NORTH DAKOTA LEGISLATIVE MANAGEMENT

Minutes of the

ENERGY DEVELOPMENT AND TRANSMISSION COMMITTEE

Wednesday, September 16, 2009
Lewis and Clark/Maximilian/Stevens Rooms
Energy and Environmental Research Center
University of North Dakota
Grand Forks, North Dakota

Senator Rich Wardner, Chairman, called the meeting to order at 9:00 a.m.

Members present: Senators Rich Wardner, John M. Andrist, Jim Dotzenrod, Robert M. Horne, Joe Miller, George Nodland; Representatives Mike Brandenburg, Lee Kaldor, Matthew M. Klein

Members absent: Representatives Tracy Boe, Todd Porter, Dave Weiler

Others present: Louise Potter, State Representative, Grand Forks

Lonny Winrich, State Representative, Grand Forks

Representative Bob Skarphol, member of the Legislative Management, was also in attendance.

See Appendix A for additional persons present.

It was moved by Representative Klein, seconded by Senator Nodland, and carried on a voice vote that the minutes of the previous meeting be approved as distributed.

Chairman Wardner said the applied research conducted by the Energy and Environmental Research Center (EERC) is critical to energy development in this state. He said, for example, only 5 percent of the Bakken oil is being retrieved, and with research and technology, more oil will be retrieved.

ENERGY STUDY

Dr. Gerald H. Groenewold, Director, Energy and Environmental Research Center, provided a presentation (Appendix B) on global, national, and regional perspectives on energy development. He said the EERC is the international center for applied energy technology. He said the EERC conducts research, development, demonstrations, and commercialization. He said the EERC has a culture of partnerships that produces research that is market-driven. He said the EERC has technology centers relating to:

- Coal utilization.
- Emission control.
- Hydrogen.
- Climate change and carbon dioxide sequestration.
- Air toxic metals.
- Renewable energy and biomass utilization.
- Water management.
- Alternative fuels.
- Supercritical and subcritical extraction.
- Coal ash.

As to emission control, Dr. Groenewold said the EERC has developed zero or near-zero emission technology for a coal-fired power plant. As to air toxic metals, he said, the EERC is the world's leader in mercury measurement and control. As to hydrogen, he said, the current and pending contracts relate to:

- Hydrogen from coal.
- Hydrogen on demand.
- Battlefield hydrogen (JP-8).
- Biomass to hydrogen.
- Integrated hydrogen and ethanol production.
- Wind to hydrogen.
- Hydrogen fuel cell-powered vehicles.

Dr. Groenewold said technology providing on-demand hydrogen without compression and storage is moving toward commercial development.

Dr. Groenewold said the EERC has developed technology using vegetable and algae oil to produce petroleum-analogous fuels that are drop-in compatible. He said algae is a good feedstock for biofuels because of greenhouse gas reductions, it does not compete with food or with high-value agricultural land, and is a higher energy density oil than other oils. He said a field of soybeans produces 48 gallons of oil per acre per year and a field of sunflowers produces 102 gallons of oil per acre per year. He said microalgae can produce between 5,000 and 15,000 gallons of oil per acre per year.

Dr. Groenewold said renewable energy consumption in the United States is 7 percent of all energy and 7 percent of that 7 percent is wind energy.

Dr. Groenewold said conventional coal-powered generation is second only to agriculture as the largest user of water in the United States. He said the EERC projects focus on power plant water capture and minimization and water issues tied to carbon dioxide capture and sequestration. He said 77 percent of the water withdrawals in North Dakota are for thermalelectric power and 12 percent for irrigation. He said in Montana 95 percent of water withdrawals are for irrigation and in Wyoming 90 percent are for irrigation. He said the withdrawal rate of North Dakota compared with other states is one-half to one-tenth of other states in the region. He said this state has

coal-fired power plants because of Lake Sakakawea. He said the water is needed for cooling.

In response to a question from Senator Horne, Dr. Groenewold said the EERC develops products from completed technology for many companies.

In response to a question from Senator Andrist, Dr. Groenewold said the EERC commonly has confidentiality agreements with its clients. He said the United States cannot be energy-independent, but the United States can be energy-secure. He said the only energy the EERC does not address is nuclear. He said 87 percent of the contracts with the EERC are with private companies and are entrepreneurial activities.

In response to a question from Senator Andrist, Dr. Groenewold said the wrong person in his job would destroy the EERC in a short time. He said he is mentoring internally for succession when he plans to leave in about seven years.

In response to a question from Senator Horne, Dr. Groenewold said the EERC has a team culture of coming in first. He said the EERC has a very sophisticated contracting office.

In response to a question from Representative Skarphol, Dr. Groenewold said in kind means something of value provided by a client that does not require additional staff or money.

In response to a question from Representative Skarphol, Dr. Groenewold said higher education has a different culture from that of the EERC.

In response to a question from Senator Andrist, Dr. Groenewold said the EERC has not turned away any good requests. He said the EERC is very selective in choosing into which contracts to enter.

In response to a question from Senator Wardner, Dr. Groenewold said at one time the University of North Dakota had promised the old Engelstad Arena to the EERC for future growth. He said the university reversed itself and is keeping the facility as an indoor practice facility for track.

In response to a question from Representative Kaldor, Dr. Groenewold said for the EERC to build in the past, the university has issued bonds and the University of North Dakota Alumni Association has guaranteed the bonds.

In response to a question from Representative Skarphol, Dr. Groenewold said the EERC does not have alumni so it is difficult to get individuals to donate for a building.

In response to a question from Senator Andrist, Dr. Groenewold said the foundations of major partners have been approached for funding construction, but because of economic considerations foundations are tight with money at present.

In response to a question from Senator Horne, Dr. Groenewold said the EERC needs more building space and has investigated having a contractor construct a building and have the EERC lease the building back from the contractor.

Mr. Thomas A. Erickson, Associate Director for Research, Energy and Environmental Research Center, answered questions for the committee.

In response to a question from Senator Horne, Mr. Erickson said there are two primary means to carry hydrogen in a car. He said hydrogen may be carried in a pressurized tank or in a tank chemically bonded to other chemicals and the bonds are broken when needed.

In response to a question from Representative Skarphol, Mr. Erickson said the difficulty with tanks is that they are very heavy. He said chemical bonding does not need as heavy of a tank.

In response to a question from Senator Nodland, Mr. Erickson said hydrogen is light and will travel straight up if the tank is ruptured. He said it burns quickly. He said it is safer in an accident than a gasoline tank.

In response to a question from Representative Klein, Mr. Erickson said the EERC recently converted a battery-operated forklift to hydrogen in one day. He said the feedback from the United States Air Force on the forklift has been very positive.

In response to a question from Representative Brandenburg, Dr. Groenewold said the problem with biomass is the problem of scale to store and transport enough feedstock. He said biomass is more competitive on a smaller scale without transportation.

In response to a question from Senator Andrist, Dr. Groenewold said Congress needs to establish what needs to be done to build a coal-fired plant so that new plants may be built with clean coal technology.

In response to a question from Representative Skarphol, Mr. Erickson said the extra capital costs for a coal-fired plant that has zero emissions is approximately 40 percent.

In response to a question from Senator Andrist, Dr. Groenewold said members of Congress, with exception, do not understand the enormity or complexity of the energy system in the United States. He said there is no one solution for energy security and that guidance on the federal level is needed for major energy development. He said more money needs to be put into coal research.

In response to a question from Senator Nodland, Dr. Groenewold said the EERC has opened an office on Wall Street to provide technical advice on energy. He said people want to invest in energy but do not know where to put their money.

In response to a question from Representative Klein, Dr. Groenewold said the major reasons Big Stone II is having difficulties is because Minnesota has said it does not want that type of power and because of no federal direction.

Mr. Erickson provided a presentation (Appendix C) on clean coal and the smart grid. He said the perfect energy is clean, has low water consumption, does not compete with food production, has low carbon dioxide emissions, is domestically produced, is green, and most of all is low-cost. He said green does not always

mean clean. He said clean does not need to mean green. He said a well-to-wheel analysis of certain ethanol and gasoline shows that ethanol produces higher levels of pollutant emissions for certain chemicals.

Mr. Erickson said clean coal technologies include conventional combustion, advanced combustion, gasification, pyrolysis, coal to liquids, emission control, near-zero emissions, and water minimization. He said the positive properties of lignite are its high reactivity and low mining costs. He said the negatives are its low energy value, high moisture, medium sulfur, and high ash. He said the positives of utilizing lignite include the low fuel cost and good collocation with carbon dioxide sinks. He said the negatives include a higher capital cost, higher environmental performance costs, high transportation costs, and low carbon dioxide efficiency.

Mr. Erickson said by adding carbon dioxide control to a power plant, the cost for controlling other pollutants may go down because all of the air needs to be handled for carbon dioxide. He said carbon capture is the capturing of a concentrated stream of carbon dioxide from a power plant. He said this may be done by oxygen firing which gets rid of nitrogen as a dilutant or by concentrating the carbon dioxide with chemicals.

Mr. Erickson said there is no planned coal gasification in North America. He said most existing and planned gasification is in Africa and the Middle East. He said gasification is an answer to getting coal out of this state.

Mr. Erickson said the United States Army has announced its intent to build up to seven coal-to-liquid facilities. He said the reason for the facilities is independence from foreign oil for military purposes. He said coal to liquids is competitive with oil at $40 to $50 a barrel. He said it could take 8 years to 10 years to build a facility. He said this is a major commercial risk.

Mr. Erickson said a smart grid provides higher energy efficiency and conservation, decreased spinning generation, greater allowance for cyclical power, and reduced consumer costs based on personal choices. He said there was a technology pilot project in Boulder, Colorado, for the smart grid. He said the smart grid reduced unpredicted transformer failures to zero. He said the smart grid reduced voltage problems and reduced consumer complaints as to voltage.

In response to a question from Senator Nodland, Mr. Erickson said the greatest problem in building a gasification plant is the permitting issues.

In response to a question from Representative Klein, Mr. Erickson said the cost for the smart grid system in Boulder was $100 million. He said most of this cost was for fiber optics, and that cost could be reduced if the Internet could be used to transmit information. He said this was a Phase 1 smart grid because it only took information from outside the home.

Mr. John A. Harju, Associate Director for Research, Energy and Environmental Research Center, answered questions for the committee.

In response to a question from Representative Skarphol, Mr. Harju said all Williston Basin gas is coincident to the liquid extraction. He said natural gas should be one-sixth the cost of oil based on British thermal units. He said the price should be $12 but is at under $3.

In response to a question from Representative Skarphol, Mr. Harju said up to the 1950s the gas used in major cities was from a type of gasification of coal.

In response to a question from Senator Horne, Mr. Erickson said the EERC has been working on a microturbine that uses flared gas to make electricity. He said it is commercially viable, but long-term demonstrations need to be done for the full life cycle cost.

In response to a question from Senator Dotzenrod, Mr. Erickson said the EERC has been focusing on drop-in compatible fuels. He said ethanol is a different fuel that is not drop-in compatible.

Mr. Harju provided a presentation (Appendix D) on the Plains CO_2 Reduction Partnership and carbon sequestration. He said carbon capture and sequestration works by capturing carbon dioxide from a major stationary source and compressing the carbon dioxide for transportation to a suitable storage site. He said the carbon dioxide is pumped underground as a liquid at great depth into traps in geological structures. He said to find a place for our carbon sequestration the geology, hydrology injection zone, and cap rock and seal need to be characterized. He said the risk timeline for leakage is heavily laden in the injection period and steeply drops off after that to near zero at 100 years. He said the Plains CO_2 Reduction Partnership has brought together the key stakeholders to make geologic carbon dioxide sequestration a viable option for carbon management. He said the partnership has completed four Phase II field validation tests, including:

1. The Zama acid gas injection site.
2. The lignite carbon dioxide sequestration-enhanced coalbed methane recovery site.
3. The prairie pothole wetlands terrestrial sequestration site.
4. The carbon dioxide sequestration in deep saline formation/enhanced oil recovery site.

Mr. Harju said the partnership is planning Phase III efforts. He said one of those Phase III efforts is in the Williston Basin. He said the concept is to capture approximately one million tons per year of carbon dioxide at an existing coal-fired power plant in central North Dakota and transport the carbon dioxide to the Williston Basin oilfield. He said the partnership is looking at candidate oilfields.

In response to a question from Representative Skarphol, Mr. Harju said an active area of research is using traditional cements used in oil recovery for carbon dioxide sequestration. He said these cements

are highly acid-resistant and carbon dioxide makes a protective coat on the cements.

In response to a question from Senator Horne, Mr. Harju said in the long term, there is mild acidification of water by carbon dioxide. The escape of carbon dioxide would be a negation of the climate change mitigation in the long term. He said in the short term, escape of the carbon dioxide, although not toxic, could be a sufficant if accumulated in a low-lying area. He said another risk is the energy release at the point of injection, i.e., the burst.

In response to a question from Senator Horne, Mr. Harju said rules are being adopted by the state for carbon dioxide sequestration, and when sequestering carbon dioxide, an entity must look for and isolate water through cement.

In response to a question from Senator Andrist, Mr. Harju said although carbon dioxide dissipates into the air, it could stay in one area long enough to asphyxiate through oxygen deprivation.

In response to a question from Senator Horne, Mr. Harju said North Dakota has the capacity to store a substantial volume of carbon dioxide above what is generated in this state. He said the carbon dioxide should be used for enhanced oil recovery, not just stored, because the use for enhanced oil recovery makes carbon dioxide a valuable commodity and subsidizes the cost of sequestration.

In response to a question from Senator Nodland, Mr. Harju said the annual production of carbon dioxide in this state is approximately 40 million tons.

In response to a question from Representative Skarphol, Mr. Harju said Broom Creek appears to be the preferred location because of good seals above and a relatively shallow location. He said because it is shallow it may have to be dealt with by oil and gas companies when exploring for oil and gas; however, these management considerations are dealt with all the time in relation to water.

In response to a question from Senator Nodland, Mr. Harju said the sequestration of one million tons per year of carbon dioxide per year will cover 10 square miles at 25 years underground.

In response to a question from Representative Kaldor, Mr. Harju said the main flow of the carbon dioxide is horizontal underground.

In response to a question from Senator Andrist, Mr. Harju said he is skeptical of an anthropomorphological-modified climate.

In response to a question from Representative Skarphol, Mr. Harju said there are naturally occurring reservoirs of carbon dioxide in the southern United States.

In response to a question from Representative Skarphol, Mr. Harju said carbon dioxide emissions are coincident with the local economy. He said in western North Dakota the local economy is energy production. He said in Wisconsin the local economy is small manufacturing. He said in eastern North Dakota and western Minnesota the local economy is agricultural processing. He said there are not capture opportunities from small sources because it is cost-prohibitive. He said an ethanol plant was investigated as a potential source. He said the average ethanol plant produces eight million cubic feet per day of carbon dioxide. He said the economics of a pipeline require one million cubic feet per day per mile. He said 15 cubic feet to 20 cubic feet per day is required for any meaningful recovery rate in a reservoir.

In response to a question from Senator Horne, Mr. Harju said there needs to be millions of barrels of recovery to justify the expense of enhanced oil recovery. He said in the primary recovery in a conventional field, 15 percent of the oil is recovered. He said in the secondary water flood, 12 percent to 20 percent of the oil is recovered. He said in the tertiary recovery, whatever oil was recovered in the secondary is generally what will be recovered in the tertiary.

In response to a question from Senator Horne, Mr. Harju said the viability of enhanced oil recovery using carbon dioxide in the Bakken is inconclusive. He said the Bakken is never going to have a water flood because it pushes the oil deeper, so carbon dioxide likely will be the secondary recovery.

In response to a question from Representative Skarphol, Mr. Harju said for enhanced oil recovery to work, the carbon dioxide needs to be recycled at a plant at a cost of tens of millions of dollars to construct.

The committee toured the EERC laboratories and facilities.

In response to a question from Representative Klein, Mr. Harju said there will not be duplication at the energy center at Bismarck State College because the center has no reasonable hope in the future of developing what has been developed over many years at the EERC.

Mr. Harju provided a presentation (Appendix E) on the Northern Great Plains Water Consortium. He said water is the most critical limiting resource throughout the world. He said sustainable water supplies are needed for energy production, growing crops, industrial manufacturing, and expanding populations. He said the overall goal of the program is to assess, develop, and demonstrate technologies and methodologies that minimize water use and reduce impacted water discharges from a range of energy technologies, including coal combustion, coal gasification, coalbed methane, and oil and natural gas production. He said one project was to assess the economic potential to recycle fracture flowback water in the Bakken. He said fracture water is fresh water that is used to pressurize and fracture oil-bearing formations to increase permeability and enhance the flow and recovery of oil. He said as much as one million gallons of water per well are used in a fracture job and the water is transported to the well site at great expense by truck. He said there are permitting issues in this state. He said permits to obtain water can be difficult to obtain. He said the State Water Commission is encouraging withdrawal of water from

the Missouri River system for fracture jobs. He said the first task of the consortium is an inventory of industry fresh water use, the second is to assess flowback quality, the third is to evaluate current water-handling costs, the fourth is to evaluate the feasibility of recycle/reuse technologies, the fifth is to assess the current state of existing recycling technologies, and the sixth is to make recommendations and plans. He said there is relatively low recovery of original fracture water within the first 10 days. He said there is very high salinity in flowback water. He said fracture flowback water treatment needs to be oilfield-compatible, robust, mobile, use existing technology, and highly treat the water recovered. He said the problems with recycling Bakken flowback are the slow recovery, the low volume, the high dissolved salts, technological challenges, and treatment is not likely cost-effective in most cases. He said with transportation and disposal, the current fracture water costs range between $2 and $11.75 per barrel. He said treatment of nonpotable ground water may provide an economical alternative resource. He said the Dakota aquifer is a potential water supply. He said different water users use different terms and there is some difficulty in discussing water when people use different terms.

In response to a question from Representative Skarphol, Mr. Harju said the Bakken and Three Forks are separate formations, but whether they are separate oil systems is debatable.

In response to a question from Senator Horne, Mr. Harju said the flowback water has a high negative value and is high in salt. He said recycling would prevent hauling for deep hole disposal.

In response to a question from Senator Nodland, Mr. Harju said the flowback water cannot be used for deicing roads, even though that water is good for deicing roads.

Representative Skarphol said the main objection to using fresh water for fracture jobs is because it is put in the earth and not placed back in the atmosphere. He said it is argued that this use of water is a consumptive use.

In response to a question from Senator Andrist, Mr. Harju said challenges to permits are a big problem. He said every withdrawal permit for oil is challenged. He said it slows down the process and is an abuse of the system.

In response to a question from Representative Brandenburg, Mr. Harju said permits should have categorical exclusions for certain uses in certain amounts.

In response to a question from Senator Wardner, Mr. Harju said the use of water for a fracture job is equivalent to the use of water for a center pivot irrigation system on a quarter section of land. He said the water used by Fargo is 77 fracture jobs per day.

In response to a question from Senator Horne, Mr. Harju said a ceramic proppant, instead of sand, is being used to hold open the cracks made during a fracture job in some instances. He said ceramic proppants have desirable properties of strength and fluidity.

In response to a question from Representative Skarphol, Mr. Harju said hydraulic fracturing is being attacked at the federal level by legislation wanting it to be regulated by the Environmental Protection Agency. He said the major concern is over impact to fresh water. He said there is no known case of an impact to fresh water.

In response to a question from Senator Horne, Mr. Harju said most horizontal wells are run to intercept the most native fractures. He said most wells run the same direction in the same area.

Mr. Erickson provided a presentation (Appendix F) on renewable energy. He said biomass feedstocks include agricultural residues, wood residues, crop oils, municipal solid waste, and energy crops. He said the availability and sustainability of biomass are largely dependent on the commodity crop prices. He said there has been a resurgence in the interest in cofiring biomass with coal. He said a new cap and trade or carbon tax may make biomass cofiring a cheap and easy near-term solution. In addition, he said, many states have renewable portfolios for electricity that require green energy and drive interest in cofiring biomass.

Mr. Erickson said there is a commercially viable gasification system for biomass to be gasified and turned into synthetic gas for power or heat production. He said the EERC has been working with the Aboriginal Cogeneration Corporation in British Columbia to convert railroad ties to electricity using two 1 megawatt biomass gasification systems.

Mr. Erickson said the primary focus of the EERC has been on producing a 100 percent renewable jet fuel for the United States military. He said a commercial demonstration facility is being designed for collocation at the Tesoro refinery in Mandan.

Mr. Erickson said the United States Air Force aims to require 50 percent of its continental United States fuel from a nonpetroleum source by 2016. He said the EERC has developed a drop-in compatible jet fuel. He said the fuel was tested in a rocket launch. He said the fuel provided excellent performance and is cleaner burning than regular fuel.

Mr. Erickson said indirect liquification is currently the only commercially available technology for producing liquid fuels from coal or biomass. He said this is cost-effective at approximately $40 to $50 per barrel of oil. He said the process is similar to the existing Great Plains Synfuels facility except instead of producing synthetic natural gas, the facility will produce liquid fuel through a Fisher-Tropsch synthesis. He said future coal gasification systems could be built to produce three energy sources--electricity, liquid fuel, and hydrogen. He said there are no commercial plants in the United States. He said there is a plant in South Africa. He said an integrated carbon-to-liquid process offers high yield and a low carbon footprint.

Mr. Erickson said the EERC is developing on-demand fueling stations for hydrogen. He said the station would use the existing distribution network. He said the equipment could be integrated into an existing liquid fuel fueling station with minimal impact. He said the first commercial demonstration will be ready in 2010.

Mr. Erickson said wind can be used to replace high-cost natural gas for domestic fertilizer production. He said this derives value from wind without the need for transmission capacity expansion. He said the United States consumption and production capacity for fertilizer are about the same.

Mr. Erickson said algae is part of the answer for United States energy security. He said water consumption varies significantly with the type of system used to produce algae oil. He said a closed-loop design uses less than an open-loop design. He said a pond uses more than a reactor design. He said algae growth can be done in brackish water. He said the gray water from power production, carbon dioxide cleanup, coalbed methane production, and other sources may be used for algae production. He said power plant carbon dioxide may be used for algae cultivation. He said the key is to be able to produce a consistent, high-quality carbon dioxide feedstock. He said the EERC has produced a 100 percent renewable jet fuel from multiple crop oils and expects no difference with algae oil.

In response to a question from Representative Kaldor, Mr. Erickson said the emissions from biomass are lower than coal because biomass is burned at lower temperatures and has no trace minerals.

In response to a question from Senator Miller, Mr. Erickson said the jet fuel is virtually identical to petroleum-based fuel. He said the engine does not know the difference between the two fuels. He said the fuel burns cleaner. He said it is not like ethanol or biodiesel, which are different fuels.

In response to a question from Representative Skarphol, Mr. Erickson said a reasonable-sized plant could produce 25,000 barrels of fuel for an investment of $3 billion to $4 billion.

In response to a question from Senator Dotzenrod, Mr. Erickson said it is the intent of the EERC to have a demonstration project for turning wind into anhydrous ammonia within two years.

No further business appearing, Chairman Wardner adjourned the meeting at 4:20 p.m.

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Timothy J. Dawson
Committee Counsel

ATTACH:6