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Minutes

LEGISLATIVE COMMISSION ON GLOBAL CLIMATE CHANGE

Tuesday 4 April 2006
10:00 a.m.
Room 544, Legislative Office Building

The Legislative Commission on Global Climate Change met on Tuesday 4 April 2006 at 10:00 a.m. in Room 544 of the Legislative Office Building with Representative Joe Hackney, Co-Chair, presiding. Other members present were Mr. John Garrou, Co-Chair, Senators Albertson, Pittenger, Representatives Harrison, Underhill and Wilkins. Other members present were Mr. Walter Clark, Dr. Dolores Eggers, Dr. Edward W. Erickson, Mr. Tim Toben, Mr. Ivan Urlaub, Mr. Robert J. Glaser, Ms. Susan Tompkins, Ms. Caroline Choi, Mr. Barry Eveland, George Everett, Ph.D., Mr. Preston Howard, Mr. Michael Nelson, Mr. Mitchell Peele, Dr. Daniel Phaneuf, Mr. Tim Profeta, Dr. Sethu Raman, Dr. Stanley Riggs, Mr. Michael Shore, Mr. Robert Slocum, Stephen Smith, D.V.M., and Dr. Godfrey Uzochukwu and Mr. James Stephenson. Staff members present were George Givens, Commission Counsel, Jeff Hudson, Commission Counsel, Jennifer McGinnis, Commission Counsel, Susan Iddings, Commission Counsel, Tim Dodge, Research Analyst, Thelma Utley, Commission Clerk and Mary Watson, Commission Clerk.

A copy of the meeting notice for this meeting, a copy of the agenda and the visitor's registration are attached to these minutes as **Exhibits A, B and C.**

Representative Hackney opened the meeting, welcomed guests and asked them sign the visitor's registration.

Representative Hackney called on Mr. Givens for his remarks and to explain the agenda. Mr. Givens said that Sen. Cowell and Mr. Cecich notified staff of their absence at today's meeting. Mr. Givens told members that draft minutes of the 3 February 2006 minutes were handed out to members and to please notify staff of any changes that needed to be made.

Mr. Givens said that the agenda consisted of two topics; the continuation of the discussion of science and what specific businesses are doing with regard to global climate change.

Mr. Givens said that there is one more meeting scheduled on 25 April 2006, before the legislative session. At that time, current plans are to shift the focus on the economics of climate change and on technology options by economic sectors, beginning with transportation, buildings and electricity.

Mr. B. Keith Overcash, Director, Division of Air Quality, DENR, gave an update on activities of the Department of Environment and Natural Resources (DENR) and the Climate Action Plan Advisory Group (CAPAG). A copy of Mr. Overcash's presentation is listed as **Exhibit D**.

Mr. Overcash said that CAPAG was formed as a result of the Clean Smokestack's Act signed into law into 2002. One of the requirements of this law was to study carbon dioxide emissions from stationery sources in North Carolina. It was discovered that stationery sources is not the only emitter of carbon dioxide; thereby concluding that greenhouse gas emissions from various sectors was another source of carbon dioxide emissions. As part of the final report, CAPAG recommended that a stakeholder process be established to look at a long range plan for climate action in NC. The Division of Air Quality (DAQ) and DENR are the sponsors of CAPAG.

Mr. Overcash said that the first meeting of CAPAG was held on 16 February 2006 where ground rules were set for members. Discussions included greenhouse gas inventory in North Carolina and members were asked their thoughts on how the process should work and where they thought we should end up in the process. There is a second meeting scheduled for 23 May 2006 and a third meeting in July 2006. The process will continue through 2006 with plans for a final report and recommendation to the Environmental Review Commission (ERC) and the Environmental Management Commission (EMC) around April 2007. Mr. Overcash said that CAPAG had established five technical workgroups to work through the process. These workgroups and their members are listed in Exhibit D. All of these workgroups will be meeting in the next week to begin looking at mitigation opportunities that have already been developed. A list of these mitigation opportunities is listed in Exhibit D. Workgroups will take these lists of measures, discuss and decide what priority to place on them with regard to cost benefit, and go forward and extract opportunities for greenhouse gas emission reductions. Mr. Overcash said that a website had been established for CAPAG www.ncclimatechange.us and would be posted on the Global Climate Change Commission website in the near future.

Ms. Tompkins asked Mr. Overcash if there was a reason why land use could not be separated from transportation. She said it appeared that land use was a large cause of climate change. Mr. Overcash said that this could be discussed with the CAPAG facilitators. Representative Hackney asked Mr. Overcash who the facilitators are for CAPAG. Mr. Overcash said that the facilitator was Mr. Peterson, a contractor at the Center for Climate Strategies. Mr. Profeta asked Mr. Overcash if land use focused more on growth patterns and development. He said that he considered agriculture and forestry as the larger piece of the land use puzzle that has its own separate working group. Mr. Profeta asked what land use means in the context of land use and transportation. Mr. Overcash said that he could not answer this question; however, land use patterns were being reviewed as well as planning. Transportation comes into play with that type of land use planning. Mr. Profeta said that this may need to be paired with transportation.

Mr. David R. Easterling, Chief, Scientific Services Division, National Climatic Data Center, National Oceanic and Atmospheric Administration (NOAA), Asheville, North Carolina, was the first speaker on the state of the science related to global climate change. A copy of Mr. Easterling's presentation is listed as **Exhibit E**.

Mr. Easterling said that he was born, raised, and educated in Chapel Hill and received his Ph.D. at UNC-CH in 1987. He taught at Indiana University for three years and then moved to the National Climatic Data Center in Asheville in 1990. Mr.

Easterling told members that, by the time all of the presentations are made, everyone should have a good idea of how the state of the science is related to global climate change. For example, is there a natural greenhouse effect on earth and what are its consequences? The answer is yes, there is a natural greenhouse effect to keep temperatures warm enough to sustain life on earth. What they are dealing with in terms of climate change is an enhancement of that greenhouse effect. Are the oceans warming as well? His expertise is the observed record—what has been seen in the past. Mr. Easterling said that he would provide evidence showing how the climate has changed over the last 100 years or so. He would show examples of observed climate change—observations and models, precipitation over the globe, and examples of extreme events and how confident we are with the results. He said he would also touch on land use and how that effects climate change.

Mr. Easterling showed slides of the global temperature curve started in 1880 to present. It decreases somewhat in the 1880's to about 1910 and then increases to the 1940's. It then goes flat and warms quite a bit starting in the mid 1970's. The National Climatic Data Center produces reports that take what happened in the last year and puts it into historical perspective. The period from the mid 1970's to the present is the period that has been mostly attributed to increasing greenhouse gases and anthropogenic climate change. The warming from 1910 to the 1940's could be due to greenhouse gases and changes in solar energy received from the sun. Mr. Easterling showed a slide of a map showing where the earth is warming. The higher latitudes in Canada, Central Asia and the oceans surrounding them are warming rapidly. There are areas of cooling in the North Atlantic and the southeastern United States over the entire 20th century, showing some evidence of cooling. This cooling could be due to sulfate aerosols and emissions from power plants. The main point is, although the globally average temperature has gone up about seven tenths of a degree over the 20th century; it is not warming the same everywhere. The highest latitudes will more than likely see the greatest warming. Mr. Easterling said that one of the big questions that have come about is the difference between what is happening at surface air temperatures taken about a meter above the ground. What is happening at the atmosphere above the ground in the layer from the surface up to about 20,000 feet or so is measured through satellites and through weather balloons. Mr. Easterling said that the largest trend of warming has been in the Pacific Northwest as well as in Alaska. Other evidence of warming, measured from sea level change, shows sea level has risen 30 millimeters (or slightly more than an inch).

Mr. Easterling explained that a climate model is a complex computer program that has a set of equations that govern the workings of the atmosphere, simulating winds, clouds, and temperature. Climate models for the 21st century compares daytime highs, using a low greenhouse gas scenario, show minimal warming. Mr. Easterling said that global precipitation appears to have increased since the late 1800's. The world has entered a more active phase of tropical occurrences thereby producing an Atlantic Multi-decadal Oscillation. He showed a slide of billion dollar climate and weather disasters from 1980 with North Carolina being in the top three, along with Florida and Georgia. Mr. Easterling said that global temperatures have warmed about 0.7 percent Centigrade since the late 1800's. Troposphere temperatures since 1979 now show warming consistent with surface warming. Warming since the 1970's, contributed mostly to greenhouse gas increases, is about two tenths of a degree C per decade. Sea ice decrease, snow cover decrease, changes in the number of frost days and days exceeding other thresholds all point to warming.

Precipitation appears to have increased since the late 1800's, with a heavy increase in daily precipitation. Hurricanes have increased with oscillation in the ocean temperatures. It is unclear if there is global warming contributing to this precipitation.

Dr. Smith asked Mr. Easterling if his slide on heavy precipitation was indicating that loading more energy into the climatic system would affect extreme thunderstorms and rapid precipitation as opposed to longer, slower, steadier precipitation. Is there some concern with impact to agriculture, given these extreme rains?

Mr. Easterling said that they are looking at heavier rainfall rates as you warm the climate because the atmosphere can hold much more moisture. This increased rainfall can affect runoff. Some climate models show mid-continental drying, which shows increased temperatures enhancing evaporation to counteract rainfall, resulting in drying and drought.

Mr. Glaser asked Mr. Easterling why the western part of the United States was warming faster than the eastern part of the US and what the impact of volcanic activity was on greenhouse gases in the atmosphere. Mr. Easterling said that the earth was warming more in the west possibly due to sulfate aerosols and emissions from power plants in the eastern US. Erupting volcanoes emit aerosols in the atmosphere, circle the earth, and tend to have a slight cooling effect. Eventually, they dissipate and temperatures rebound. It does not have an impact on greenhouse gases.

Senator Pittenger asked Mr. Easterling if clouds have an affect on the accuracy of climate models. Mr. Easterling said that biggest issue of climate models is how they handle clouds. This is due to how they are handled. When sulfate aerosols interact with enhanced clouds, they decrease rainfall. Senator Pittenger asked Mr. Easterling if the IPCC report was correct in stating that clouds make it impossible to have a sound basis in the climate models. Mr. Easterling said he disagreed with that report. Senator Pittenger asked Mr. Easterling to comment on carbon dioxide as it correlates to climate change without an anthropogenic cause. Mr. Easterling said that carbon dioxide has gone up and gone down, climates have been warmer and colder. If you looked at the last ice age, carbon dioxide levels were down. The real issue is not that the climate has varied in the past; the real question is why we are decreasing greenhouse gases due to emissions. We know that carbon dioxide is a greenhouse gas through laboratory experiments and know that it absorbs infrared radiation. By absorbing infrared radiation, it is going to warm the atmosphere. The real question is, if we are increasing greenhouse gases to the point that it is going to outstrip natural variability and go up faster than human and natural systems can keep up, are we willing to live with the consequences of that.

Patrick J. Michaels, Ph.D., Research Professor and State Climatologist, Virginia State Climatology Office, University of Virginia, Charlottesville, Virginia, presented his view of the state of the science related to global climate change. A copy of his slide presentation is listed as **Exhibit F**. Dr. Michaels said, as a state climatologist, he deals with the public on a day by day basis on issues such as climate change. Dr. Michaels explained how bias enters into forecast. The public is not receiving a balanced flow of information which unfortunately creates pressure for political change and pressure for adaptation or limits on carbon dioxide, etc. Dr. Michaels referenced a book he had written and handed out to members entitled **"Meltdown"**.

Dr. Michaels said that one of the things that bother him about the issue of global climate change is the polarization with which it is presented in the public. He referenced a book from the first book that popularized that climate changes on time and space scales could be important to societies, published by Emmanuel Laudurie in 1971, and entitled **Times of Feast, Times of Famine, Climate Since the Year 1000**. This was published because we were in an era of slight global cooling and there was concern that this cooling was caused by the emissions of aerosols and this was over dominating the changes in carbon dioxide. If we didn't do something, we would go into an Ice Age. He showed comparative slides of the Argentiere Glacier from 1850 and 1966, which showed the glacier going down the mountain. This is the nexus of the debate and discussion on climate change. He asked members to think about the debate of the 21st century, we have the technology to put the surface temperature of the planet where we want to put it; the question is where we want to put it. The IPCC reports show that temperatures were about one to two degrees C warmer than they are today when civilization was developed. The high latitudes were one to two degrees warmer than they are today. Ninety five percent of the last one hundred million years show the mean surface temperature of the planet as being warmer than it is today. That is the debate we have to think about.

Dr. Michaels showed a slide indicating a portion of Antarctica with 60 percent of it cooling and about 40 percent of it warming, annually. Dr. Michaels said that the area that is losing the most of its ice is in Greenland. The net temperature trend from the 1920's to present is negative. The article on the melting of Greenland was based on the logical argument that, during the last interglacial, when the Arctic was about five to six degrees C warmer than today, much of the Greenland ice was gone and the sea levels were 10 to 12 feet higher than today. Unchecked, we will reach temperatures slightly exceeding those levels by the year 2100. Therefore, Greenland will contribute a massive amount of water to the ocean, raising sea levels to where they were in the last interglacial. Dr. Michaels said that this information is misleading. Dr. Michaels showed slides of hurricanes in the Atlantic basin. He pointed out that 2005 was a big year for hurricanes. Since 1970, there has been a clear increase in the proportion of category 4 and 5 storms. On the Outer Banks of North Carolina, we are adapted to a 12 foot sea level rise in 30 minutes, known as a hurricane storm surge. Dr. Michaels said that he has recognized that weak hurricanes, category one or a tropical storm, is capable of inflicting large damages because of the flood potential. We are now naming and watching storms that we may not have been named or watched before because we recognize the damage potential, even from weak systems. Dr. Michaels said that many scientists believe that El Niño becomes more frequent or consistent in a warmed world. He said that the warming of the west, in Alaska, has to do with increased El Niño frequency and increased precipitation. Dr. Michaels said that increased sea surface temperature raises the intensity of hurricanes because the area of the ocean is raised that can reach 28 degrees C. This is important to North Carolina because they are on the northern end of this which spreads to the north. However, the Gulf Stream will remain constant, providing a buffering near landfall.

Dr. Michaels spoke to climate change and mortality issues. To meet Kyoto Protocol, we would have to reduce our emissions 25 percent. The question of adaptation is do people adapt to their changing environment. IPCC said that the annual number of heat related deaths will double by 2020 and increase several fold by 2050. Our cities

have been warming up, with or without global warming. The range of warming projected by the United Nations runs from 1.4 to 5.8 degrees C. Dr. Michaels said he has a problem with this. In science we have data from the past and hypotheses or models, which are the future. So, what is the consensus of models? Dr. Michaels showed slides of four studies, called coupled modeled comparison projects, all showing something similar. The consensus of scientists is not the consensus of models, which is all we have for the future. However, to make these models comparable, they increase their carbon dioxide in their atmosphere by one percent per year. The increase in parts per million in the atmosphere in the last 10 years was .49 percent. In the previous ten years before that, it was .42 percent and ten years before that it was .43 percent. That is less than one-half of the rates of increase that is fed these models. It turns out that the temperature response is quite linear with percentage increase in these models. If we stop emitting today, we would still warm some because the pulse of carbon dioxide takes time to warm. Because these models have been fed the wrong carbon dioxide increase, the last thirty years being one-half of what is going in, means that the models have to be over predicting warming. Dr. Michaels said that his solution to the questions on global warming is that Kyoto is expensive and causes long term economic problems. It costs between one half and two percent of our GDP per year. Dr. Michaels said that a better idea is to do nothing now, but encourage economic development, not only here but around the world. Why, because that puts capital in people's pocket. Dr. Michaels said the future belongs to the efficient, so people tend to invest in companies that produce things efficiently or develop efficient technologies. Don't overreact to the 15 to 1 information bias that you are seeing. Keep a calm head, a cool outlook, and help guide us to a more efficient future.

Mr. Shore asked Dr. Michaels where the scientific consensus is on polarization. Dr. Michaels said that scientific consensus is an extremely slippery issue. He said that today's consensus is not necessarily tomorrow's consensus and you have to be careful of that. Also, the way that we fund science in this country is by presenting issues in public, in large programmatic themes. These issues compete with each other. That creates a culture, which creates a consensus.

Mr. Profeta asked Dr. Michaels to clarify that we do have a warming trend that we have bought ourselves at this point, and it is related to carbon dioxide. And that the policy argument is to hang our hat on economic development and allow ourselves to adapt and engineer our way around it. Dr. Michaels said that the only way we can adapt is with money. He said that people did not live in the Outer Banks until people built flat top houses underneath the dune line because they were afraid of the wind. They discovered it wasn't the wind at all, it was the water. So they put houses on stilts, high enough to see the sound on one side and the ocean on the other side. This is an example of adaptation.

Mr. Profeta asked Dr. Michael's if, as a scientist, he believes we are better off going with economic development. Dr. Michael's said that Kyoto was a noble attempt but not the way for us to go.

Mr. Urlaub asked Dr. Michael's about eastern North Carolina and the inundation from sea level rise. He said that approximately 300,000 households in NC qualify for home weatherization assistance because they cannot afford the current technology available to them to weatherize their home. Where does the State step in and help

pay for all of this with taxpayer dollars and what do we really advocate for economic development that specifically enables us to adapt as opposed to reduce greenhouse gases. What do you think the cost will be to just adapt? Dr. Michael's said that Tidewater Virginia saw sea level rise of one foot in the last century, mainly because of geologic activity. They adapted to it. You have to tax energy to prevent its usage in order to draw down emissions. The other cost is the cost of adaptation. If the capital is taken out of the system by drawing down emissions, and we know that we are going to get warming anyway, you are taking capital away that can go to adaptation.

Dr. Riggs said that Pine Island represents adaptation and what follows is extinction. That is a system that is changing dramatically and we have to do better than adaptation.

William L. Chameides, Ph.D., Chief Scientist, Environmental Defense, New York, New York gave a presentation on the state of the science related to global climate change. A copy of his presentation is listed as **Exhibit G**. Dr. Chameides said that he, like most scientists, started out looking at climate change skeptically. He decided he needed to do something about his grandchildren's future, so he gave up his professorship at Georgia Tech to go to work with Environmental Defense. Dr. Chameides said that with regard to scientific consensus, the National Academy of Sciences (NAS) was chartered by Congress, when Lincoln was President, with the express purpose of advising the nation on scientific and technical issues. The National Academy of Sciences is not supported by the Government; it is independently supported, and governed and run by scientists. The NAS has been praised by a variety of different sources, including the administration which called the NAS the gold standard of scientific review. The NAS has spoken on global warming in a report asked for by President Bush. In June 2005, NAS said the scientific understanding of climate change is not sufficiently clear to justify nations taking prompt action. They urged all nations to take prompt action to reduce the causes of climate change. Dr. Chameides said if this was not a scientific consensus, he did not know what is.

Dr. Chameides said that global warming science is portrayed like a house of cards. If an individual could identify one, two or three things about global warming science and say it is a little uncertain, the implication is like pulling one of the cards out and the whole house of cards will come down. That is not the way most science works and is not the way global change science works. He gave the analogy of a jigsaw puzzle without the box cover to give the picture. As you put the pieces in place, a picture starts to emerge. Eventually, all of the pieces may not be in place but at some point you can see what that picture looks like. Dr. Chameides said that global science change is like that. The basic fundamentals and understanding of global warming and the need for action is in place. Dr. Chameides said that the scientific foundation for action relates to the fact that carbon dioxide is a greenhouse gas and it warms the atmosphere. Carbon dioxide concentrations are increasing because of human activities and the globe is warming. Dr. Chameides spoke to the effect that warming can be attributed to human emissions of carbon dioxide and other greenhouse gases. Future warming and impacts depend on future emissions of carbon dioxide and other greenhouse gases. Technologies are needed to take first steps and we need to decide how best to do that.

Dr. Chameides said that enhanced greenhouse effect provides the only quantitative explanation of global warming. Climate change is the rule, not the exception. He showed a slide of Ice Age Temperature Changes over a thousand years ago. Glaciations and short punctuated periods of warming have been in place in our climate for over two million years. Over this period, we have had fairly long ice ages of about 100 thousand years, with short periods of warm temperatures, with the last ice age ending about 10,000 to 12,000 years ago. We are currently in a warm period. We have a good idea of what causes most major climate shifts. These temperature variations were triggered by variations in earth's orbit about the sun. As the earth changes, the amount of energy absorbed by the earth changes, triggering ice ages and warm periods. Other longer periods of climate changes that occur relate to the assembly of the breakup of super continents. These natural variations are slow variations of temperature and do not relate to the timescales that we are talking about for global warming, which are on decadal to century timescales. Dr. Chameides said that the triggering of those ice ages and warm periods related to variations in the earth's orbit is the trigger for the large changes in temperature, but we now know are not the reasons for the large temperature changes. The reasons for those large temperature changes is that there are feedbacks in the earth's system that lead to large changes in greenhouse gases; for example, carbon dioxide. There is a large discussion in the scientific community about the sensitivity of the climate system to carbon dioxide. This ultimate sensitivity is fundamentally based in some empirical information. Dr. Chameides said that the current concentration of carbon dioxide is now at about 380 parts per million. The pre-industrial concentration was 280 parts per million. There is data suggesting that it has never been this high for 650,000 years and has probably not been this high for two million years.

Dr. Chameides said that current increase in carbon dioxide is not due to natural processes but is due to burning of fossil fuel. How can we be sure that this is not due to natural processes? If the earth was cooler and now it is warmer, source of heat must come from somewhere to cause the earth to warm. One of the sources of heat that could possibly explain the global warming in the last 40 or 50 years is the greenhouse effect. Another source is increased solar output. There has been some increase in solar output but the amount of that increase is not sufficient to explain the current warming. Another possible source is decreasing planetary reflectivity. Over a rapid period of warming, there is a process called global dimming where the earth has become more reflective; however, the earth has become less reflective thereby causing global warming. The fourth explanation has to do with internal variations. The only realistic source of heat that could lead to global warming is from the oceans. Over the last year, there is data that shows that the oceans are warming and increasing their heat reservoir. The atmosphere is supplying heat to the ocean. There is no internal oscillation that can explain this warming. In fact, the oceans have absorbed about 85 percent of the heat from the greenhouse gases. Dr. Chameides said that because the oceans are absorbing the heat, the atmosphere is heated up more slowly. The bad news is that the system has an incredible amount of inertia. When you take into account the amount of heat in the ocean and the amount of heat in the atmosphere, and the extra heat from the greenhouse gases, you get an energy budget which balances.

Dr. Chameides said that as we study the climate, it is becoming clearer that there are things, which we call tipping points, where the atmosphere can switch from one type of system to another type of system. When we pass this tipping point, we have

reached an irreversible point where it will be impossible for us to go back. One of the closest tipping points we are looking about has to do with the loss of the Greenland ice sheet and a 20 foot increase in sea level. An ice sheet is a big block of ice that sits on the continent and is like a river slowly flowing into the ocean. An equilibrium as slowly as that ice sheet flows into the ocean, ice forms from precipitation at the top of the ice sheet. The initial models of the way ice sheets melted was a big block moving as one thing and slowly creeps down to the ocean. We now understand that, as an ice sheet melts, tracks form and melted water ends up getting down to the bottom of the ice sheet and lubricates that ice sheet. The ice sheet will then begin to slide down the mountain and it cannot be stopped. If temperatures increase by about two degrees above pre-industrial, we would end up with an irreversible system where the Greenland ice sheet would melt. Even if this happens, it would take a century or two for it to melt and 20 feet will increase in sea level rise.

Dr. Chameides said there were other more immediate and more frightening tipping points. One of them relates to the loss of the Amazon Tropical Rain Forest. Another has to do with the melting of the permafrost and the release of greenhouse gases from that permafrost. Right now, the scientific community is working on how we can avoid these irreversible and dangerous climate changes. The accepted wisdom is that we need to begin do something to avoid a temperature of about two degrees centigrade. In order to avoid that temperature increase, it is not adequate to simply wait forty or fifty years for those new technologies to come along. The problem is to get from here to there. The models suggest that it is very likely there is a fifty percent chance or better that if we don't act now, we will not be able to avoid passing that tipping point. What we are now looking at is coming up with strategies that give us a fifty percent chance of avoiding the irreversible melting of the Greenland ice sheet. How do we get there? Over the next forty to fifty years, we need to stabilize emissions. By the middle of the century, we hope that new technologies come along that will allow us to significantly decrease emissions by about 40 to 60 percent. To get to the middle of the century, we need to start acting now. The good news is that is does not require major economic hardship or major new technologies. A paper, presented by Pacala and Socolow, point out that there are probably 15 technologies already existing. We need to pick out seven of those 15 technologies. By putting all of those wedges together, we can essentially reverse the increase in greenhouse gas emissions and keep them stable until 2050. Those wedges include conservation, efficiency, renewable energy, bioenergy, nuclear power, and clean coal with sequestration. How do you choose from that menu? One of the ways to choose from that menu is to hope that it happens or we can pick the winning technologies and subsidize them. This is not a very good idea. A market-based, cap and trade system probably is the most efficient way to allow these wedges to compete and provide the most cost-effective emission cuts. All of the money that goes into these technologies stays in the marketplace. The government caps emissions at a certain level necessary and allows the marketplace to decide the most effective way or cutting emissions.

Dr. Chameides that in order for us to avoid these dangerous climate changes, this has to be a global effort. Countries like China and India are going to have to take a part in a global discussion. The U.S. is the largest emitter of greenhouse gases in the world and probably will continue to be for the next 20 years. In order for the U. S. to do their part in avoiding dangerous climate change, we would need to cap greenhouse gas emissions at about 10 percent of their current level. We are not

talking about the U.S. doing Kyoto; we are talking about the U.S. doing something very different and more modest than Kyoto. If all developed countries were to take this cap as well, they would have an advantage over us. Kyoto went into effect over a year ago, and countries do not need to meet their targets until 2012. If we took a cap at 10 percent below present levels and we take into account business as usual, we would have to cut our greenhouse gas emissions by about 2,000 megatons per year. The USEPA estimates that with land management practices, such as growing trees, no till farming, and capturing methane from hog waste to generate energy, at $15 a ton for carbon, we could cut 1500 million tons of carbon emissions by 2025. The current farm subsidy in the United States is about $20 billion per year. Lawrence Berkeley Laboratory estimates that at $15 a ton, just from efficiency alone, we could save about 2000 million tons of carbon dioxide emissions a year. This ultimately saves us money, helps us become oil independent, and will not cause major dislocation. The other importance of cap and trade and carbon markets is that it will make a tiny difference in the ultimate temperature change. That argument misses the fact that by doing cap and trade, you send a signal to the marketplace that there is money to be made through low carbon technologies. Dr. Chameides said that we need to send a signal to our industry that there is money to be made through a carbon economy. Specially, in North Carolina, there is money to be made in part due to new technologies. A carbon cap is on its way. In fact, the U. S. Senate, in 2005, passed a resolution saying: "it is the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory, market-based limits and incentives on emissions of greenhouse gases." Dr. Chameides said that America is moving forward on global warming. States, cities and corporations throughout the country have already made it clear that they are getting on board. The northeastern states have started the Regional Greenhouse Gas Initiative. They have a carbon cap on power plant emissions. California has a global warming initiative and other states have indicated similar types of intentions. States that have carbon caps are going to be sending signals to their technologies in their states that they can make money by developing new technologies. North Carolina would be wise to get on board with similar initiatives.

Dr. Chameides said that China mandated catalytic converters on all of their cars. The catalytic converter was invented in the U.S. and ended up being an international technology. Will the U.S. be an exporter of new technologies? The best way for us to get that system going is through a cap, not through subsidies, but through a carbon cap that forces everyone to look at carbon emissions and develop the best technologies.

Senator Pittenger asked Dr. Chameides to respond to the statement by the NAS, saying that "the casual linkage between the buildup of greenhouse gases in the atmosphere and the observed climate changes during the 20th century cannot be unequivocally established." Dr. Chameides said that report was written in 2001. He also said you have to ask yourself what unequivocal means. There is a certain level of proof that scientists demand that is a level of proof that is much higher than most other human activities or reasonable doubt. The evidence that this is occurring due to greenhouse gases is way past that level. The other thing to point out is, since that report was written in 2001, an incredible amount of new data has been established and new studies done that strengthen that conclusion rather than weaken it. Anyone who reads science or nature magazines know that virtually every study that has come out in the last four to five years has confirmed that human activities are causing

the global warming and has confirmed that the impacts and the signs of global warming are occurring much faster and much more significantly than we have predicated, even five years ago. For example, with regard to attribution, five years ago we were not sure that the oceans were warming. Now, we are sure that the oceans are warming. And, once we are able to know that the oceans are absorbing heat, there was the last data needed to know for sure that the oceans are warming. That is why the NAS, in 2005, said the scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action to reduce the causes of climate change.

Senator Pittenger asked Dr. Chameides if he was sounding an alarm to the country that we need to do something and we need to do it now. Dr. Chameides said that he did not feel that Environmental Defense was sounding an alarm but were letting the public know there is a serious problem out there. Senator Pittenger asked Dr. Chameides to respond to several quotes from the 1970's. Science Magazine, December 10, 1976, quoted "a warming of extensive northern hemisphere glaciations"; Science Digest, February 1973, reported that "the world's climatologists are agreed that we must prepare for the next ice age"; Christian Science Monitor warned that "the earth's climate is changing faster than even experts expect"; April 27, 1974 reported that "the glaciers have begun to advance, growing seasons in England and Scandinavia are getting shorter, and the northern Atlantic is cooling down about as fast as an ocean can cool"; and Newsweek, April 28, 1975, "the meteorologists are almost unanimous that catastrophic famines might result from the global cooling", and a quote from The New York Times, stating that "September 14 may mark the return of another ice age". Dr. Chameides said he could not speak for any of these magazines quotes but could speak for scientific literature. In the 1970's, that link to the ice age was made and there was much discussion about climate change occurring on timescales of many thousands of years. When we recognized that there was a cycle between ice ages and inter glaciations, and we were in a warm period that was lasting about 10,000 years, scientists began to say that in the next several thousand years, we might come to a new ice age. Dr. Chameides quoted from Science Magazine that "Having presented evidence that major changes in past climate were associated with geometry or the earth's orbit, we should be able to predict the trend of future climate. Such forecasts must be qualified in two ways. First, they apply only to the natural component of future climate trend and not to anthropogenic effects such as those due to the burning of fossil fuels. Second, they describe only the long term trends because they are linked to orbital variations with periods of 20,000 years or longer climatic oscillations at higher frequencies which means shorter time periods, are not predicted by this return to an ice age." The scientific community was never saying that within the next 10 to 100 years, we were going to have another ice age.

Dr. Everett asked Dr. Chameides if it was clear that the Senate was going to do something in the cap and trade field. And, assuming that is the case is there some reason that we need to act here in North Carolina. Dr. Chameides said, that to some extent, the Senate is responding to the movement that they are seeing at the state level. The other point is whether the U.S. is going to be a leader or a follower for new technologies.

Michael MacCracken, Ph.D., Chief Scientist for Climate Change Programs, Climate Institute, Washington, D.C. gave his presentation on understanding and projecting climate change. A copy of his presentation is listed as **Exhibit H**.

Dr. MacCracken said that his background was in climate modeling and that he had been working with climate modeling since the 1960's. He then took an assignment in Washington, in 1993, to coordinate interagency research among ten federal agencies to work on the U.S. National Assessment. Dr. MacCracken said that two states in particular are really trying to press ahead with things—one is California and one is New York. California's electricity use, per person, is half the national average. They have imposed standards to trying and reduce electric energy use and estimate a savings to each family of $1,000 a year in electricity cost. They had an energy crisis when everything went up, got that signal, and are doing something about it.

Dr. MacCracken said he gave a talk in New York in January and was fascinated to hear that Governor Pataki was focusing on this field. The Secretary to Governor Pataki said they had done a calculation in New York that the state is spending $55 billion dollars a year on energy, exporting that money from their state. That is about $2,000 a person. Their transportation system is about 95 percent based on imported fossil fuels. Governor Pataki has implemented a program to limit elimination from utilities and is pushing flexible fuel, plug-in electric hybrid cars, and installing the ethanol gas fuel system all along the freeway. They are setting up a program to help people convert over to ethanol fuel and are proposing $25 million dollars to the first company that can come up with and build a refinery that will make biofuels out of products that are grown in NY State. There seems to be a competition between NY and CA to see who is ahead. Dr. MacCracken said that we can really see that humans are having an influence on climate change. We have to acknowledge that 80 percent of the world's energy is coming from fossil fuels and it is a tremendous challenge to switch over to different sources.

Dr. MacCracken quoted Pittock (2005) who stated "uncertainly about the future is inevitable, but risk is certain". Scientists focus on the uncertainties and if you are going to get hung up on the uncertainties, you are not going to get to the issue of the thing that is certain, which is, climate change is a tremendous risk to the planet. Dr. MacCracken said that IPPC's members are the nations of the world. They convene author teams that undertake preparations of scientific reviews and try to reach consensus. A draft of their report is then sent out for review to the scientific community. The IPCC, which was formed in 1989, has put out three assessments in 1990, 1995 and 2001. These assessments from the countries of the world have unanimously agreed to a summary for policymakers on global change. Dr. MacCracken said that no organization that gets unanimous agreement from 150 countries is cutting edge.

Dr. MacCracken talked about the future impacts of global climate change. He said that the sense we have about the future is the huge population that is occurring. As the population raises its standard of living, there will be a lot more need for energy and energy will be coming from places like India and China, quite probably from coal and other fossil fuels. But this is mainly a coal and oil issue, not natural gas and oil. There is potential for large increases on what is happening with carbon dioxide. We are presently emitting about six billion tons of carbon per year into the atmosphere, there are about six billion people on the planet, and everybody is responsible for one

ton of carbon, on average. However, it isn't spread evenly. In the developing countries it is maybe a few tenths, in Europe it's about three, and in the US it's about five or six. Across states, it goes from about three to about thirty. The projection for the future is a relatively conservative one. We are going from one ton of carbon per person, up to two, for the world as an average. Ten billion people and two tons of carbon: that is 20 billion tons of carbon per year, three times the present estimate. Still, that is 60 percent less per person on average than we use in the U.S. right now.

Dr. MacCracken said that the reason Dr. Michael's linear extrapolation doesn't work is that aerosols have a lifetime in the atmosphere of only a week or so. You put the sulfur up, it turns to sulfate, and it comes down as acid rain. On the other hand, carbon dioxide goes up in the atmosphere and stays for centuries. So what we have seen in the past is sulfate and carbon dioxide going along. Carbon dioxide is taking off, emissions is starting to take off as the countries' population grows.

Dr. MacCracken showed a model of the global pattern of warming suggesting greater warming in mid-to high latitudes, over land, and during the winter. We are putting back carbon dioxide into the atmosphere in 100 or 200 years that just hasn't been there for tens of millions of years. The trend in emissions is changing. If we cut back emissions, the sulfate comes out of the atmosphere very quickly and the carbon dioxide stays for centuries. So, we are stuck with going to numerical models and they are trying to represent all of these various processes. Clouds are a real challenge but you can get a sense of what is happening with clouds. There have been clouds in models since the 1960's. The first thing you do is have a representation of how much water vapor there is in the atmosphere. You know if it's more humid you are more likely to have clouds. That is one way of doing it. You can also look at the vertical temperature gradient. If it is really warm at the surface, you are going to get some penetrating kind of convective clouds. The issue isn't whether or not you have clouds, but how the nature of clouds will change as the climate changes. We have a sense as you go from the high latitudes where it is cold to low latitudes where it is warm. You get more convective clouds. These models around the world put in representations of the physics that represent what is happening with the various kinds of conditions around the world. Dr. MacCracken said that models don't do as well in the mountainous areas. Models don't do as well on precipitation as temperature. The reason you get more warming in high latitudes is due to snow and ice and the reason you get less warming is low latitudes relates to the question of why it is warming more on the west than in the eastern U.S. In moist regions, more of that energy goes into evaporation. If you go to a dry area, there is no moisture to evaporate, so the energy goes into warming the temperatures. So, what really matters is whether there is soil moisture around that can evaporate. In low latitudes and over the oceans there is plenty of moisture around which keeps the temperature changes less.

Dr. MacCracken said that fossil fuels provide a tremendous benefit to society. If you are going to do something about fossil fuels, then you are going to look for major reasons and impacts to society that you may be concerned about. If you affect peoples' health, that would be an important issue. So, there are weather related issues on health. If you affect food supply (agriculture), that could have a big effect on people. There was a major study done in the U.S., looking at what the consequences were. A federal advisory committee tried to pull things together and put out a report, but each region had its own report, based on the university in that

region. So, there is a southeast region report, based at the University of Alabama. There are also sector reports, for example, what will happen along coastlines. Those were all based in universities. Dr. MacCracken said it was hard trying to get federal agencies to give up control and let the universities and the regions do it. You therefore see differences of across some of these reports because each university was in charge of their own report.

Dr. MacCracken showed highlights from two of the reports that are of most interest to the State of North Carolina. The key issues that came up for the southeast regional assessment were what it would do to agriculture, forests, water quality, air quality and extreme events. However, there were some additional issues that they recognized but did not get into. The coastal issue has a whole lot of things about what could happen along with sea level rise and other things that are happening in the ocean. Forget climate change for the moment, just putting carbon dioxide in the atmosphere causes some impacts. Carbon dioxide is a nutrient for plants. Agriculture can do better if there is enough soil moisture. In the U.S., the issue is not so much growing enough food, but that we grow too much food and subsidize it with commodity prices. If we grow even more, the price will drop. That is good for the consumer but it can be very hard for the farmers. So, for a farmer, important issues are competition of one crop versus another, and what the demand is.

Dr. MacCracken said that the important issue in the ocean is coral reefs. Ocean waters are being acidified and coral reefs will be compromised. However, that also applies to some of the other organisms that form such as calcium shells. For carbon dioxide alone, there is a serious issue for the world. With affect to warming, what the models showed were different results. One tended to get a little more heat and dried things out and one was a moist, warm scenario. The new IPCC report will be looking at the new results and providing some new answers.

Dr. MacCracken showed slides of what models showed with regard to ecosystems. If you get moist and hotter, you keep the forests in the southeast. However, if you get dry air, you get the potential to turn over to a Savannah. If you get dry conditions, then you get fires and transformation. It is already happening in Alaska where five to six million acres have burned and the transformation of their ecosystem is going down rapidly. Dr. MacCracken said that along with the changes in the ecosystems, changes will affect migrating species moving up and down the coast. Water resources will also be altered in a lot of different ways. In every region of the U.S., water is the most important issue. There is a natural distribution of conditions in the climate. More precipitation is coming down in the heavy events and models predict this to continue in the future. With regard to hurricanes, we are putting more energy into the atmosphere, and that has to be released someway. There is a lot of uncertainty with future number of hurricanes. We are seeing hurricanes with higher intensity around the world. Sea level rise is going up in most regions; however, there are some regions where it is going down. The projection for the IPCC has it going up in the range of 18 inches.

Dr. MacCracken said that the coastline is endangered. There are also a range of health effects such as heat-related illness. The temperature is going up but so is the humidity. The U.S. can keep the pandemic epidemics at bay if it really works at it. There are disease vectors coming in all of the time from people traveling. Across the U.S., there were different effects in different regions. One of the things that have not

been considered much in most of these reports is the couplings with the rest of the world. We depend on the rest of the world and they depend on us with regard to health, shared resources, migrating species, etc.

Dr. MacCracken said that he did not believe that the IPCC had looked into how much infrastructure is vulnerable along the coastline. A few years ago, Maryland and Virginia were worried about what was going to happen with the Chesapeake Bay and held a conference on sea level rise. They invited a couple of Dutch engineers to consult with them on this. The Dutch engineers told these states they were negligent in not already having a plan to put a barrier across Chesapeake Bay to protect and control things.

Representative Harrison asked Dr. MacCracken to clarify the slide regarding groundwater impacts in the southeast, shown on page six of Exhibit H. Dr. MacCracken said that what happens is a balance between what the demand is for groundwater and how much is coming in at various times. Are you getting precipitation that is running off or seeping in, or do you have to pull water out of the ground. The concern that people in the southeast region had was that you have this stress between how much water you are trying to extract and how much is going in. This will keep building up and intensify.

Dr. Smith asked Dr. MacCracken when the next IPCC report is due out. Dr. MacCracken it would be out a year from now. Dr. Smith asked if the projections on sea level rise would higher than what they were in the last report, based on new information. Dr. MacCracken said that people have become much more concerned about the risk from the west Antarctic ice sheet and from Greenland because the ice is melting much more rapidly. Dr. Smith asked Dr. MacCracken what year the Southeast Assessment was completed. Dr. MacCracken said it was completed in December 2002. Dr. Smith asked if there were plans to keep the Southeast Assessment updated. Dr. MacCracken said that Congress had called for that in a law passed in 1990.

Senator Pittenger asked Dr. MacCracken to respond to a quote from IPCC. "Climate models give no consistent indication of whether tropical storms will increase or decrease in frequency or intensity as climate changes. Neither is there any evidence that this has occurred over the past few decades. It is not possible to say whether the frequency area of occurrence, time of occurrence, mean intensity or maximum intensity of tropical cyclones will change." Dr. MacCracken said what has happened and is in a state of tremendous change and debate going on right now, is the way we have looked at trends is to see a linear increase. That was what was being done in looking for a northern hemisphere temperature surface temperature change in the early 1990's. Then, what happened in the IPCC assessment in 1995, we realized that we can't just look at what is happening just with carbon dioxide but we have to look at what is happening due to carbon dioxide, aerosols, and natural influences. If you look at the record of the human influence on temperature in the northern hemisphere, over the 20th century, it shows some warming earlier and then it went down due to sulfate aerosols dominating, and then it has come up at the end. So, a natural thing to say is why a linear trend should be looked for when it fluctuated. That is what was done early on, looking for the carbon dioxide effect, it is basically the first thing you do, but it doesn't prove that there is no human influence. It turns out that this up, down, up, influence, due to sulfate aerosols, was predominately occurring

over the North Atlantic Ocean. Dr. MacCracken said that, in his opinion, the conclusion that there is no influence has been strongly overstated

Senator Pittenger asked Dr. MacCracken to respond to a quote from the 2001 IPCC report on clouds. "Clouds represent a significant source potential error in climate simulations". Dr. MacCracken said that scientists don't like to be wrong, so they try and choose a range of possible things for the future. You saw one that existed for what the emissions will be in the future. That causes about half of the influence of the 1.4 to 5.8 degrees. The other half comes from trying to get a sense of how the climate will respond and what will happen to carbon dioxide in the present. The range that they use is that it will be three degrees, plus or minus one and one-half degrees. Most of the one and one-half degrees relates to how the clouds will respond if climate will change. In the IPCC report, to come to an agreement, they have chosen a relatively wide range for allowing how the clouds can be. There is experience on record on how the ice age has worked, and if you don't have climate sensitivity in this range, you cannot explain past geological climate change. Senator Pittenger said that the backup he saw had a lot greater variables than just three degrees on the climate models representing the differences with the clouds.

Dr. Riggs asked Representative Hackney if it would be possible for the Commission to receive a copy of the southeast report. Dr. MacCracken said it was posted on the web at http://www.usgcrp.gov/usgcrp/nacc/default.htm

Following the lunch break, Representative Hackney noted that several handouts were placed at each member's desk and would be noted for record. A CD from Dr. Eggers on the "60 Minutes" program on Climate Change, a handout from Senator Pittenger on Climate Change that has been put into the record, a booklet from the George Marshall Institute, provided by Dr. Erickson, and a handout from Progress Energy provided by Ms. Choi. Mr. Profeta said that he was a part of a number of hearings over the past five years in the U. S. House and Senate on this topic and thought it would be of value to this Commission to provide record of those hearings for consideration.

Mr. Truman T. Semans, Director for Markets and Business Strategy, Pew Center for Global Climate Change, Washington, DC, was the first of four speakers to give a report on activities taken by businesses in the state and the United States to address global climate change. A copy of Mr. Semans's presentation is listed as **Exhibit I**.
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Mr. Semans said that he would introduce the next three speakers and tell what he would achieve as part of the panel discussion. He said there were a number of corporate leaders doing quite a lot directly or indirectly aimed at cutting greenhouse gas emissions and at the same time boost profitability. This is good for the states where they do business. These companies are taking advantage of the technologies available today that have a positive return and justifiable to shareholders. What differentiates the true leaders are companies that are willing to go beyond that to look at new areas of business opportunity, to look forward into the future, and understand risks to their business and to their clientele and to act on those now, before they really come to pass. Another theme is that most expect regulation to come at some point in the future. Getting the rank and file of the business community to do the kinds of things that the corporate leaders are doing, especially with respect to developing the next generation of technologies that are cleaner and leaner and

provide new business opportunities for the State of North Carolina, will involve a clearer role for efficient steps by government in partnership with the business community to stimulate private investment, research development and commercialization of some of these technologies. Mr. Seaman's said that today's discussion would be a look into what some of the larger businesses are doing and offered to bring to the Commission the new business opportunities associated with clean energy technologies and how they fit with economic development in North Carolina.

Mr. Semans gave an overview of some of the things they have heard in working with large corporations and use that as a springboard to dive deeper with the panelists. Mr. Semans introduced Tom Darden, CEO of Cherokee Investment Partner, a private equity fund with over one billion dollars under management for investing in Brownfields. Cherokee has offices in North Carolina and several other states. Mr. Darden has served for many years as the Chairman of the Cherokee Sanford Group, which is a privately held brick manufacturing company in the U.S. and was the largest southeast remediation company. He was a consultant for several years with Dane and Company in Boston and worked from 1977-78 as an environmental planner for the Crete Institute of Science and Technology in Seoul Korea.

Mr. Semans introduced William F. Bailey, Principal Consultant with DuPont, Charlotte, NC. Mr. Bailey joined DuPont in 1978, after receiving his B.S. in Mechanical Engineering from Virginia Tech. He is currently a principal consultant in DuPont's Energy Engineering Group and has over 25 years experience in industrial power and energy. He leads the energy center of competency within DuPont, which is responsible for driving forward their energy efficiency across their operations. He is also a leader of DuPont's Energy Technology Network, Global Information Sharing Network of over 600 professionals that are dedicated to improving the safety and reliability and efficiency of the company's energy related assets.

Mr. Semans introduced Mr. Robert L. Kee, Senior Vice President, Document Management, Bank of America, Charlotte, NC. Mr. Kee is responsible for the whole life cycle of digital and hard copy documents for BOA. He manages an operation which is responsible for $1.5 billion in annual spend. The Document Management Group is global, so it cuts across all aspects of the enterprise of BOA. It leads him to be an innovator across all sorts of business processes within the bank. Mr. Kee is a graduate of Texas Tech and sits on the advisory body to the U.S. Postal Service.

Mr. Semans said that the Pew Center for Global Climate Change was formed in 1998 to promote and develop sensible solutions to the problem of climate change. They work with policymakers at the state, federal and international level. He said he runs the Business Environmental Leadership Council for the Pew Center. This is 41 fortune 500 corporations that are active on climate and the largest climate focused association of companies based in the U.S. Collectively these companies employ over 3 million people and account for over two trillion dollars in combined market capitalization. They are also large emitters, either directly or indirectly. Whether it is through the electric power that they use or the energy and emissions associated with their products, they account for more than five percent of total global emissions. These companies also have very diverse business interests and are not going to align on issues of policy and business but do agree on the need for corporate and

government action to deal with climate change. Mr. Semans said that the Pew Center sits as an advisor on Wal Mart's Greenhouse Gas Strategy Network.

Mr. Semans said that they hear from the corporations on how climate and energy fit into their business strategy. There are three main buckets—first are reducing greenhouse gas emissions, second is in capturing some type of a competitive advantage in a business opportunity associated with energy and climate change; and third is with constructive, external engagement. There is a fourth area that really cuts through all of these which is in the area of risk management which Mr. Kee will be touching on later. Companies also have to deal with climate related changes in market demand, risk associated with government regulations that may occur in the future, and also climate change impacts to their infrastructure. Mr. Semans concluded by saying that in terms of reducing greenhouse gas emissions, there are two broad approaches—one is energy efficiency and reducing greenhouse gas reductions from operations and the other is in reducing the broad footprint of the products and services that a company makes. An example is Alcoa who has reduced the electricity required to produce a ton of aluminum by over 7 and one-half percent in the last 20 years. One way of thinking about the importance of that is that energy (as a matter of cost) constitutes over 80 percent of the value of the aluminum that comes out of their processes. When you come to reducing the footprint, each kilogram of aluminum that replaces a higher density material in a car, airplane or truck, can save 20 kilograms of carbon dioxide equivalent through better fuel economy and recyclables. There is a close tie-in with becoming more energy efficient and in industry cost leadership which something that DuPont exemplifies as well as number of other companies the Pew Center works with. When energy or energy products are an important input into your business, it is clear that quite a range of energy efficient activities that are consistent with reducing greenhouse gas emissions are also going to be good for the bottom line. However, to get this done across the sector, as a whole, you need a level playing field. This is one of the tie-ins that the Commission will be thinking through in the weeks and months ahead on policy. Another area is around boosting demand for products and services and things that are in the pipeline. General Electric has committed to double its annual investment in cleaner technologies from $700 million annually to $1.5 billion annually. They have launched a multi-million dollar campaign to encourage the use of cleaner technologies while also engaging extensively with academics, nonprofits, and other businesses and policymakers on the climate issue. There is another great example around new products and services in BP. BP just announced plans to enter the electric power business in the US. They want to build a power plant in Los Angeles that would take a pretty nasty byproduct of the petroleum refining process, called petroleum coke, gasify it, burn hydrogen in a power plant and take the strip off the carbon dioxide which they would sell to Occidental for use in enhanced oil recovery. This is an important example of a technology where a few people are stepping out front, trying things that don't have a clear return on investment but would if we take the steps that some countries have done in the world, to adjust the market to accurately reflect the costs of greenhouse gas emissions and the benefits of reducing greenhouse gas emissions. The exact cost and benefits are not exactly clear, but we know them in ranges and BP has committed to this investment as well as a broader investment to consolidate all of their businesses related to clean energy into an entirely new business line. They believe that regulation is coming and believe that the economic viability of developing and deploying these next generation technologies depend on allowing the marketplace to function correctly and price in

climate change. Mr. Semans noted that GE would like to come in and discuss the nuclear business which they believe is part of the answer to climate change.

Mr. Semans discussed constructive external engagement. He showed a slide of all of the companies who are examples of those who have engaged in this policy process. Most of these companies are involved in disclosure and public awareness process. A lot of investment houses have demanded of the portfolio companies that they invest in, to disclose what both their climate related risks and business opportunities are. In the area of collaboration, up and down the supply chain within sectors will also be covered by Mr. Kee.

Mr. Semans ended by telling a story about Wal Mart, which is the equivalent of the fifth largest city in the U.S. It is one of the top ten largest trading partners of China and employee 1.7 million people. The CEO of Wal Mart, Lee Scott, has made a set of very ambitious commitments to address climate change in the operations of the company, including a long term goal of powering what Wal Mart does on 100 percent renewable energy. One of the things is going to do is to try to push energy efficiency and clean energy up and down their supply chain. They are instituting a supplier score card and work with producers to come up with and to market a new set of technologies, such as more efficient light bulbs and appliances, etc. Mr. Semans said that Wal Mart recognizes that this is not going to happen without policy engagement and is one of the reason why they have come out and called for the kind of regulatory certainty that allows them to make plans as they are building new stores, the same that the electric power industry, the cement industry, glass, chemicals have to really understand the future when they are making large capital investments that they make today.

Mr. Semans said that he was recently outside of Detroit at what was once the largest cement factory in the U.S. That factory will last for 100 years and it basically puts out a ton of carbon dioxide for every ton of product that it makes. They need to know what the regulatory future looks like and is one of the reasons why they are engaged in this issue. In the interim, they are incredible innovators in energy efficiency and capturing that low hanging fruit. That is what you are going to hear about today from Tom, from Bob and from Bill. Mr. Semans said that he would take any questions from members after the next three speakers had concluded their talks.

Mr. Tom Darden, Chief Executive Officer, Cherokee Investment Partners, Raleigh, NC, spoke about what Cherokee Investments is doing to address global climate change. A copy of Mr. Darden's Perspectives on Energy Reduction and Environmental Innovation and a copy of Cherokee Investment's 2004 Sustainability Report are listed as **Exhibit J.**

Mr. Darden said that he was not an expert on Global Warming or an expert on carbon, not a scientist but he happens to be in a business that is maybe adjacent to or kind of in the general vicinity of a lot of these issues and they have chosen to address some of these issues for a variety of reasons. He said he was happy to speak about them and tell what Cherokee Investments is doing. He said it was highly anecdotal and hoped it was of some use to the Commission. He caveated his remarks by saying that he was very much a lay person and the focus of his efforts associated with this are not specifically targeted at global warming, per se, but were trying to address a set of issues that may have a positive affect.

Mr. Darden said that he went to graduate school at UNC-Chapel Hill in City and Regional Planning, studying environmental planning. He was quite interested in environmental issues back in the 1976-77 and ended up buying some brick plants in North Carolina with a plan to convert them from burning natural gas to burning wood waste. The bad news was that the sites were contaminated from leaking fuel storage tanks that was discovered in 1985. He got a call from their engineering consultant who said that a certified letter had been sent to the regulators because they were perceived to require notifying the regulators within 24 hours of having discovered any contamination in the ground.

Mr. Darden said that out of this concern, they created a business of treating fuel contaminated soil, mostly with bacteria by remediation. They started buying contaminated property in 1990, cleaning up the sites and selling the sites. They didn't have a lot of money to do this with, so they went out and raised $50 million dollars for this purpose in 1995-96 and spent that money. When this money ran out, they went back to the market and raised $250 million in 1998 from a number of funds, including a large pension fund from the State of Washington, who invested $100 million. Later, $620 million of equity was raised in 2002. For every dollar of equity, there was about $2 of purchasing power. Mr. Darden said that a fourth fund closed in December 2005 at $850 million, which will end up being about $1.2 billion of equity. He said he thought it was interesting that these investors would have such an appetite for investing in urban infield, urban redevelopment, and the purchase or contaminated property. Mr. Darden said that all of this money comes from large pension funds and university endowments. Mr. Darden said that Cherokee has purchased, since 1993, 520 sites around the U.S., Canada and Europe and the remediation costs of those 520 sites would be $250 million of in the ground remediation cost.

Mr. Darden added that they buy these sites and assume the liability for the cleanup. They cannot release the owner of the polluter from liability because under the strict liability regiment, the liability is attached permanently. However, they can step in front of them from a liability standpoint. They assume the responsibility for the cleanup of the sites, remediate the sites, and work with local planning agencies to plan and rezone the sites. These sites are then sold to somebody else in the chain that would build on them or do with them whatever they wanted to do. Mr. Darden said they bought property from kind of who's who of corporate entities such as Exxon, G.M., KKR, American Airlines, ICI and mostly large companies. Mostly their focus is on very large, urban redevelopment sites. They bought 31 sites, adjacent to one another in a series of purchases in Charleston, SC, on the peninsula, to assemble about 500 acres into what will be a new town adjacent to Charleston. This is in conjunction with the mayor's plan for the development of the peninsula in an effort to combat the growth of the people leaving Charleston and moving out into the suburban areas outside of Charleston. Mr. Darden said that they had 2,000 acres of land, five miles from Manhattan in the midlands of New Jersey, former landfill sites, which will be capped and contained. A methane collection system will be installed. In exchange for doing this, they have development rights for some property near the landfills. Golf courses will be put on top of the landfills, which will enhance the value of the surrounding property. They have development rights to develop about 3,000 homes, a hotel, and some office space and retail uses around the landfills. The

value of those planning consents to that land will be used to pay for the remediation of the sites.

Mr. Darden added that if you clean up contaminated land, it is a good thing from an environmental perspective; however, the social and longer term environmental implications of a built environment are pretty important. Historically, they did not think about this so much but focused on what was in the ground. But, they began to think more about that because communities care, especially as the sites got larger. They feel a great sense of responsibility and as an organization they try to incorporate as a set of values, a broad sense of responsibility for social issues. Workforce housing is an example—what will the 500 acres that are a part of Charleston going to look like and what kind of uses will be there and how will it fit into the social fabric of the community. If you are going to sell real estate, it needs to fit some economic model. By far, the largest environmental impact of the developments is in the buildings that are built on the sites. They try to have some input into what is built on their sites. They perceive that the environmental impact on the environment is significant and if they could do a better job with respect to that, they could have a big impact. What are they doing with respect to that? They are trying to do this in the context of an economic model. They are willing to make green, building investments that generate fairly lousy returns in the scope of a large project. These are large redevelopments and as a rule they probably have a little bit of slack in there to add amenities in there to these developments, the economics of which are a little bit hard to define. So, there are all kind of decisions made and can be debatable as to the economic return. They are fiduciaries for their investors' capital and need to be getting an economic return.

Mr. Darden said that the biggest impact from greenhouse gas or carbon effect, from his perspective, is energy consumption from the buildings that will be built on these sites. Unique to his situation, they have an opportunity because they deal with a fair number of landfill closures. This gives them development rights around the sites by using their money instead of them having to find funds to close these landfills. In turn, they have an opportunity to capture methane coming off of these landfills. The methane capture associated with the larger landfills has a fairly significant carbon dioxide equivalent impact. The biggest impact is reducing energy. Some research is being done on this subject, the purpose being to mandate to purchasers of land that they implement some of these practices. It cannot be a mandate with no information or knowledge.

Mr. Darden said that ground was broken yesterday on an interesting project in Raleigh called the mainstream green home. They believe that if these practices are going to be developed, it has to happen in the context of real estate. It needs to look and feel like conventional real estate. They took a lot in a conventional subdivision near Rex Hospital. Someone who works at Cherokee bought the lot and is developing a home, consistent with the practices of reducing energy. A webcam will document this building process at http://www.mainstream.dreamhome.com which will follow the process, talk about the technologies being used in the house, and monitor the energy produced by the house after it is occupied. This information will be made available to home builders and to people who are buying their sites. They will mandate that the ten attributes will need to be achieved when they build on these sites. It can be a difficult conversation because most of the people who buy the sites are very large homebuilders and real estate developers like Pulte or Centex. It is not

in the DNA to address these issues, although they are getting more interested. It is selling the notion that their customers will appreciate the attributes of these developments.

Mr. Darden said that Cherokee was a private business and has no dog in the policy discussions. So what is their motive for addressing these issues? Some of it is personal curiosity; however, mostly they are rational decisions. There will be over 100,000 people living on property that Cherokee owns and with the new fund being raised, that number will get close to a million people who will live on a site that Cherokee Investment partners owns or will own with the capital they are raising in their fourth fund. About a comparable amount of square footage will be developed as either retail or office space or other uses. He said he does not know who much energy 100,000 people use, but it is a lot. It seems to him that if you have that in your hands, you need to think about it. This is an anti-waste or efficiency ethos—a notion that waste is bad. It is clear that quality is associated with less cost. We will eventually get to the point that the same is true for environmental issues. Pollution is a form of waste. It is money going out the door or up the stack. So, just at a waste level, we need to find ways to reduce our pollution and be stewards of the investors' capital. Mr. Darden said he believed that energy prices are going to rise and he is willing to make an investor bet on that. They are willing to spend money on low return energy investments, right now. So, if they can figure out ways to produce energy or to save energy and capture the benefit of those energy savings in their developments, they can generate good returns, long term.

Mr. Darden said this was a national security issue and believes we all should be concerned about this. He is concerned about national security implications of energy. He used to tell his children, when they were facing a complicated decision, what happens if you are wrong and what happens if you are right. If we take action, and we are wrong, then how bad is that? Or, if we take action and we are right, they how good is that? If human activity is affecting global warming, and we do something about it, then we will be happy that we did. But, what if we are wrong? He said he was not willing to believe that the economics that are tossed about in this argument are really valid. He said that the economics are gross economics, not net economics. It is the gross cost, not the net cost because if we really try hard, we can figure out ways to do these things and not net spend incremental money doing that. If we do this and we are wrong, we have permanently improved the efficiency of the economy, because we have reduced our energy consumption, we have reduced our waste and have permanently improved our national security situation and hedged against future energy price increases.

Dr. Eggers asked Mr. Darden what some of the major barriers are to make what they are doing less attractive, and what are some of the ways that what they are doing can become more of an incentive, from a policy perspective. Mr. Darden said that the thought has crossed his mind, as we cap and contain the methane in these landfills, if there were to be carbon credit associated with this, it would be foolish for us to do it now instead of doing it after we get the benefit of the carbon credits. In other words, you do not get the credits if it has already been done. If you build something new and have less carbon impact, you do not get a benefit from it. Cherokee has a dog in the policy fight from the sense that we all should be concerned about the environment; however, he had not spent a lot of time thinking

about specific programs. The tax credits associated with solar energy will possibly be extremely important in their New Jersey project.

Mr. Shore asked Mr. Darden what the penalty would be for taking early action and how do we reward companies taking early action, and what should be North Carolina's role in this issue. Mr. Darden said that he has not ever been comfortable taking a position that his efforts would not make a difference and therefore he should not do anything. It appears to be a state versus national policy issue which is beyond the scope of his thoughts about this. Since most of Cherokee's activity is not in North Carolina, he has wondered about the implications of different programs in different states. He said if you are in a position to do something to possibly affect a problem, then somebody needs to step up. However, he was not making policy recommendations.

Representative Hackney said that we had a green building entrepreneur among the Commission membership, Tim Toben of Orange County.

Mr. Robert L. Kee, Senior Vice President, Document Management, Bank of America (BOA), Charlotte, North Carolina, gave his and Bank of America's views on the issue of global climate change. He said that Bank of America is one of the world's largest financial institutions. Forbes listed them as the third largest corporation. They lend to 97 percent of Fortune 500 companies, 79 percent of the global 500 companies and have over 40 million customers in domestic United States, 5800 retail banking centers, and are the largest lender to small business in the United States.

Mr. Kee said he was not a scientist but was in the supply chain group within Bank of America. BOA developed an environmental council to consider environmental issues, including climate change. The environmental council is comprised of senior executives across the Bank, including him, who represents major lines of business. The chair of that council reports to Ken Lewis, CEO of BOA, on environmental issues. Mr. Kee said that the environmental council has carefully weighed in on the issue of climate change and has identified it as a significant risk in terms of doing business. When they use the term risk, banking is all about managing risk, therefore it is a significant element in the lending portfolio and in procurement space. They are charged with finding market based solutions to address climate change.

Mr. Kee said that there BOA affects the environment—one is in their credit policy and the other in their procurement policy. Mr. Kee said that when BOA first started addressing the environment, it was more in the credit portfolio and prompted by the regulation related to superfund issues, hazardous environmental spaces, etc. From that, the bank was motivated to develop environmental specialists in those spaces, to help guide the lending practices and policies. That grew significant expertise in that space and lending processes were developed, relating to the remediation of contaminated real estate. They are begun to address illegal logging issues with the largest forest lender in the world. Mr. Kee said that in an operation space, which the area he is most comfortable talking about is, one of every 225 pieces of paper in the United States is consumed by BOA. In that regard, if they have influence in an area, they therefore have responsibility in that area. Over ten years ago, the company set forth a goal to reduce paper consumption by 25 percent over three years and co founded the Recycled Paper Coalition (RPC). BOA recycles about 28,000 tons of paper, which is two and one-half times more than they produce internally.

Mr. Kee said that BOA implemented a paper purchasing policy simultaneous to the RPC, and were able to reduce the consumption of internal paper by over 32 percent that has multiple million dollars worth of savings. If you look at the difference between carbon dioxide emissions in 2005 versus the year 2000, it represents something like 46 million pounds of carbon dioxide equivalents that were eliminated, 45 million pounds of solid waste that did not reach the landfill, the equivalent of the BTU's it takes to drive a city of 10,000 people for a year. Just the interaction in the paper space, which is a relatively minor expense in what the Bank does, has significant environmental considerations. The Bank has launched the Electronification of Paper Program, to look at where paper is utilized in any of the Bank's initiatives, and to develop digital means to have those communications. This is simple when you are working in internal operations because you basically own both sides of the equation. But, because the Bank has a lot of customer facing communications, they are also looking for methodologies to drive more digital approaches in communications. Out of the 40 million customers, roughly 15 to 16 million of them do online banking with BOA. Over five million customers have opted out of receiving their statements electronically, at a six to seven dollar a year savings per person. Mr. Kee said that the environmental credit policies are certainly not due to the bank. They continue to look at balance at how they approach the environment. Aside from taking a look at specifying what they consume and diminishing what they consume, they also extended their procurement influence into the forestry area where the lending side of the business had developed a forest lending policy related to illegal logging and carbon dioxide emissions. On the other side of the equation, they decided they were going to ask for those same sorts of parameters to be extended to their paper suppliers. Last year, BOA signed their forest lending practices policy that requires any company that BOA purchases paper products from can trace its pulp back from a sustainable site; it avoids old timber sites, and avoids areas that are involved in illegal logging. BOA feels that if they have influence in an area, it is their responsibility to manage that and use that influence in a constructive manner.

Mr. Kee explained why climate change is a significant issue for BOA. As a risk issue, it is nothing new to BOA. As a global financial services provider, BOA is in the risk management business. To be competitive and create a return for shareholders, they have to balance these risk factors or credit, market, operational, and reputation risks with opportunity. BOA's health, as a company, is reflected by the health of its customers. Being more involved in the climate change space is just a case of enlightened self interest. Mr. Kee said that the role of business and government go in hand and business needs to take a leadership stance and be principally responsible on this issue and help push for solutions. BOA has made this move with its own commitments to address greenhouse gas emissions in their public support of regional initiatives such as the Regional Greenhouse Gas Initiative in the northeast. They believe that government needs to continue to move forward in these initiatives. As they learn more and more about this space, they are making measurable commitments. When they talk about the lending space, they are actually saying that in their utility and credit portfolio, they have spent the last several years benchmarking what the carbon footprint looks like and have made a commitment to reduce the carbon dioxide emissions in that area by seven percent by the year 2008, by simply making more astute decisions about who they are going to lend money to and moving away from more intensive sorts of businesses. When they take a look at

their own direct emissions from operations they generate from their own facilities, BOA has set an aggressive voluntary goal with EPA climate leaders to reduce greenhouse gas emissions by nine percent by 2009, based on a benchmark of 2004. This is no small initiative since BOA has 6,347 properties, totaling 65 million square feet. Mr. Kee said the capstone to that initiative will be their new building in New York at One Bryant Park. It will be the second tallest building in the Manhattan skyline and will be rated a platinum environmental rating. So, they are making this building the showcase of their stance from a facility standpoint. Mr. Kee said these efforts have included benefits in NC. In April 2005, BOA received the NC Leadership and Sustainable Energy Award acknowledging the company for outstanding contributions in helping the State in achieving its energy efficiency, renewable energy and sustainable goals. From the procurement side of the house, those areas they have good metrics on what the carbon footprint is, goals have been set that are the equivalent of what they are trying to do in their lending portfolio of reducing their footprint by seven percent by 2008. In addition, they are really disturbed about what they don't know. They have recently provided a grant to UNC-Chapel Hill to have a study done on the products and services BOA acquires in the United States and to describe to BOA, in measurable form, what their environmental impact looks like so that they can move their resources to mitigate where they have the largest impacts, not what they understand in a traditional manner.

Mr. Kee concluded by saying that BOA, as a corporation, touches many aspects of the environment. They have learned that their leadership influences economic fatality, the well-being of their communities and even the way people live. This commitment stretches from their energy and utility portfolio to making sure that they turn the lights off at the local branch. They know that addressing climate change is the right thing to do. It is the right thing to do for the investors, for their associates, and most importantly for the communities we all live in. BOA weighs in on this issue because they are committed to the long term sustainability of their business and that of the communities which they serve. By being focused on the long term, climate change comes clearly into focus. They recognize that there is an urgent need to act quickly to address climate change and they support mechanisms such as regional initiatives aligned with this objective.

Dr. Eggers asked Mr. Kee what the baseline year was on BOA's portfolio goal. Mr. Kee said the baseline year was 2004. Dr. Eggers asked if that means that the borrowers need to report annually their climate footprint. Mr. Kee said that was correct. Dr. Eggers asked if these reports from borrowers on greenhouse gas emissions, just based on energy consumption. Mr. Kee said there is a website he would make available on how that data is collected and reported. He said that on the flipside, in terms of looking at BOA's footprint, when they take a look at the 200,000 associates that commute to work, they have expectations that this will be the second or third largest impact. BOA is creating satellite sites that are much closer to the concentration of folks, so that they can cut their commute.

Senator Pittenger asked Mr. Kee what role the government plays in the efforts that BOA has employed. Mr. Kee said that when you talk about the procurement side, he would say government plays essentially no role. It has been driven by leaning processes. It is the right thing to do economically. Originally on the lending side, it may have been significantly stimulated by regulations related to the Superfund and hazardous waste sites, originally, in terms of recognizing that if there was a default on

the loan and they acquired property, they would acquire all of the environmental liability that went with it. Senator Pittenger asked Mr. Kee if most of BOA's incentives had been market driven, good for business and good for the environment. Mr. Kee said that was correct.

Mr. Toben asked Mr. Kee if BOA had found, in the insurance and reinsurance sector, that the sensitivity to these climate change issues is also high, and within bank and financial sector associations BOA is affiliated with, are they finding that the level of activity and response that BOA is exhibiting is typical of the financial services sector or is BOA ahead of the curve. Mr. Kee said he was completely unqualified to answer this question but would provide the name of the individual who could provide him with some good answers in that respect. Mr. Kee said he believed BOA had been a leader on the environmental side of the equation and thinks it is becoming more type of mind for other financial institutions to follow suit. Wells Fargo just recently appointed a pretty significant environmental committee of renowned scientists to provide them some guidance. City Corps is doing things, but his perception is that BOA has been a leader in that space.

Dr. Smith asked Mr. Kee if BOA feels that it is appropriate for the State of North Carolina to set a target reduction goal. He also asked Mr. Kee to talk more about BOA's support for the regional initiative in the northeast and why BOA feels it is important. Mr. Kee said that BOA has a pretty significant presence in the northeast and feel that this initiative will stimulate a lot of market growth in innovative new businesses, moving to more clean technologies. This stimulates jobs and investment opportunities; therefore it is good for the communities in that space. Mr. Kee said that his personal opinion about setting some goals for the State is things that are not measured, rarely get done, so for the North Carolina to set some goals would be a very healthy thing.

Mr. William F. Bailey, Principal Consultant, DuPont, Charlotte, North Carolina, gave a presentation on DuPont's activities with regard to addressing global climate change. A copy of Mr. Bailey's slides is included in a handout marked **Exhibit K**.

Representative Hackney asked Mr. Bailey to explain what a Principal Consultant is. Mr. Bailey said that DuPont has an internal consulting organization of which he is one of the principals.

Mr. Bailey said that DuPont is a global science company, solving problems in ways that make people's lives better, safer and easier. They currently operate 135 manufacturing plants across the world in 70 countries and have 80 research and development (R&D) facilities, with five locations in North Carolina. These locations are in Fayetteville, Cedar Creek, RTP, Charlotte and Kinston. The major business segments in DuPont include agriculture and nutrition products, coatings and color technologies, electronics and communications, performance materials, and safety and protection. As a company, DuPont is one of the oldest companies in the Fortune 500. The company began over 200 years ago on the banks of the Brandywine River in Wilmington, Delaware, when its founder, DuPont decided to make gunpowder. Trying to make gunpowder was a very hazardous undertaking and Mr. DuPont recognized that if he was going to be successful, he needed to protect his most valuable assets, his people and his equipment. So, from day one, DuPont has a deeply engrained concern for the wellbeing and safety of its employees and their

health. That deeply engrained concern for employees has grown over the years to what they now come to represent as their core values, the DNA of DuPont. Mr. Bailey said these core values are safety, health, and environmental stewardship, integrity and high ethical standards, and fair and respectful treatment of people. These are the values that DuPont strives to live by. Going forward into the third century, they recognize that their operations have a global impact. If you are operating 135 manufacturing plants in 70 countries, you better be concerned about what is going on in the world around you, and DuPont is.

Mr. Bailey said that the challenge for DuPont is to address issues such as climate change in a way that makes business sense and upholds its core values, sustainable growth. Sustainable growth means to DuPont, increasing shareholder and societal value while decreasing the footprint of its operations along the value chains in which they operate. The word footprint is an interesting term to apply to what they do, but when they use it, they mean injuries, illnesses, waste, emissions and depletable forms of raw materials and energy. A vision for sustainable growth like that is very much aligned with a core value of safety, health and environmental stewardship.

Mr. Bailey said that DuPont's view on global climate change is based on CFC/Ozone issue in the 1980's which helped them to understand the implications of environmental issues that are global in scope and decades-to-centuries in duration. Global climate change is really an extension of the experience that DuPont gathered when they went through the CFC/Ozone issue. They studied the science relative to global climate change and concluded that there is reasonable cause for concern. They recognize that this is a global issue, not just a North Carolina issue in the five communities where they do business here. They also recognize that their greenhouse gas emissions are significant. So, they decided to take responsible action to reduce their emissions footprint and be part of the solution to this problem they believe exists in global warming.

Mr. Bailey said that in 1999, DuPont made a public commitment to achieve the following three goals, related to energy and the environment, by the year 2010. First of all, DuPont committed to reduce their greenhouse gas emissions by 65 percent versus a 1990 baseline. Secondly, they committed to hold total energy use, flat, versus a 1990 baseline and that's not just energy efficiency or BTU's being flat, that is total energy use, period. Thirdly, DuPont committed to supply ten percent of their total energy needs from renewable resources at a cost, competitive with the best fossil-derived alternatives. DuPont reports its progress annually on these three, 2010 energy and environment goals in a document called The DuPont Sustainable Growth Report. It is also reported to the USEPA as part their 1605(b) report. Anyone interested in reading can go to http://www2.dupont.com/Social_Commitment/en_US/

Mr. Bailey said that DuPont's approach to reducing greenhouse gas emissions really took the following track by finding out what they had. They had to develop an inventory of global greenhouse gas emissions and then track them over time. They had to know what they were emitting in 1990 in order to measure their progress versus that baseline. That inventory of carbon dioxide and other greenhouse gas emissions was very important to establish what it was they were going to be reducing against. Secondly, DuPont had to identify emission reduction opportunities and thirdly had to implement the projects that reduced the most but cost the least. Mr. Bailey said that the Flat Energy Use Goal was the hardest of the three to achieve

because that is what he spends his nine to five life working on everyday. If you want to make more pounds of whatever, in order grow the value of your company, then you have to find the way to use less energy per pound of product. DuPont very much wants to be a growth company like most investor held companies do these days. Improving the energy efficiency in their manufacturing plants is no small task for DuPont. Mr. Bailey said that most of their assets had been on the ground for 30 or 40 years and the economics for energy using equipment are not such that they can afford to throw out everything they have on the ground and install brand new, high efficiency equipment. But in addition to that, energy use on their plants is literally disbursed among hundreds of different devices. Secondly, inefficiency in energy use is very difficult to spot. In many cases, they are invisible. It is like owning a car, the combustion of the car is not very good and may be making some noise, and you know if you take it to the shop for work, it will improve the fuel economy and the noise will go away. That is kind of an invisible indicator that you have a problem with energy efficiency that needs addressing. Third, the data that is required to pinpoint inefficiencies in energy use is frequently unavailable in our plant sites. And, like many companies, DuPont has undergone restructuring programs over the last 10 to 15 years and have far fewer people in the plants to look at things like making improvements in energy use. Lastly, and perhaps most importantly, energy efficiency is not a product, quality variable. This means that customers who buy most of their products really don't care at this particular point and time how much energy it takes for them to make their products. They want a product that meets their quality specifications and a product at a competitive cost. If it takes the company ten percent more energy to make that product, many of the customers probably would not care. That puts the company in a very unusual position in their manufacturing plants where employees are focused on giving the customer what the customer wants. The plants have to learn how to improve something that the customer generally doesn't care about. DuPont is paying much more attention this year relative to energy use in the plants because they are paying so much more for the fuel used to make the steam and drive their plants. Their sustainable growth focus and core values around environmental stewardship are really providing the long term support for a program to continually work on improving plant energy efficiency. They have taken a very strategic approach to help the manufacturing plants to see that this is something that is equally important as demands of the customer. For example, each of their largest plant sites, 45 globally at this time, have set an annual energy reduction target. They have appointed individuals at those sites to lead a site energy efficiency program that is designed to implement improvements to operations that will enable us to achieve those targets. DuPont's plant managers are now accountable for delivering results against the targets that their plants set. Plant managers' bonuses may be determined by whether his site meets the energy cost reduction target that it has set.

Mr. Bradley said that DuPont has established a center of competency, relative to energy use in the company, to share best practices and educate the few people who are left to run their manufacturing plants. Lastly, they have standardized in DuPont on an improvement methodology. Low hanging fruit, mentioned earlier, is something that DuPont has been working on since 1999 and the low hanging fruit is gone. They are way up the ladder trying to find ways to further improve energy efficiency and having a standardized improvement methodology such as Six Sigma is enabling them to do that and pick the fruit in a way that it doesn't grow back.

Mr. Bradley said that with regard to how DuPont is doing versus its goals, they report recently that their greenhouse gas emissions are down 60 percent from 1990 levels, at year end 2004. Their total energy consumption has decreased six percent while their production has increased 41 percent. So, they are 60 percent below their flat energy use goal while their production has grown over 40 percent. Efficiency improvement has saved the company over two billion dollars since 1991, versus a business as usual approach, where no improvements were made in energy efficiency. Mr. Bradley said that over five percent of their total energy, worldwide, is now supplied from renewables. The largest contributors in the two most recent years are landfill gas projects and wood-fired projects.

Mr. Bradley said it was hard work to go to work everyday and work on energy efficiency when you know that DuPont's customers, in general, don't care a whole lot about it. So, it is very rewarding when this work is recognized by people outside of the company. In the December 12, 2005 issue of BusinessWeek, entitled "Battling Climate Change", DuPont was recognized as the top company of the decade, based on total reduction of greenhouse gases. The article said that "DuPont reduced energy consumption 70 percent below 1990 levels, saving more than $2 billion dollars including at least $10 million a year by using renewable sources." Mr. Bradley added that two weeks ago, Ceres, a group of investors and environmentalists who are all about sustaining prosperity, ranked DuPont number one in the U.S. and number two, globally, in its first ever ranking of companies on climate change strategies.

Mr. Bradley said that DuPont also provides a broad array of enabling technologies that can help their customers reduce their greenhouse gas emissions footprint. They make biofuels and bio-based raw materials like bio propanediol (PDO) for Sorona polymer. This material is made by taking corn and feed it to genetically modified bacteria which then excrete PDO. They are taking what used to be a depletable resource and replacing the raw material with a truly renewable resource in the form of corn. DuPont is very much committed to bio-based technology as shown in the announcement last November in Kinston. This announcement was that DuPont would increase its capacity to make bio-based PDO to 85 million pounds when that plant starts up in the third quarter of next year. Secondly, DuPont makes a broad array of engineered plastics and composites that can help reduce weight in automobiles. DuPont makes Tyvek house wrap, which makes homes more energy efficient by reducing infiltration and energy leakage. They also make fuel cells and components that can be used in photovoltaic systems. DuPont's Kevlar is being used in windmill blades to make them more efficient by reducing the weight that would otherwise be taken up by a metal windmill blade.

Mr. Bradley concluded by saying that DuPont believes that enough is known about global climate change to provide a basis for concern and to warrant prudent action. They have set aggressive goals to reduce their environmental footprint, including greenhouse gas emissions and energy use. They are making good progress on all of their goals and on track to meet the commitments they publicly made for the year 2010. Climate change is an environmental and economic challenge, not only for DuPont but for everyone. And, a successful strategy to address this issue must address both of these elements.

Representative Hackney told Mr. Bradley that if DuPont was in the market for buying methane, eastern North Carolina had plenty of it. He said that our Commission Counsel could put him in touch with lots of hog farmers who have lagoons and they could work together. Mr. Bradley said, "let's talk".

Senator Pittenger asked what role government had in DuPont's success in achieving their goals. Mr. Bradley said that it was essentially zero. Mr. Bradley agreed with Mr. Kee that his company sees this as the right thing to do.

Mr. Profeta asked Mr. Bradley what the reason and rationale was for DuPont's involvement and development of common change policy. Mr. Bradley said that he was not a policy person but an energy engineer and preferred not to answer the question. He personally believes that DuPont is doing this because they believe it's the right thing to do and it has made good business sense for them to do it.

Representative Hackney noted for the record that additional handouts were out passed by Senator Pittenger with reference to a recent George Will article, he also noted for the record that a copy of the book, Meltdown, was also handed out.

Mr. Shore asked Mr. Bradley if DuPont would have made some of the progress on the global warming pollution reductions and the energy efficiency had they not set goals for the future. And, would it be good for North Carolina to consider such goals.

Mr. Bradley said that eight years ago, prior to the announcement of their 2010 goals, if anyone had suggested that DuPont would be interested in buying landfill gas to run even part of its operations, they would have been laughed out of the room. The reliability of the supply and all of the issues associated with it, being connected with something that had to do with an odious part of the environment, they would have preferred to avoid utilization of landfill gas. When they set a goal in 1999, to procure ten percent of their raw energy from renewable resources, they had to reconsider those kinds of approaches. All of a sudden, landfill gas became a lot more attractive fuel alternative for DuPont because it was one of the most cost effective renewable out there, especially in locations where there was a landfill less than ten miles from one of their plants that burned natural gas. Mr. Bradley said that DuPont had implemented three landfill gas projects in the last five years. The driver for this was that goal to source ten percent of renewable energy from them, but the people who authorize those projects are looking like heroes, because that stuff is a lot cheaper than natural gas that it replaced. Mr. Bradley said that the goals have driven DuPont to do things they otherwise would not even have considered doing.

Representative Hackney asked Mr. Bradley if he had studied Interface Corporation and Ray Anderson, or did he consider himself a predecessor of what they have done. Mr. Bradley said he was not familiar enough with their work to comment. Representative Hackney said that there was a wonderful book entitled, Mid Course Correction, about Ray Anderson's attempt to bring his company to as close to zero energy use as possible.

Mr. Garrou asked Mr. Bradley if the goal had been to save $2 billion from energy efficiencies, how different would the strategies that he pursued have been, if at all. Mr. Bradley said that he was not sure the strategies would have been a great deal different because in order to generate the dollar savings, they would have had to

known what needed to be changed in the operations in order to produce those kinds of economies. As a publicly traded company, DuPont is very concerned about what happens quarter to quarter. A goal that set strictly on economics may have a great deal of weight behind it one quarter. But, if they have a poor quarter in terms of meeting their objectives, those kind of goals can receive much less prominence in their day to day operations than a goal that goes back to core values of safety, health and environmental stewardship. Mr. Bradley said that he did not know if the leaders who set those goals thought about that when they did it, but it turned out to be a great way for them to present their goals.

Senator Pittenger asked Mr. Kee to clarify if he sees the role of the state as setting goals or mandates. Mr. Kee said that his comments were related to goals, not to mandates. He said he thinks that corporations set goals that are in their long term economic, strategic interest and that is the way BOA prefers to set their goals.

Dr. Everett said he thought that one of his comments may have been misunderstood. In the presentation by Bill Chameides of Environmental Defense, he asked a question about one of his slides which is the one that says America is moving forward on global warming and the sense of the Senate resolution. It is the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory market based limits. Dr. Everett said that Duke is on record as supporting just a move by Congress.

Dr. Eggers added that government establishes the rules of markets. Governments establish how companies win and we have some great opportunities to tweak the playing field so that people can still make lots of money and future generations will still be healthy and the onerous is on the government to set the rules by which the game is played.

The meeting was adjourned at 4:11 PM.

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Representative Joe Hackney	Mary R. Watson
Presiding Co-Chair	Committee Assistant

LIST OF EXHIBITS

EXHIBIT A	Meeting Notice
EXHIBIT B	Meeting Agenda
EXHIBIT C	Visitor's Registration
EXHIBIT D	Presentation by Keith Overcash, Director, Division of Air Quality, DENR, gave an update on activities of the Department of Environment and Natural Resources (DENR) and the Climate Action Plan Advisory Group (CAPAG).
EXHIBIT E	Presentation by Mr. David R. Easterling, Chief, Scientific Services Division, National Climatic Data Center, National Oceanic and Atmospheric Administration (NOAA), Asheville, North Carolina, on the state of the science related to global climate change
EXHIBIT F	Presentation by Patrick J. Michaels, Ph.D., Research Professor and State Climatologist, Virginia State Climatology Office, University of Virginia, Charlottesville, Virginia, on the view of the state of the science related to global climate change
EXHIBIT G	Presentation by William L. Chameides, Ph.D., Chief Scientist, Environmental Defense, New York, New York on the state of the science related to global climate change
EXHIBIT H	Presentation by Michael MacCracken, Ph.D., Chief Scientist for Climate Change Programs, Climate Institute, Washington, D.C. on understanding and projecting climate change
EXHIBIT I	Report given by Mr. Truman T. Semans, Director for Markets and Business Strategy, Pew Center for Global Climate Change, Washington, DC, on activities taken by businesses in the state and the United States to address global climate change
EXHIBIT J	Presentation by Mr. Tom Darden, Chief Executive Officer, Cherokee Investment Partners, Raleigh, NC, on what Cherokee Investments is doing to address global climate change. A copy of Mr. Darden's Perspectives on Energy Reduction and Environmental Innovation and a copy of Cherokee Investment's 2004 Sustainability Report
EXHIBIT K	Presentation by Mr. William F. Bailey, Principal Consultant, DuPont, Charlotte, North Carolina, on DuPont's activities with regard to addressing global climate change