Approved: April 29, 2004

MINUTES OF THE SENATE AGRICULTURE COMMITTEE

The meeting was called to order by Chairman Derek Schmidt at 8:30 a.m. on March 3, 2004 in Room 423-S of the Capitol.

All members were present.

Committee staff present:
Raney Gilliland, Legislative Research
Lisa Montgomery, Office of the Revisor of Statutes
Robert Myers, Committee Secretary

Conferees appearing before the committee:
Dr. Richard Nelson - Engineering Extension, Kansas State University, Manhattan

Others attending:
See Attached List.

Dr. Richard Nelson appeared before the committee in order to give a briefing on the use of switchgrass as an alternative energy source. He stated that his presence before the committee was due to a call that he had received from a constituent within the district of Senator Lee, bringing to his attention the use of switchgrass there as an alternative source of both electricity and heat. Using a PowerPoint presentation as an aid to his briefing, he began with a quick overview energy issues, both nationwide and worldwide. He pointed out that petroleum will remain the primary source of energy through the year 2025, by which time electricity consumption is expected to have increased by almost 50%. Furthermore, he highlighted the fact that Kansas is a net energy importer, thus indicating the state's future reliance on increasingly unstable countries such as Saudi Arabia for petroleum imports. He used this reasoning to justify his claim that Kansas needs to begin developing its own energy base by way of exploring the use of different resources, such as switchgrass. He continued by giving a listing of biomass resources in Kansas, indicating that the following are the most plentiful:

- soybeans
- urban wood wastes
- primary and secondary wood wastes
- tallows, lards, and greases

In addition, with regard to these and other mentioned biomass resources in Kansas, he stated the following four general end-uses:

1. Combined heat and power (i.e., the burning of a biomass resource in order to generate electricity)
2. Large-scale thermal heat
3. Small-scale thermal heat
4. Liquid fuels, for example biodiesel and bioethanol

He concluded this aspect of his briefing by stressing that Kansas does indeed have an extremely energetic, economic, and environmental potential with regard to the production of bioenergy, pointing out though that it remains a very underdeveloped field.

Dr. Nelson switched to a more specific focus, providing the committee with an overview of switchgrass and its presence in Kansas. He noted that it has a root system of approximately ten to twelve feet, thus allowing for efficient use of water, even during periods of drought. In addition, he stated that 80% of one square mile planted to switchgrass would roughly equal the energy provided by 5,500 barrels of oil. He also indicated that it is a perennial plant, requiring only fertilization following its establishment on a given area of land.

Dr. Nelson stated that the burning of switchgrass would most likely be performed in competition against the use of coal as an energy source. He thus provided a list of both environmental benefits and energy advantages that make switchgrass an appealing alternative. The environmental benefits are as follows:

- rainfall and wind soil erosion reduction
- surface runoff reduction
- nitrogen and agricultural chemical mitigation

- increased soil organic carbon
- "closed" carbon loop (i.e., whatever carbon is produced from the burning of switchgrass at a facility is later used to help the growth of the next year's crop)

The following are the mentioned energy advantages:

- switchgrass contains almost 16 million Btus of energy per ton
- switchgrass has a sustainable energy-profit ratio of 6 to14 at the field edge (i.e., for every unit of energy put into switchgrass, anywhere from 6 to14 units of energy are produced)
- co-firing switchgrass offers the lowest cost renewable electricity

He further portrayed switchgrass in a positive light due to its allowance of efficient of utilization of waste heat in combined heat and power (CHP) applications. He declared these CHP applications as being favorable, partly due to their utilization of already-proven technologies, for example turbines and reciprocating engines (Attachment 1).

The next meeting is scheduled for Tuesday, March 9, 2004.

SENATE AGRICULTURE COMMITTEE GUEST LIST

DATE: 3-3-04

NAME	REPRESENTING
Paul Johnson	
Dan Kepley	
Robyn Studebaker	
Megan Hartman	FB. Cap. Exp
Jim Wagner (instructor)	Officer (VICA)
Diana Zoretic Diana Zoretic	Barton/Pawnee county coordinator FB Capital Exp
Sara Maresch	
Nathan Maresch	
Jason Linsner	
Hallie Chrest	
Robert Johnson	Great Bend FFA
Aaron R. Law	La Crosse High Gov.
Brian Graff	" "
Darrell W. Talbot	Linn county
Eric Castle	Linn County
Kathlyn Conley	Linn County
Angela Hill	Linn Co Women's Chair
Andrea Marshall	Decatur County
Amber Reynolds	Decatur County
James J. Dechant	La Crosse High Gov.
Nick Starkey	"

Dedicated Energy Crop Production & Utilization in the Kansas Economy

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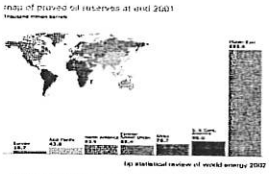
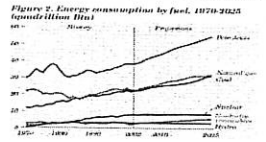
Testimony before the Kansas Senate Agricultural Committee
March 3, 2004

World & National Energy Issues – Quick Overview

- World energy consumption expected to increase **58%** by 2025
- United States energy consumption expected to increase **40%** by 2025
- Petroleum will remain the primary energy source through 2025 and will increase in developing countries significantly (Saudia Arabia's share projected to be 67% by 2025)
- Electricity consumption is projected to increase almost **50%** in the next 20 years with coal the major energy source for electrical generation and increasing **47%**
- Kansas is a ***net energy importer*** (Kansas Energy Plan 2004, p. 5)
- What are/will be the economic, environmental, and energetic effects on Kansas?
- **Kansas should be pro-active in developing its own energy base**





Improve total system efficiency with respect to all energy resources

- Consider Energy Efficiency Resource (fossil fuels and renewables) Allocation
- Environment (air emissions, water quality, sustainability)
- Economics through life-cycle costing

Kansas Biomass Resources

- **Agricultural Crop Residues**
  - corn stover
  - wheat straw
- **Dedicated Energy Crops**
  - switchgrass and big bluestem
- **Oilseed Crops**
  - **soybeans**
  - rapeseed/canola
  - sunflower
  - peanut
  - cottonseed
- Municipal Solid Wastes (MSW)
  - paper
  - newsprint
  - **urban wood wastes**
  - **primary & secondary wood wastes**
  - cardboard (corrugated)
- Agribusiness Processing Wastes/ Residues and By-Products
  - **tallows, lards, and greases**
  - food processing wastes
- Animal Manures (beef, dairy, & swine)

Senate Agriculture
March 3, 2004
Attachment 1

End-uses for Kansas Biomass Resources

1) Combined Heat & Power (CHP)
2) Large-scale Electricity (co-fire w/ coal) {Iowa Charlton Valley, Madison Gas & Electric}
3) Small-scale Thermal Heat (processing energy – hot water heating)
4) Liquid Fuels (biodiesel & bioethanol) {focus of a major DOE effort}

Kansas has the biomass energy resource base utilizing these technologies to make a strong contribution in helping alleviate some of the energy problems this country will face

All applications would bring energy, economic, and environmental benefits to Kansas, especially the rural sector

Our Challenge

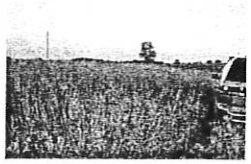
- The state of Kansas has tremendous energetic, environmental, and economic potential in its biomass resources for bioenergy and/or bio-product production
- What strategy is optimum for development, conversion, and implementation of our bio-based resources in a practical and sustainable manner to supply our energy needs and possibly supply a percentage of the needs of the US?

Previous Experiences with Large-scale Biomass Energy Assessment in Kansas

- Significant, applied research effort concerning energetic, environmental, and economic aspects of herbaceous energy crops was undertaken in the mid to late 1990's on use of switchgrass for alternative energy purposes
- Funded by the Kansas Electric Utilities Research Program (KEURP), the state energy office, and the United States Department of Energy

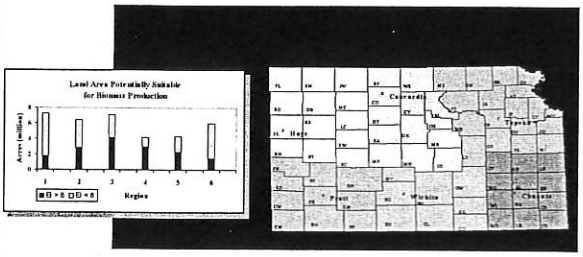
Switchgrass

- Switchgrass is capable of efficiently using water, particularly in warm weather. It's deep root system (10 -12 feet) provides drought tolerance.
- 80% of one square mile planted to switchgrass with a yield of 4 tons per acre would equal 5,500 barrels of oil.



EPR = 6.0 – 14.6

Areas of Switchgrass Production & Potential Acreage



Richard Nelson, KSU & Joseph E. King, Coriolis Presentation to Senate Agricultural Committee 3/3/2004

Switchgrass Yield - NE Kansas

Richard Nelson, KSU & Joseph E. King, Coriolis Presentation to Senate Agricultural Committee 3/3/2004

Dedicated Energy Crop Environmental Benefits

- Rainfall and wind soil erosion reduction (75-99% versus conventional commodity crop rotations)
- Surface runoff reduction (55%)
- Nitrogen and agricultural chemical mitigation (34%)
- Increased soil organic carbon (0.44 tons C per acre per year stored)
- "Closed" carbon loop

Richard Nelson, KSU & Joseph E. King, Coriolis Presentation to Senate Agricultural Committee 3/3/2004

Energy Advantages of Dedicated Energy Crop Production & Use

- Switchgrass contains 15.8 million Btus of energy per ton
- Sustainable energy-profit ratio of 6-14 at the field edge
- A recent Kansas Electric Utilities Research Program study found co-firing switchgrass offers the lowest cost renewable electricity, only $0.01 - $0.015 per kWh more than coal

Richard Nelson, KSU & Joseph E. King, Coriolis Presentation to Senate Agricultural Committee 3/3/2004

Distributed Resources (DER) & Distributed Generation (DG)

- Distributed Energy Resources and Generation — small, modular power-generating technologies connected to the electricity grid that utilize local resource base (wind, biomass, solar). DG systems range in size and capacity from a few kilowatts up to 50 MW.
- DER and DG provide opportunities for *greater local control* of electricity and thermal heat delivery and consumption.
- DER provides more efficient utilization of waste heat in combined heat and power (CHP) applications — boosting efficiency and lowering emissions (33% versus 60% thermal efficiency).

Combined Heat & Power (CHP)

- Conventional, centralized power plants are 33% efficient (67% lost "up the stack" as waste heat)
- CHP generates electricity and uses the "waste heat" for water and/or space heating dramatically improving the total efficiency (33% versus 60%)
- CHP utilizes proven technologies such as
  - Reciprocating Engines (Industrial Grade)
  - Turbines (Aero-derivative, Micro, Steam)
- Useful for smaller applications

Candidate Applications for CHP

- Hospitals
- Colleges / Universities
- High Schools
- Residential Confinement
- High Rise Hotels
- Fitness Centers
- Food Processing
- Paper / Lumber Mills
- Chemical Plants
- Metal Fabrication
- Ethanol Plants
- Landfill/Water Treatment Plants

Biomass: Co-firing

Chariton Valley Project - Iowa

- Swithgrass can be burned in utility boilers - ground and mixed with coal at rates of 5 – 10%
- Co-firing tests have been conducted at the Ottumwa Generating Station in Iowa
- Use of switchgrass in a watershed providing the resource base for co-firing can provide large water quality gains