come from hydro or nuclear or natural gas or coal or renewable. They just want to make sure that it's affordable and reliable, right? So when we look at where the United States was 30 years ago when we were at a 70 percent national average for coal, there was a lot of concern that maybe that was an unhealthy mix because you didn't have enough other supplies in there. As we're shifting the natural gas and obviously the environmental benefits of natural gas versus

uncleaned coal, right, in terms of CO2 are significant. But you look at the addition of bag houses and all the other pollution control scrubbers that have been added due to EPA regulations where the coal emissions are dramatically lower than they used to be, we don't want to necessarily shift into a full 100 percent natural gas bucket any more than we wanted to be in a 100 percent coal bucket. We want to make sure that we have the healthy, vibrant mix so if a, you know, natural gas major trunk line goes down for a day or two that you will be able to have, whether it's backup coal or you have other ways of meeting your transmission needs through interconnects with other regions, that that's the way that you want to do it. I think, you know, coal is going to be part of the fuel mix going forward. I don't think that we're going to see in our lifetimes 0 percent coal. But there's no question, based on the trajectory that we've seen, the regulations that are already in place, let alone the new regulations that are sitting in court right now, that coal is going to continue to be phased out and you do not have the ability to build any new coal-fired power plants in the United States. So what is that mix going to look like? And from our perspective, what's the most rational way over an appropriate period of time for us to get there so that we don't end up with blackouts and we don't end up with price spikes? [LR455]

SENATOR HAAR: In my lifetime, 10, 15 years, 20; yeah, it wouldn't be bad; 20 years we'll be done with burning fossil fuels. [LR455]

SENATOR LARSON: Obviously, and here you talk about the mix and we, I think everybody here supported LB824 this year, and that's something that Nebraska is going to continue to move on, which is wind energy and a number of other things. And you talk about coal and natural gas, and I'm probably not as educated on the issue as Senator Haar in terms of we're in the Southwest Power Pool now. And maybe this question would be better for an NPPD member instead of you, but maybe you can give me your thoughts. If we don't...with coal moving, you know, lower and lower and we're in a more nationwide...or not nationwide pool but specific state or, slash, region pool, if we don't provide our facilities the ability to move to natural gas or something else like that do we risk the, you know...do we risk our generation actually just becoming obsolete instead and having to buy, when...like until, you know, as we move forward our plants shutting down essentially and us having to buy power from other states? [LR455]

MICHAEL WHATLEY: Yeah, I think, you know... [LR455]

SENATOR LARSON: Or like is that something that we should be worried about and actually switching to more natural gas? And obviously that means building the infrastructure and things like that. Is that a concern? [LR455]

MICHAEL WHATLEY: The short answer is, yes, right, because what we're seeing is for the first time, you know, electricity generation has always been regulated by the states. And really only since 1992, when we passed the Clean Air Act amendments, have we seen a federal environmental program that has the ability to affect what the states are doing in terms of their mix. And the program basically sets it up that you, the state, have basically a bucket of emissions that you're allowed to have. You figure out what you're going to do through your regulatory agencies, through your public service commissions, and through your Legislature of how you're going to meet that electricity fix, right? With the Clean Power Plan coming along then EPA for the first time is saying, in addition to meeting a specific goal, we're also going to tell you, you have to do A, B, and C, some of which are inside the fence line and some of which are outside. And that is really the hook of the litigation that's been up to the Supreme Court and is now at the Circuit Court. Regardless of how that thing comes out, there is now a federal overlay in terms of what's going to happen with you guys here in the states. And all of your consumers, all of your plants, your manufacturers, your farms, and your families are going to need to have access to electricity. And if that is not being provided or produced inside this state then it's going to need to be produced somewhere within the power pool. And the Federal Energy Regulatory Commission does have an absolute say over all of, you know, the Southwest Power Pool and all the other RTOs, what types of generation the utilities and the public power districts and the rural electric cooperatives within that region are going to do in order to meet demand projection loads because there is a requirement in the law that you have sufficient generation to meet demand. [LR455]

SENATOR LARSON: So you're saying if we don't, it's possible if we don't move forward with some of the changes moving towards natural gas that our plants could by FERC or whoever just be closed down. [LR455]

MICHAEL WHATLEY: Well, they would be closed because of the emissions requirements, right, and the costs associated with meeting those requirements, as well as you have a number of

coal-fired power plants that were permitted to run for 40 years, the economic investments that the power districts made were, you know, over 40 years. Some of them have run 40, some of them have run 50, and on and on, that at some point those plants are going to be phased out under the current rules that are in place right now nationally. You cannot build a new coal-fired power plant unless it has CCS technology, which doesn't exist. So how are they going to be able to meet that is, in the simple answer, is going to be a combination new nuclear, if Nebraska is going to move forward with that; new natural gas, which is much more likely; as well as an increasing role by the renewables, which again have to be backed up by natural gas. So it's very important. You know, the conversations that I've had with Governor Ricketts, as well as Senator Mello and others, have really focused on the state needing a plan and what are you going to do when the Clean Power Plan, you know, goes into effect. What is the state going to do to meet those needs? [LR455]

SENATOR LARSON: Can renewables be backed up by nuclear as well as natural gas or just natural gas is the easiest one? [LR455]

MICHAEL WHATLEY: It is the easiest because you have the ability to turn it on and off, whereas with nuclear it becomes baseload. You cannot turn it off under any circumstances. [LR455]

SENATOR LARSON: Okay. So nuclear is just always producing energy whether or not...okay. [LR455]

MICHAEL WHATLEY: Correct. Now it is a matter of are you going to direct that into a particular market. You know, that's a transmission wheeling issue. But in terms of if you're building a new, you know, solar farm or a new windfarm with a certain number of megawatts, then you're going to have to ensure that you have the natural gas backup for it. Because if the windfarm goes down or the solar farm goes down, you need to be able to flip a switch and turn it on immediately. [LR455]

SENATOR HAAR: And when a mass storage is perfected and comes down in price, that will also be the out...the combination for wind and solar, right? [LR455]

MICHAEL WHATLEY: Correct. [LR455]

SENATOR HAAR: Yeah. Okay. [LR455]

SENATOR LARSON: Oh, Senator Mello. [LR455]

SENATOR MELLO: Can I, Mr. Whatley, can you...and Senator Haar asked, that was a question was if you could get us the additional testimony or additional information you gave us on the question I asked. Could you get us copies of those plans you discussed as well, the American Trucking Associations plan, the recent USDA plan? And I was trying to write down my notes, I didn't hear you say there was a specific steel and iron or chemical industry plan. But if their trade associations or anything else has kind of their private sector approach to kind of what we're looking at in regards to reducing carbon footprints and CO2s that would helpful as well if they have some specific points. [LR455]

MICHAEL WHATLEY: Yeah, we'll get that right over to you. [LR455]

SENATOR MELLO: That would be great. [LR455]

SENATOR LARSON: I appreciate you coming in. Like I said, I think you and Mr. Tubman and a few others have talked about that and I know throughout this whole process I've learned a lot about infrastructure and whatnot and ways that we can reduce our carbon footprint tomorrow, as well as 50, 60, 100 years. And I think infrastructure is something that is (inaudible) more immediate way to reduce our carbon footprint very quickly as we move forward to the future. [LR455]

MICHAEL WHATLEY: We appreciate the opportunity to testify. [LR455]

SENATOR LARSON: Thank you, Mr. Whatley. Mr. John Hansen, welcome back. Do you still plan on testifying this afternoon? [LR455]

JOHN HANSEN: Yes. Senators Larson and Haar and Mello, good afternoon. For the record, my name is John Hansen, J-o-h-n, Hansen, H-a-n-s-e-n, and I'm the president of Nebraska Farmers Union. We have been working on wind energy and renewable energy for a very long time and this is a bit of a status report in terms of where we're at. But the first handout before you is our best effort to be able to document where we're at relative to the status of development and deployment of wind energy in our state. And that puts us by the end of the year right at 1,330 megawatts. If you think back just a few years ago, about three, three-and-a-half years ago, we were 459 megawatts. So this is by far the most wind development that we have ever had in our state, certainly over a short period of time. And so we have made a lot of progress. We also have a lot of projects on the drawing board and so we've got a lot of projects that are sitting there trying to use the production tax credit. The federal tax credit, as you know, is something that has been renewed, but renewed in a fashion on a declining basis. And so at the end of 2016 it will go from 100 percent to 80 percent of the PTC level as of the first of the year; and then each succeeding year it will go down 20 percent. So in five years it will be eliminated. So there is a bit of a rush to try to get to safe harbor for these projects so that they can qualify and that gets to buying a certain percentage of the turbines and making certain kinds of things done relative to the progress of a project. So we have got more projects in Nebraska that are safe-harbor status and so we have got this opportunity for us to move forward, you know, and take advantage of the PTC while it's here. In very rough terms, a full production tax credit cuts the cost of wind energy generation pretty much in half. So I sort of jokingly call it the 50 percent off sale. And so it is, as you look at our state and where we're at, on the back of the first page is the second quarter of 2016 installed wind power capacity that gives you an idea. So while Nebraska will be at 1,330 by the end of the year, Kansas has a 3,836; Oklahoma, 5,453; Colorado 2,965; Iowa, 6,365 megawatts. So, you know, it's the importance of state support for these activities is very clear when you look at where the wind is actually developed and you look at these maps and you compare them to the last page in your handout, which is the National Renewable Energy Laboratory gross capacity factor--80 megawatts. And so I suspect at some point they're going to update this, but this is the most recent data that's available. So Nebraska is number three. But we see states in our neighborhood, that surround us, that have substantially more wind resources, including Iowa, who is number eight. Yet, they have six to seven times as much wind development. So this speaks to the role of state policy in renewable energy development. And so if we think back nine years ago, we passed LB629, and that was the first real way to make it

possible for us to utilize the public and private partnership that our state has pursued. So the private sector developers, who could use the federal...in lieu of federal corporate income tax liability production tax credit, could in fact use those and pass those savings on through competitive bids to Nebraska public power entities, because our public power entities are at a competitive disadvantage relative to private sector development when you look at the disparity of the production tax credit. And that disparity was also carried forward relative to the stimulus package when that was passed. And so we were again at a competitive disadvantage. So now that we have that private-public partnership in place, based on our wind resources, we have some of the most wind resources in the country. And so relative to the amount of development that we have, we are an underachiever. Or, as we sometimes say, we have an enormous amount of upside potential based on our capacity. So in the kind of blue-green copy, I've quantified the value of renewable energy, both ethanol and wind. But in wind, this is our best estimate. We worked at this with the Nebraska Energy Office, a bunch of the utilities, and we're trying to come up with conservative numbers that are defensible. But what does this mean? It means we've got right at $5.3 million of new annual income for Nebraska farmers and landowners based on conservative estimates of the value of easements, we have $8.6 million of new annual local tax revenues, we have 130 new permanent jobs with an annual payroll or $7.4 million, and all of these are in rural Nebraska, which is where we really need to focus on economic development. And we have $90 million of payroll for construction jobs while we're going through the construction process. This is not a minor or a low number. It has a huge impact in communities while it's going through that. But all of this collectively represents $2.3 billion of capital investment that we didn't have just a few years ago. So of all the things that are going on in rural Nebraska, we don't have a lot of opportunities for new capital investment, new tax base, new farm income, new jobs. And these jobs, a lot of these jobs for these wind technicians and these kids coming out of Northeast Community College and their training program, these are $50,000, $60,000, $70,000 a year jobs, depending on how much supervisory responsibility they have. These are really good jobs for rural communities. So in this document I also explain the methodology of how we got to these numbers. And so we'll be taking another look and trying to update them for the upcoming Wind and Solar Conference coming up the 7th and 8th of November. But these are significant, really significant, helpful numbers. And, you know, the calculation that I tried to do but was not able to do today was to crunch the numbers and figure out how much carbon was not emitted, how much water was not used. And so it represents a very substantial savings of two things that as we go

forward with climate issues that are really of paramount conflict and importance. And so any time you can provide energy and you can do it without using water or emitting carbon, it's a big deal and it's a positive. So we have, in our view, having been with this effort for the last 15 years, we have come a very long way, we have tried to systematically identify the barriers to wind development and to systematically work together with a broad base of stakeholders in public policy, you know, in environmental and ag and labor and all the different folks working together with the private sector wind developers, public officials and identify those barriers and try to remove them. And so we have been able to do that in a very I think "Nebraska Nice" kind of way where it is a collaborative effort. I don't...when I talk to folks around the country, they are amazed at the way that we've been able to work together in order to do this. And I think that if we can continue to do that, we have an enormous amount of potential yet. We still have, you know, two of the three major utilities in the eastern end of the state. Their renewable energy buckets are pretty much full. We still have one that has more opportunity for a higher percentage of renewables yet. And then, as you look at the big picture relative to development and deployment then we're looking at the export market, which we think, based on the things that we did in the last legislative session, should put us in a better, more competitive place with other states. And so we have not done some of the things that some of the other states have done, but with RFS and those kinds of things, or RPS, renewable portfolio standards, but we have been able to come a long ways. But certainly looking at our resource base we certainly have a lot of upside potential yet. And so I thought I would at least kind of do a status report of where we're at. Solar is coming on, solar is coming down in price. There is a lot of interest by communities, a lot of interest by farms, businesses, and the residential is still there's interest there. But being able to pool...I like some of the community efforts where you're able to put together a park, put together a solar park so that you're not putting panels on a whole bunch of different roofs with a whole bunch of different conflicts and uses and problems, but you're able to buy your own solar array...or panels out of that array. And so you are able to do the efficiency of being able to build them, insure them, protect them, and service them in a much more cost-effective way. And if you decide to move you can sell your investment share to someone else. So we're seeing a lot of communities that are getting involved in that. And, you know, we have the first utility scale solar project in Nebraska in the northwest corner of Lincoln with the Lincoln Electric System, about a 3.5 megawatt system. But in terms of some of the communities, especially in the flyway, solar is I think coming of age, where you don't have any of the migratory conflicts with wind. So those

technologies along with, we think that electric vehicles are the future, and finding a way to be able to plug them into the grid and use them as well to help manage peak load. So solar and its management of peak load has a lot of potential and there is just an enormous change in the way we do business in Nebraska on renewables because of the Southwest Power Pool and our ability to be able to buy and sell energy. And it has completely changed the way we develop and deploy electric energy but also buy it, use it, and make sure that we're still protecting the interests of our consumers through redundancy and reliability. [LR455]

SENATOR LARSON: Thank you, Mr. Hansen. [LR455]

JOHN HANSEN: Thank you. [LR455]

SENATOR LARSON: Senator Mello. [LR455]

SENATOR MELLO: Thank you, Chairman Larson, Chairman Haar. Thank you, John, for the update and I know we could probably talk at length about some policies that maybe the Legislature should be considering in regards to expanding our renewable energy generation options. I have a question in the sense of whether or not anyone who's been involved, and I kind of open this question up to my friend Senator Haar since it was his bill, in passing net metering, back in 2009 I believe we passed net metering. Has there been any look-back in regards to seeing the determination of the impact? I know the compromise that was made with public power was a lower, if I'm not mistaken, it was a lower reimbursement for the generation that's being done, renewable generation that's being created at a home or a commercial or industrial property. Has there been any look-back to make the determination of if that needs to be revisited in the sense of trying to help, at least maybe looking at the solar potential now that seems to be growing more and more, starting in Lincoln and moving its way to other communities around the state? [LR455]

JOHN HANSEN: I don't really think that there's been a really comprehensive look. It's one of the things that we identified and said in the previous hearing that we thought needed to be looked at. We need to look at being able to combine different meters, especially in farm settings. I use my farm as an example. I think I got five meters. It would be nice if we could pool them together for

the grain bins, for the shops, for the house, etcetera, and the well, and all of those things, and use them together in that way. And I still think, going back to that net metering law, I still think that a good compromise would be is to treat those sources of electrical generation, that are either small wind or solar, treat them as a customer when they are a customer. When they are using power, charge them the power rate; and when they're proving electricity and putting excess capacity back into the grid I think that we ought to be looking at what it is that they're paying; what's the going rate for that, you know, that particular period of time for what they're buying it from somewhere else, because that is economic development. And it's electricity that's coming in, it's feeding right to their neighbors. You have very little line loss. It's...I think we need to expand capacity from 25 kW up to more reasonable levels. We're seeing some of the estimates of energy use on some of the farms and whatnot that we're...of the solar installers that we work with. We need to up that rate from 25 to 50 or higher and so we need to revisit that. But I think that it's...we know that it's worked okay. We know that its implementation has been a little up and down and patchy, not quite as consistent as it should be. We've had some districts who have tried to charge fees that were wholly inappropriate and do some things that were...but now that we're more comfortable with it I think it's time to look at it and make it more user-friendly. Thank you for the question. [LR455]

SENATOR LARSON: Thank you, Senator Mello. Senator Haar. [LR455]

SENATOR HAAR: To quote one of the campaigns this year, if you don't know it's a lie and you say it, it's not a lie. I'd said earlier this morning that Iowa was number 12 in potential. They're 7, so I want to correct that. And then I was going to ask you, one of the wind developers, just to crow a little bit about what the Legislature has done, last year we passed LB824; all of us voted for that. And one of the developers said that putting us on the level playing field in terms of regulations on the level playing with Oklahoma and Kansas could bring as much as $1 billion of capital investment in new wind development in 2016. Do you think that's a reasonable figure? [LR455]

JOHN HANSEN: Well, I think that that's a reasonable figure, but it's not going to happen just in 2016. It's going to happen as we go forward, you know, what's already in the pipeline and already what's in process. So when you look at this map you can see what's already been

developed, which was already in the pipeline for, you know, how many years as you go through the development process. And so we've only got a couple smaller projects left to develop. So, you know, and that's with all of this stuff. So we've got left--we've got a 35.8 and a 12.8 project left to get on-line this year. And so but, you know, this is ongoing process. All of the...I believe there's 52 different sets of regulations that at the local, state, and the federal level that a wind project goes through in order to get licensed. So there's a lot of regulatory compliance in the development of a project. There's a lot that goes into the siting, the environmental assessment, all of these things. And all of this takes time and money. And so it takes, you know, it is a long process and remembering that some wind projects, even though you've gone through all of that planning and you've gone through all of the regulatory hoops, you still are waiting to be a successful bidder in a competitive bidding process. And we sort of forget that part in Nebraska, but we don't just build projects and then just plug them in. These projects that are successful and go forward are the result of responding to requests for proposals by utilities or outside players for competitively priced energy. And so we...everything to date in Nebraska that we've developed is going to Nebraska. So we have yet to export our excess capacity out of Nebraska. So in simplest terms, Nebraska is long on electricity, long on potential, and we are short on load, which means we're short on people. [LR455]

SENATOR HAAR: So the Go Big Red electrons stay in Nebraska right now, but... [LR455]

JOHN HANSEN: They do. All of the Big Red electrons are here helping stimulate our economy. So that's all money we don't send to Wyoming, that's all jobs we don't send to Wyoming, that's all income we don't send to Wyoming. And, you know, I like people from Wyoming, but I like people from Nebraska just a little better. [LR455]

SENATOR HAAR: But then, you know, it sort of demonstrates the power of the legislation. And the PACE bill, Senator Mello's bill, is another one that's really going to help a lot when as it starts to take hold I think. [LR455]

JOHN HANSEN: I think that bill, Senator Mello, has an enormous amount of potential as we figure it out and get people understanding what it can do. And, you know, so it's an educational

process, it's a new tool, but it should be very helpful. And, you know, the up-front capital costs are always an issue for folks and so that financing mechanism I think is really helpful. [LR455]

SENATOR HAAR: Thank you very much. [LR455]

JOHN HANSEN: Thank you all very much. [LR455]

SENATOR LARSON: For your own reference, I think, so you don't hand it out to anybody else, I think you have 15 and 16 mixed up on your map. [LR455]

JOHN HANSEN: Okay. [LR455]

SENATOR HAAR: But it's not a lie because you didn't know. [LR455]

SENATOR LARSON: Just because I'm pretty sure O'Neill has the 400 megawatts and you have it labeled as 15 on here. [LR455]

JOHN HANSEN: I have Antelope County as 15. Oh, on the map. Oh, on the map itself, yeah. Okay. Yep. I looked at this part, I didn't look at the map. Oh, I think you would know. [LR455]

SENATOR LARSON: Yeah. I appreciate you coming in and I know at the last hearing that we had you at, this is more of a statement than a question, obviously, we talked about the R-line and things of that nature. And we heard more about infrastructure today and I think that's one of the things that we continually hear from testifiers is the importance of infrastructure in looking at ways to reduce our carbon footprint. Because things like the R-line can, you know, will help the wind capacity. It's built for another reason, but it will help grow Nebraska's wind capacity, therefore reducing our carbon footprint, even though the R-line is running to Gerald Gentleman, which is a coal-fired plant right now. So I think one of the themes that I continue to hear is infrastructure, infrastructure, infrastructure if we really want to look at focusing at cutting down our carbon emissions. So I appreciate that and thanks for coming in today. [LR455]

JOHN HANSEN: You bet. And we support that infrastructure the same way for transmission that we do highways and bridges because agriculture, we have to move our product to market. And so we view it as all a part of infrastructure. Thank you. [LR455]

SENATOR LARSON: Thank you. We'll have our last invited testifier before I open it up. Don Cox, welcome to the LR455 Committee. [LR455]

DON COX: I apologize, I do not have a formal presentation. I did not know I was supposed to have a written one. [LR455]

SENATOR HAAR: No, you don't need one. You don't need a written... [LR455]

DON COX: I will wing it. I have some new graphs. [LR455]

SENATOR HAAR: Great, thank you. And while you're getting settled in, just to let other staffers know that we will have your Teslas here sometime this fall yet for staff members and any senators around, too, to test drive. We appreciate that. It's fun. [LR455]

DON COX: I appreciate the opportunity. Should I wait until Senator Larson... [LR455]

SENATOR HAAR: No, just let's go ahead. And if you give your name and spell it and then get into your... [LR455]

DON COX: Right. I'm Don Cox. I retired from Stanford University from the department of electrical engineering four years ago and moved back to Lincoln. I'm here today to talk about electric vehicles. I do not represent anybody but myself, so the opinions that I express are my opinions; they may not agree with everybody around here. We have had an electrical vehicle in our family for almost eight years, since 2008, my wife and I. Also, our son has one. We have another one that we purchased in 2012, almost four years old. Our son has, and his wife, have three electric vehicles. And we have actually three of our own. So I speak not from theory, not from a lot detailed analysis, but from a lot of practical experiences. One of our electric vehicles has been driven to California and back twice, once by my wife by herself. Our vehicle has been

driven to Milwaukee, Wisconsin, and back; it's been driven to Minneapolis, Minnesota, and back; it's been driven to western Nebraska and back--all the cars, several times. So I have some familiarity with the challenges, some familiarity with the charging issues. And I guess I'd like to comment before I get started, there is no one kind of electric vehicle; there's a whole family of electric vehicles. Much of the discussion today has been centered around a limited-range electric vehicle; there are various kinds. I guess before I get started any further, I'd like to invite anyone who's here today that would like to drive an electric vehicle. I drove one here today, it's parked over in the Ferguson House lot plugged into a charger to permit me to have a place to park. It did not need the charge. I would also, before I go, like to thank Martin Eberhard and J.B. Straubel for the use of some of their view graphs here. Some of them I prepared myself; some of them are from other places. So I guess we'll start we'll start off with page 1, upper left-hand corner. It comes as a surprise to a number of people that in the year 1900 there were more electric vehicles on the road than there were gasoline vehicles and there were more steam cars than there were electric cars. Within the next few decades, of course, all electric vehicles disappeared almost. They're in museums. And one needs to look I think at the past to try to figure out what's going to happen in the future. The next slide over, top right, indicates what one of the major issues was--and it's still an issue--gasoline stores a lot more energy than batteries. This compares it with lead acid batteries that were available more than 15 years ago. Lead acid battery is the kind of battery you have in your car, that starts it in the morning, hopefully. These comparisons are in terms of electrical quantities. If you want an interpretation, watt-hours per kilogram there, you can think of watt-hours in terms of for a given vehicle range, how far can you drive. And a kilogram, a kilogram of weight of a battery, you can think of how many miles can you drive with a pound of batteries. You know, it will be a little bit different numbers, but that's what those numbers, those units represent. You can see that gasoline is hugely more energy storage than lead acid batteries. Gasoline engines are much more efficient than electric engines, so we got a 20 percent efficiency for gasoline engines and 90 percent for electric there on the right-hand column. When we take the efficiency into consideration we've helped things a lot for electric vehicles but we're still way shy of what gasoline will do with respect to lead acid batteries. So electric cars went away. They wouldn't go far enough. So why have we had a renaissance of electric vehicles? Lower left-hand corner shows a table which gives some indication of that. This is an old table, it's 2003. I apologize the data is old, but it's still pretty good. The left-hand column we have listed four different kinds of batteries: the lead acid battery that we talked about, nickel-cadmium batteries

that came along a few years ago that were used in cell phones. They had a nasty habit of having a memory capability, if you didn't discharge them completely, you could never get them to hold that amount of energy again. Nickel-metal hydride batteries came along in sort of the 1990s. They're better than nickel-cadmium; not a whole lot better, you can look in the second column there and see that they were about twice as good at energy storage in if you want miles per pound of battery. Nickel-metal hydride batteries are the ones that you find in most of the early hybrid gas-electric vehicles: Toyota Prius, Ford had an Escape hybrid, there's a bunch of others out there. Most of those early ones had nickel-metal hydride batteries in them. The bottom row there is a lithium ion battery, which came along to supply computers, laptops. You can see there that they have...general lithium ion battery has three times the storage that the lead acid did, helps a lot. There's also a note down there about Tesla. I do not work for Tesla, but sometimes it sounds like I do. They have done more for the electric car in the last ten years than anybody else. You know, with the Tesla battery there, the lithium ion battery they got is four times better than the lead acid batteries were in terms of miles per pound of battery. The third column over there, energy density, is in watt-hours per liter, which you can think of that as miles per quart of gas. And you can see that there's not a whole lot of change with the first three battery types there in terms of miles that you can get for a volume of battery, but the lithium ion batteries again are at least twice as good and the Teslas are way more than that. The last column over there, specific power, watts per kilogram, that's power, that's the amount of thrust you get on a...can put on a motor. You can think of the push, the push you get for pound of battery. You can see that lead acid, nickel-cadmium, nickel-metal hydride were not very much different, but the Tesla battery again is more than twice as good. So the big improvement in batteries had a lot of people looking at electric cars, one company in particular. The next slide over there, lower right-hand corner, again sort of indicates the progression of batteries over years. Again, I think it's useful to look at history. You'll see the horizontal axis there is in years, starting with 1985, and unfortunately it runs out at 19...looks like 2007. And the upper, the vertical scale, is volumetric energy density, again in watt-hours per liter or you can think of that as miles per quart of gas, or miles per quart of something. There's three curves on there, lead acid is not even on there. If you look at progression over time, it's around 1990 the three types of batteries were very similar; lead acid is way off the bottom. Nickel-metal hydride improved, lithium ion improved. Eventually nickel-metal hydride peaked out, plateaued out, and didn't get any better after about the end of the 1990s. The lithium ion battery has considerably improved over years; over that period of time it's

doubled in energy density in ten years between 1990 and 2007. There are a couple of notes on there, one is the introduction of the EV1, which was an electric car that General Motors put out in mid- to late 1990s. Unfortunate story about that, they put out about 800 of them in California, they leased them, they took them all back and crushed them. You may form your own opinion for why that happened. At the top of that curve is indicated the introduction of the Tesla Roadster, which is the car I have out here that you're welcome to drive. It sort of revolutionized electric car business. The next page, the upper left-hand corner shows the lithium ion battery price trend at the time. Again, the horizontal scale is years; this time the vertical scale is dollars per lithium ion cell. These are 18650 cells, they're about the size of your thumb. They're the thing in the laptop computer and they're the thing that's in the Tesla Roadster--6,831 cells in the Tesla Roadster. The important thing about this curve to note is that the cost went down considerably over a ten-year period. In fact, they went down by a factor of four. So not only did over ten years we have much more energy density, twice as much, we had a quarter of the price. Both of those trends have continued since the ends of those graphs. They've gotten cheaper and cheaper and more and more energy storage. The energy storage in our Tesla Sedan, which is a 2012 model, is much better than in the original Roadster. It has much more energy storage, much cheaper battery. So batteries are getting better, the problem is getting better, still the major issue in electric cars is still battery. The upper right-hand corner...you can't even read it. On my computer that comes out in English, sorry. The lower scale is in energy storage of the battery per weight, the vertical scale is energy storage per volume. And it shows several different types of batteries there. The lower circle I believe, I can't even remember what it is, probably lead acid. The next little circle up is nickel-cadmium, then we have a circle there that's nickel-metal hydride, that's sort of three boxes up from the bottom and two boxes over from the left scale. And then in the middle there is a large ellipse that represents the lithium ion technologies. There's no one technology for lithium ion batteries, there's a whole number of different chemistries. Most of the different car companies use different versions of lithium ion batteries, they all have different characteristics: some of them store more energy, some of them are more likely to catch on fire, some of them are more safe, some of them can be charged faster. So all of the car companies have to pick a technology and they use it and they're all different. But you notice that the lithium ion batteries are considerably better again, even though you can't read the scales, considerably better than any of the other batteries and they're getting better. The upper right-hand corner, that ellipse, says future lithium ion batteries. So there's a lot of optimism out there. I sometimes say there's more

work being done on batteries right now than there was in the whole history of batteries, and that's work in universities, in government laboratories, industrial laboratories, in companies. So a lot of work and a lot of, I'll just put it straightforward, a lot of hope that batteries are going to still get better, even way better. [LR455]

SENATOR HAAR: Don, we'll rerun these in bigger size with color and stuff so we can read all of the labels. [LR455]

DON COX: What's that? [LR455]

SENATOR HAAR: We'll rerun these so that...for the committee, so that we can read the labels. [LR455]

DON COX: I'll try to do that. [LR455]

SENATOR HAAR: Okay. [LR455]

DON COX: I'll print them out at home. I think I can print the English out and I'll send them up to you. [LR455]

SENATOR HAAR: Okay. [LR455]

SENATOR LARSON: Why don't you just...you can e-mail? [LR455]

DON COX: What's that? [LR455]

SENATOR LARSON: Can you e-mail us just the slide show? [LR455]

AARON BOS: I saved a copy on the computer. [LR455]

SENATOR LARSON: You have a copy on the computer? [LR455]

DON COX: He has a copy of it, but I'm not sure he can print it out either. [LR455]

SENATOR LARSON: We don't need to print it out; what we'll do is we'll convert it into PDF and so for the record. [LR455]

DON COX: Okay. [LR455]

SENATOR LARSON: So you won't have to if it all shows up on his computer. [LR455]

DON COX: Can you do that so it will be readable? [LR455]

AARON BOS: I'll call you (inaudible). [LR455]

DON COX: Okay. [LR455]

SENATOR HAAR: Okay, great. [LR455]

DON COX: Sorry about that. [LR455]

SENATOR HAAR: No, that's okay. [LR455]

DON COX: But this is a compatibility issue with computers. Upper right-hand corner up beyond the graph there is a little cloud that says lithium metal battery. And this is kind of the holy grail for batteries. It stores a lot of energy. The problem with lithium air batteries or other metal air batteries is they don't produce a lot of power, so you don't get a lot of push for the car. And people have looked at the possibility of combining lithium ion with the lithium air and getting a combination of batteries and it's again a lot of hope. I'm not going to go over the lower ellipses there, lithium sulfur batteries. They're probably not good for vehicles but they might be good for energy storage, fixed storage. So down here in the lower left-hand corner there's just a pie chart that indicates that as of the date of that chart, which was 2009, that transportation was two-thirds of U.S. oil use. So transportation is a very important place to look if you want to get rid of oil. Might have changed a little bit since then, but it's still about the same. The right-hand corner

there is U.S. transportation energy, a pie chart. Fortunately, you can read this, it's in English. It shows that at that point in time 94 percent of the energy in the U.S. for transportation came from oil, gasoline, and diesel fuel. There's a little sliver there that's natural gas and a little sliver there that's ethanol and a really, really little sliver that's electricity. Now since that curve came out the alternates have increased a little bit but we're still way dominated by oil. They may have increased it to the point where maybe it's only 90 percent oil now, but it's still mostly oil. So if you really want to fix things, you need to work on transportation, you need to work on gasoline. Go to page 3 and I'd like to spend a little more time on the upper left-hand corner. It's a little maybe obscure, but the things you need to know, and I'll try to explain it a little more, is the lower left-hand corner is not good, the upper right-hand corner is good. What we have is boxes here to represent the energy used to drive a car, run a car a kilometer. Again, these are strange units. A megajoule is equivalent to, is similar to a kilowatt-hour, and you can think of that as a bucket of energy. The kilometer, again, you can think of that in terms of miles. This is well-to-wheel looking at the energy, looking from an oil well to the wheels of the car; or from a coal mine to the wheels or whatever. Down in the lower left-hand corner is indicated a pretty good gasoline car, you don't need to worry about the exact numbers, you can see it is 3.8 megajoules per kilometer. So that may be something like a Toyota Camry or equivalent. The next box up to the left says "Best Available Gasoline," you can see it's, what, about two-thirds better, takes two-thirds less energy to get a kilometer. And that's a Toyota Prius, which is the most efficient gasoline car out there. Yes, the Toyota Prius is a gas car, every mile you drive a Prius burns gasoline. You don't...the plug-in Prius you can plug it in, but not the early ones. To the right of the Prius box there it says legacy coal, and that's actually the Tesla Roadster indicated there. If you generate your electricity from the worst coal plant in existence, 30 years old, the Tesla Roadster is about efficient as the best gasoline car. You get different answers if you put different cars in there but essentially the message is there. Even if you use the worst coal you are no worse off than you are with gasoline in the best case. The next box up, which is the second one down from the upper right-hand corner, says "Best Realistic (Case) Coal." Coal plants are a lot better now than they were years ago and new coal plants are much more efficient and much less polluting. So if you have your power coming from a good coal plant you're up again, you've reduced your energy needs or you reduced your pollution by a factor of two-thirds. But you don't have to generate power by coal, you can generate it from natural gas. The upper right-hand corner is the best case natural gas and you can see up there you're way, way better if you

generate your power from natural gas than you are if you generate it from coal, which you probably already know. My view of the best way to use natural gas is to put it into a combined cycle power plant and generate electricity and put the electricity in a battery on your electric car. Of course, you don't have to burn things to make electricity, as you well know. The upper right-hand figure there, which again you can't read, is a picture of a parking lot in San Diego, California. And what you see there is a large solar array covering a lot of the parking places. So you didn't waste any land by putting the solar array there, the land is already being used to put cars out there. And I don't remember what the number is there, but you can charge several hundred electric cars from that array. It is additional advantage of course you got shade for the cars, it makes it much better for charging the cars, makes it much better for the cars. So that's a way to generate power without taking up any extra space and to not produce any pollution at all. The lower left-hand corner, which you can't read either, is another large solar array, and that's on top of a Walmart store in San Diego, California. Sorry, I have mostly California examples, because that's where the action is. I'm sorry. That Walmart store roof will again charge, I don't know, a couple hundred cars. A lot of Walmart stores in the world, there's a lot of other flattop buildings around Lincoln, around Nebraska. If you use all those to put solar cells on, you can generate a lot of power without taking up any more space. The lower right-hand curve or picture is a picture of solar cells on a house roof and a Tesla Roadster, and it happens to be Martin Eberhard's Tesla Roadster, the second one delivered with (inaudible). A lot of people that have electric cars in parts of the country have solar panels on their roofs and they generate the electricity for their cars at home. So that's one good way to generate electricity. The next page of course, the upper left-hand picture, something you're all familiar with: windmills, wind turbines. And that is a very good way I think to generate electricity to power cars. One good thing about that is that you can regulate your charging on your electric car and use the wind energy when it's available; and when it isn't, why, you don't have to charge your car. So those are more or less the story I was going to tell. Even if you drive an electric car under the worst charging conditions, you're as well off as you are if you're driving a gas car. And there's lots better ways to do it. And you can't do it...if you got a gas-burning car you can't use the wind or the sun. So the best thing I think in the long run is renewables for charging cars. As I understand it, Lincoln Electric System has about a third of their power generated by coal, about a third of it by natural gas, and about a third of it from renewables. So charging an electric car in Lincoln is a whole lot better than driving on gas, and some places even better yet. Some places it's worse. Want an analysis? I can

give you an analysis. Tell me what answer you want and I'll put in the states and the cars and we'll get you what you want. But anyway, that's sort of the overview, I can talk a little bit more, if you're interested, about other cars. There's some interesting information about cars there. The General Motors EV1, upper right-hand corner, is the one that got myself and my family involved, my son had one. Lower left-hand corner is the Tesla Roadster, which I have out here parked and anybody is welcome to come up and to drive it that wants. There's some information about the Roadster which I won't go over in deference to time. A little bit of information on the next page about the Nissan Leaf, I brought it up today. The bottom of page 5 is some information about the Chevy Volt, which is not really an electric car, it's a plug-in hybrid, but it will run electric with the new versions around 50 miles. The page 6, upper left-hand corner, the Tesla Model S, which is currently one of the better-selling electric cars, surprisingly, because of the cost. Electric cars come in two flavors in my mind: There are the small-battery electric cars that have range in the order of 100 miles, which I think most of the talk today was about; and there are the Tesla cars, which have ranges in excess of 200 miles, some of them up to almost 300 miles now. Large batteries, they're more expensive. They're more expensive because they have big batteries and batteries dominate the cost. The cost of batteries is going down, the cost of the cars will go down. There are about 150,000 Tesla cars on the road in the world. There are 2,000 of them a week come out. So it's not, if you're General Motors, it's not a lot of cars, but if your car company has been making cars for four years, that's a lot of cars. The Tesla cars have had a big impact on the auto industry. General Motors says they're going to come out with a 200-mile car at the end of this year, the "Bolt," with a "B." Most of the car companies have made big claims about what they're going to do. Bottom of the page 6 there is some other battery electric vehicles and other plug-in hybrids. It's not comprehensive, but it's a list. And I'm not going to go over the last page in the interest of time, and I'm entertaining questions. [LR455]

SENATOR LARSON: Thank you, Mr. Cox. Any questions from the committee? Senator Mello. [LR455]

SENATOR MELLO: Thank you, Chairman Larson and Chairman Haar. My question just comes down to kind of the consumer market where obviously Tesla Motor Company gets all of really most of the news and most of the spotlight in regards to driving kind of the electric vehicle market right now, at least in regards to publicity. But the reality is the cost still for a Tesla is just

out of the range of most middle-class families. And so you had some good examples of the Nissan Leaf and the Chevy Volt. Is that where, in any of your research, any of your work, is that where the major American car companies are moving is more towards kind of the Chevy Volt model so to speak or even to some extent moving towards maybe a Ford Fusion electric vehicle model, which are more sedan, more middle-income families can afford these kind of vehicles in regards, comparison to the Teslas? [LR455]

DON COX: There are several pieces to the answer to that question. First off, I'll give you a little lesson in high technology. High-tech things always start expensive. [LR455]

SENATOR MELLO: Of course. [LR455]

DON COX: And they're driven down by the economy of scale and by new technology coming on-line. We're seeing that dramatically in the case of batteries, not as fast as electronics. Most of the car companies are looking at less-expensive cars, including Tesla. They have announced a car with a base price of $35,000, that's getting closer. [LR455]

SENATOR MELLO: Okay. [LR455]

DON COX: They had over 400,000 people order that car before they made one. They're waiting for a few years. So is that aimed at the right market? It's certainly aimed at a better market. [LR455]

SENATOR MELLO: Absolutely. [LR455]

DON COX: The Chevy Volt, with a "V," that comes out at the end of this year, is supposed to have I think it's $37,000 base price. And it'll have over a 200-mile range. So, yes, as in the case of all high tech, electric cars are getting less expensive and getting...have better range. And we will see that continue as long as Tesla stays in business because they keep pushing the rest of them. [LR455]

SENATOR LARSON: Thank you, Senator Mello. Senator Haar. [LR455]

SENATOR HAAR: Yes. You're basically retired, but you're still teaching a course at the university on electric cars? [LR455]

DON COX: Yes, I teach a course at the University of Nebraska-Lincoln in the spring semester on electric cars. [LR455]

SENATOR HAAR: Okay. Do you find a lot of interest, I mean, especially I suspect among young people and this whole thing of, not just going electric, but it seems to me the next step is electric self-driving cars? [LR455]

DON COX: I won't touch self-driving cars with a ten-foot pole. There's pluses and minuses on that and it definitely has caught a lot of attention lately. I'm not sure, I've driven a couple of those cars that drive themselves and some of them do a pretty good job. There's always going to be coroner cases that are going to be difficult and I don't know how it's going to shake out. I think we're going to see a lot more of it. [LR455]

SENATOR HAAR: Well, assuming that they're going to work out the bugs, that technology, one of the adaptation things about mitigation with climate change is using less energy. So if some of the predictions come true that lead to have electric cars that...I wouldn't own one, but I would just use one, a self-driving electric car, when I needed it. That would probably result in less energy usage overall, wouldn't it? [LR455]

DON COX: That is definitely something that's been proposed and it could well come to pass. There's a video on the Web that just came out last week, again it's Tesla, where they demonstrate a car that drove around out in California from some parking place down the road and around. There's a guy sitting there in case, drove up to the Tesla headquarters and parked. So that sort of technology is getting possible; Google is doing the same thing. How soon, how soon you're willing to pick up your smartphone and ask for a car and have it come for you to use? I don't know. Different people have different versions of that. It's going to be somewhat dependent on your risk tolerance. [LR455]

SENATOR HAAR: My prediction: in our lifetime, Don. [LR455]

DON COX: Probably. The only thing one can be sure of with technology is you're going to be wrong. Your guesses for tomorrow or short-term are going to be way overoptimistic, but your guesses for the long-run are going to be way pessimistic. And things over the long-run are going to happen faster than you expect. And I suspect this is going to be one of those things. [LR455]

SENATOR HAAR: When I was a young man, just a quick story, I was in a cafe one day and not too many booths away was somebody taking the keys away from their really old father, you know? And so my hope of self-driving cars is it will happen before they take my keys away. [LR455]

DON COX: I'm facing that same challenge. [LR455]

SENATOR HAAR: Thank you very much. [LR455]

SENATOR LARSON: Thank you, Senator Haar. Thank you, Mr. Cox, for coming. I might drive that Roadster someday. All right, that ends our invited testimony. Do we have anybody else that would like to testify? Both of you? Ladies first. [LR455]

SHIRLEY NIEMEYER: Thank you, and I do have to leave. My name is Shirley Niemeyer, S-h-i-r-l-e-y, Niemeyer, N-i-e-m-e-y-e-r. I'm from Ashland, Nebraska. I'm on the end of my life cycle and some of the environmental issues have been a concern since I was in college. In the '60s and '70s we had a very high peak in interest in the environmental issues, overpopulation, what was happening to water, what was happening to the environment. So I've had a long-term concern about this and it does concern me greatly in terms of our children, in terms of those of you that are younger, and your children, and your grandchildren, and all the children because...I just really have, like Senator Brooks, a very fearful concern if we don't do more. But on the other hand, I have a belief in technology and education and science, so that's where I'm holding out is the hope of science and technology and advanced education. Anyway, I am passing out, and I'm just going to go through these relatively quickly, and then I'll center back on this morning I handed out this. The graph is...I don't know if you have some. Okay, thank you. It was...I'm going to start on page 9 on that. But I just wanted to pass this out, this morning I referred to the policy and ways to define policy in this chart so I handed that to you. And then I am going to

have handed out to you, I talked about the Internet on-line program that was for inventorying combustion carbon emissions. And so that is a copy on this one, mine has writing all over it, but that particular one is an example and where to go to get that particular graphic. It's kind of an Excel spreadsheet. And then if you want to know what's going on with them, the Exxon Mobile, all of those companies, this is a summary of some of the leaked documents and documents that have been released that talk about the oil companies and what they knew within but weren't telling the public and they still were saying it was not going to happen and climate. So that's kind of an interesting piece. I also have given you what I have put together on climate health, I have a degree from Iowa State University, and what climate means to you and your family. So I think those are interesting pieces. I'm going to look now to number 9, but before I do that, Senator Mello, I wanted to mention that I've had two Priuses and the first one I sold it and it's still operating. And that was some of the first versions, same batteries. And my husband currently has a Tesla, we charge it in our garage, he put a 220 in at his office, our building, so that he could charge it there a little bit faster. And he's still reading, he had to print the manual off, he's partway through the manual. So I think the technology is going to be the understanding and education to use the vehicle. And then I wanted to say I've done a lot of work while I was at the university. I'm not speaking for the university as a faculty member, I'm retired. But I just wanted to say that I did a lot of work in the '70s with the energy issues, a lot of education through cooperative extension, and I've done a lot of research at the university when I was a faculty member there on housing and the environment and also attitude behavior change and how people change their behavior and adopt innovation. But in all of that, you know, you find things out like I have a picture of a house from the early 1900s that has a solar panel on top of it--early 1900s. So people have used the sun for many, many years and I think we got away from that and now we need to go back to that. So I think that's something to keep in mind. I did a lot of teaching on energy efficiency but one of the best techniques I found was to use bus tours and take them around to examples of a dome home, super-insulated house, solar house, passive solar house so that they look and they can see and feel and experience what it was like. And then they are more likely to adopt innovation or at least use part of what they hear. Okay, starting on number 9, I just wanted to say it talks a little bit about carbon dioxide concentrations. You've probably read a lot about that. This one's a little bit older than I would have liked to been used, there's more recent ones, but they do talk about here emissions from human activity may double by 2054 and that's scary but we've got to do something, and have done some things, but we've got to do more. And

then there's a reconstruct temperature scale in there and then on page 11 it shows public scientists agree that humans are the cause of global warming primarily. And then I wanted to call your attention to this one, carbon pollution from power plants, and 60 percent of the carbon pollutants come from electricity and transportation. So it breaks that down and I thought that was interesting. Okay, so now to policy, page 13. I think in terms of housing policies we have to develop those that are critical to improving human health and well-being and consider the environment. I think technology advances in housing has been coming. Housing policy, we need to look at that in changing those. We need to be using adoption of best practices as we remodel and construct housing, and we need to increase policymakers, builders, and consumer education. The other thing I wanted to point out here is expand the use of cleaner technology. Now here's some ideas that may or may not be feasible as you look at them. I think education and public and private entities about the feasibility use of solar technology is a really important one, providing tax incentives for developing of businesses that construct a solar or part of a solar system or they sell solar panels or they install solar panels, because if you....you can just promote them all you want but if you don't have the businesses there to install them and take care of them. And that's where the economic advantages might come in. And I particularly think this would be helpful in north Omaha, in the economic depressed area of near north Omaha, but also in rural Nebraska. Increase tax or initiate fees on newly or recently built houses above--now this would not sell well--above a certain number of square feet, depending on the number of person of occupants. We're talking about the "McMansions," in other words they might up-front pay a special fee, if they're going to build a 5,000 or 7,000 square foot house, they have an up-front fee. And they can build it really efficient but probably over the long haul it's still not going to be as efficient as a well-built, efficient smaller house. And you'd have to adjust for some things there and write in some exceptions. So initiate tax or fees on the "McMansions." Increase fees on second homes that are built in recreation and vacationing purposes. You know, that might be...it's not going to sell well, but it's a way to help expand the solar market, you know, and provide some funds to do some things, especially for the low-income. Encourage enforcement of the Nebraska energy codes in housing construction and some remodeling projects. You know, you're probably saying, well, we have really good codes. Enforcement, enforcement, enforcement. Many of the local...and I come from a small town of 2,500 people in Ashland. Enforcement, enforcement, enforcement. It's not happening in many towns, they don't have somebody or somebody that does it is also controlling the weeds in the, you know, or they're...they're not...some of them are

extremely good. But in smaller towns it is difficult or maybe the person is in a county. So that's really important. And I think collaboration with the state and community colleges, UNL Extension, the Builders Association, the code officials, the Nebraska Realtors Association is important. And this one I felt strongly about even when I was working. I did training for the Nebraska Realtor Association for credit and they have such a strict licensing process to become a realtor. To sell the house you have to pass a test and then you have to take I think it's 6 or 12 hours every two years or three years. I can be a builder, any one of you could be a builder, anyone in here could be a builder because of our licensing. When you go to other states you have to take a test in order to do...I know that, my husband has done that for building laboratories, he had to take the residential housing test. So it does require yearly updates, but I have heard from some of the large builders of the...the quality builders support because what happens is persons pick up a hammer, they do not know the whole codes, they don't know the information and where to put the vapor barrier, which side it goes on, what kind of insulation to use. They don't know the details and so we have problems. And so I think some of the quality builders support that, but others would fight it. But I still think I can't believe you can sell a house and you have to have all of that education, but you can build it and you don't have it very much. I'm sorry, one more. Okay, and then I think educate organizations about disasters. To me that's going to be an attitude behavior change when they start seeing, you know, we've had high winds, rains, and so on. We need to collaborate with FEMA, NEMA, and all of the counties, but also with UNL, the colleges, the community colleges. And one of the things I've seen, because I worked in housing disasters when I was at the university, is we have plans that don't have very broad representation in the county. But when it happens, you're going to need the clergy, you're going to need the Red Cross, you're going to need people to have moving equipment, big trucks, you're going to need a real wide business, the chamber, businesses, professionals, mental health--a huge different kind of people that bring skills--superintendent of schools. You have to have that if you're going to address these disasters in the future. It's a broad representation for coping with disasters and I think that's something I would really suggest if you can initiate that or encourage it. So with that, there's more in there, but I appreciate the opportunity and I hope I didn't take too much time. I hope you'll take some time to at least look at part of it. I believe information helps. Thank you very much. [LR455]

SENATOR LARSON: Always, thank you. Questions? Seeing none, thank you for attending today. [LR455]

SENATOR HAAR: Thank you for coming. [LR455]

SENATOR LARSON: And our last testifier, welcome. [LR455]

SCOTT JOSIAH: Thank you, Senator Larson, Senator Haar, Ken. Okay, sure. So it looks like I'm cleanup hitter here so I think I'll just cut right to the chase and save everybody some time. [LR455]

SENATOR LARSON: Please. [LR455]

SCOTT JOSIAH: Again, my name is Scott Josiah, S-c-o-t-t J-o-s-i-a-h, and I'm the Nebraska State Forester and director of the Nebraska Forest Service. And I'm just going to focus on the focus of this hearing, on how trees can help reduce greenhouse gas emissions, as well as carbon storage. And so we all know that greenhouse gas emissions and climate change is a gigantic issue, it's the trump card for natural resource issues as far as the Forest Service is concerned. And we're already feeling it in Nebraska through catastrophic wildfire, severe weather events, deep droughts, unprecedented flooding, and aggressive spread of new insects and pathogens. And that's all in the last four years, so we are definitely feeling climate change here in Nebraska. There is no one silver bullet. I think you've heard a lot of different approaches today to rectify and reduce greenhouse gas emissions, as well as to increase carbon storage. And I don't think, and I think many experts would say, there's no one silver bullet that will single-handedly reduce the impacts of climate change and so we need comprehensive, multifaceted strategies. And even do that, we need that even within the forestry sector. So I'm going to propose a number of initiatives or actions that could increase carbon sequestration and storage, as well as offset fossil fuels. So one, and you won't be surprised by this, is to support tree planting initiatives in both rural and urban areas. Trees store significant amounts of carbon. Currently, 88 million tons of carbon are stored in Nebraska's forest lands. That's a lot of carbon. Currently, more than...so the more trees we plant both in rural and urban areas the more carbon is stored. There's 11,000 miles of farmstead windbreaks in Nebraska right now, some of which are in pretty bad shape, but

they're saving producers $24 million a year in energy costs. In other words, they're reducing the use of fossil fuels by $24 million a year just by blocking the wind. And they need a lot of renovation. Strategic tree planting in urban areas is a really powerful way to reduce carbon or the fossil fuel use by shading houses and buildings in summertime, possibly reducing air conditioning costs by 25 percent. That adds up when you add it in a hot state like Nebraska across the entire summer. That's four times more carbon avoided than carbon storage in trees. So not only can we plant trees but we can avoid carbon by saving, cooling those buildings through natural means, green means. We can tap carbon exchange markets that are emerging, that have been around awhile. But if we have national policy initiatives that drive the development of powerful exchange markets we can use those to support and subsidize tree planting and biomass utilization as well. We can reduce the risk of forest fires--and this may be a stretch but it's not really--by expanding programs that creates defensible space around houses; thin, overgrown forests, of which we have a lot of; exchange or, excuse me, enhance rural firefighting organizational capacity by expanding training, equipment, and air support, all of which will improve initial attack, keep fires small, less damaging, less expensive, and minimize greenhouse gas emissions. The fires in 2012 didn't have any of this. We didn't have any enhanced capacity whatsoever in the state and we had enormous amounts of wood converted back to CO2, and that's a gigantic greenhouse emission all within three days. We can minimize those through aggressive fire suppression and fire planning. We need to develop policies that support locally grown Nebraska wood products for the long-term storage in buildings, carbon storage in buildings--that wood is locked up for maybe 100 years in buildings--including the use of biochar. Biochar is a new...well, it's a new old product that could be used to enhance carbon storage in soils and a variety of other applications as well. We can develop policies that support the development of woody biomass energy markets, both markets and utilization in Nebraska. The Chadron State College, the Arbor Day Foundation Lied Lodge, the NCTA in Curtis, all of your alfalfa dehydration plants, South Sioux City, and now Wayne are all looking at using woody biomass for heating and cooling in their facilities. That directly offsets all of their natural gas, all of their coal activities and burning. So it's a complete offset of fossil fuels. I think that's powerful. We can improve pest monitoring and rapid response capability to reduce pest impacts so we don't have massive outbreaks of forest pests, again, releasing large-scale amounts of carbon across the landscape. We can expand education and outreach. I think that's important, I think that there's a lot of people that could learn more about climate change and the impacts of

climate change and how it will impact them personally. We need a climate action plan, I think that's what you're all about here, and this is great. And I think there's a potential to explore not only the university but maybe other institutions to lead efforts to coordinate statewide climate change analysis and response. I think there needs to be some sort of coordination function that needs to exist, it doesn't exist right now so. [LR455]

SENATOR LARSON: Thank you. [LR455]

SCOTT JOSIAH: That's all I had. I walked through it quickly but no so quickly. [LR455]

SENATOR LARSON: Senator Mello. [LR455]

SENATOR MELLO: Thank you, Scott, for your testimony. [LR455]

SCOTT JOSIAH: Sure. [LR455]

SENATOR MELLO: And I just want to thank Ms. Nie...is it Ms. Niemeyer? Thank you, Shirley, for your testimony. I got called out quickly from our Legislative Fiscal Office, but thank you for your testimony as well. Scott, I'm going to give you an opportunity because you briefly talked about it in recommendation number six, but where do you see the likely now statewide outbreak of emerald ash borer having an impact on climate change in the state, knowing that we had thought that this was an issue that we were years away from possibly and within a year after kind of the issue coming in front of the Legislature this summer it was discovered that trees in south Omaha actually, of all places, now have emerald ash borer, and a number of trees likely now around the metro area, as it will start to continue and grow west. And your recommendation number six, improve forest pest monitoring and rapid response, do you want to share any perspectives in regards to where the emerald ash borer outbreak now likely could have a much more significant impact in our discussions in regards to a climate change action plan? [LR455]

SCOTT JOSIAH: Sure, sure. Emerald ash borer is now in Nebraska, it's in 28 other states. We stand to lose, we will lose, 20 or 43 million trees both in rural and urban areas, so that's all carbon that's trapped in those trees right now that will be released into the atmosphere either

grinding up as mulch or burning or in some ways. We probably will see massive mortality and almost all of those trees will be gone within 15 years, I would think. So we're going to see a rapid, rapid conversion of stored carbon to atmospheric carbon. That's the impact in terms of climate change. Not only that, but we're going to see a million of those trees are in urban areas and a lot of those trees shade houses. And so we're going to see substantially increased energy usage during the summers in areas where they've had massive die-off due to emerald ash borer. So it's taking us entirely in the wrong direction than we need to go in terms of greenhouse gas emissions. So that's why I say we need to plant trees, we need to plant a lot of trees, and more so now than ever before, just because of that, those two facets alone. We're no longer going to be offsetting or reducing the amount of fossil fuels to cool our homes and we're going to be releasing a lot of carbon. Did I answer your question? [LR455]

SENATOR MELLO: Yeah, thank you. [LR455]

SENATOR LARSON: Senator Haar. [LR455]

SENATOR HAAR: Is there any alternative to, you know, like a third of the trees I think in Lincoln, for example, are ash trees, of burning them? Is there any other possible use so that you don't return that carbon into the atmosphere? [LR455]

SCOTT JOSIAH: Yeah, there's...well, we're working on that. There's, you know, ash is a valuable species for furniture, for baseball bats, for a lot of things like that but these are not forest-grown trees, these are, especially in the urban areas, they're urban trees. They're full of metal, they're full of concrete, they're the wrong lengths. So they're really not marketable in a lot of ways, so we're working on a variety of products, we have now two people in the Forest Service working full-time just on developing markets for that wood. But that goes back to one of the recommendations, we really need more markets in Nebraska to absorb this massive number of trees that are going to be converted into something. And we hope it's not just... [LR455]

SENATOR HAAR: Burning, yeah. [LR455]

SCOTT JOSIAH: ...burning. Or if we burned it under controlled conditions in boilers then we're offsetting all of that carbon that would be released from fossil fuels. So in a sense that's because this is not old, ancient carbon that's being released, this is just carbon that's been sequestered over the last 40 years. So it's new carbon, not old carbon. It makes a difference. [LR455]

SENATOR LARSON: Where's Johnny Appleseed when you need him? [LR455]

SCOTT JOSIAH: Well, I think you're looking at him. [LR455]

SENATOR HAAR: National Arbor Day Foundation. [LR455]

SENATOR LARSON: There you go. All right, thank you. Seeing no other questions. [LR455]

SCOTT JOSIAH: Thank you so much. [LR455]

SENATOR HAAR: Thank you so much, everybody. [LR455]

SENATOR LARSON: That will close the hearing. Thank you for a successful day. I think we've had a lot of recommendations and a lot of things to consider, so thank you. [LR455]