V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		42%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		29%	
205	Plant Management Systems	30%		23%	
511	New and Improved Non-Food Products and Processes	70%		6%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	19.0	0.0	7.0	0.0
Actual Paid Professional	11.0	0.0	13.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
267253	0	274775	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
290983	0	224912	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Conduct research and extension programs to develop/deliver information on new or improved energy products and technologies and emerging efficiencies of production to Nebraska's ag-based industries.

2. Brief description of the target audience

Land owners, agricultural producers, youth, and graduate and undergraduate students.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	660	1000	1270	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	5	16	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of refereed journal publications related to sustainable energy.

Year	Actual
2012	21

Output #2

Output Measure

- Percentage of Agricultural Research Division HATCH projects in sustainable energy.

Year	Actual
2012	14

Output #3

Output Measure

- Number of workshops, continuing education programs, web-based curricula and field days/tours related to sustainable energy.

Year	Actual
2012	20

Output #4

Output Measure

- Number of new extension publications and other educational resources related to sustainable energy.

Year	Actual
2012	1

Output #5

Output Measure

- Number of new products and decision tools developed and made available to clientele related to sustainable energy.

Year	Actual
2012	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Nebraska will have access to higher educated workforce trained in the new biology with skills applied to addressing critical science in sustainable energy.
2	Extension will assist land owners involved in negotiating land use contracts with wind energy developers (measured by number of land owners participating in educational programs).

Outcome #1

1. Outcome Measures

Nebraska will have access to higher educated workforce trained in the new biology with skills applied to addressing critical science in sustainable energy.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To remain economically viable and environmentally compatible in a rapidly changing world, Nebraska farmers and related agribusiness representatives must have access to a highly educated and trained work force in order to take advantage of new information, incorporate new technologies, and adjust to changing economic, social, and environmental conditions.

What has been done
On September 15, 2012 nearly 85,000 Nebraska football fans witnessed Astronaut Clayton Anderson, 4-Hers, teachers and middle school students launch science experiments 20 miles into the atmosphere using high altitude balloons. The balloons were launched during half time of a Nebraska football game in front of 80,000+ fans. This is part of a pilot program initiative to develop Science, Technology, Engineering, and Mathematics curriculum and experiences for high school youth addressing climate science and engineering awareness.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
511	New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Extension will assist land owners involved in negotiating land use contracts with wind energy developers (measured by number of land owners participating in educational programs).

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2012, 1.3 billion kilowatt-hours were generated by utility-scale wind energy in Nebraska from 260 operational wind turbines with a total capacity of 459 megawatts. The average annual output could power about 165,880 homes. In 2012, Nebraska ranked second in ethanol production capacity, with 25 operating plants having production capacity of 2.25 billion gallons (851,717,651 dal). Over 40% of the State's 2011 corn crop was utilized in ethanol production. At the beginning of 2013, seven of Nebraska plants were either shutdown or idled representing about 30% of the capacity in this state. Commercial biodiesel plants in Nebraska currently have the capacity to produce 5,400,000 gallons although both plants have ceased production.

Our Extension programs no longer target landowners negotiating contracts with wind energy developers. We will rewrite this outcome measure for future annual reporting.

What has been done
Home and Farm Energy Production: UNL has received a grant from DOE to develop research and demonstration of solar and wind energy systems for smaller scale home and farm based energy production. As part of the grant six solar array products, two small wind turbines, and a center pivot powered by 98% ethanol using a specially designed engine are installed at a regional research farm in Northeast Nebraska. Live internet streaming of data is accessible at (http://cropwatch.unl.edu/web/bioenergy/sustainable-energy-options). Performance data collection and associated workshops, tours, and webinars based upon research data and experiences with these operation data began in 2012.

Switch grass Production: Faculty installed a demonstration addressing switch grass production plot and hosted training for Extension Educators and Crop Consultants (through our annual Crop Management Diagnostic Clinics) as part of the CenUSA Bioenergy multistate AFRI grant. In

addition, the Bioenergy Friday Web Seminars continued in 2012 addressing topics of ethanol, energy codes, photovoltaics for electrical power generation, wind physics, biomass production, switch grass production, pyrolysis, farm energy efficiency, turbine certification, and ethanol engines.

Visibility of Wind Towers: Extension faculty is collaborating with National Agricultural Aviation Association and Nebraska Aviation Trades Association in the teaching of owners of wind measurement towers about the importance of marking them correctly. After the death of a California pilot due to an unmarked tower the need for improved visibility was clear and led to this project.

Youth Education: Wired for Wind and related energy curriculum is being targeted for middle school youth. Wired for Wind curriculum was developed for the National 4-H Council in 2011.

Energy Audits for Irrigation Systems: Work is continuing on a joint UNL Extension and Michigan State University curriculum for training individuals displaced by the economic situation to conduct energy audits of irrigation systems for use by the NRCS and US Irrigation Association. In addition the team is developing a tool for predicting pumping plant field performance.

Climate Masters Training: UNL Extension faculty are leading the Climate Masters of Nebraska training program for the purpose of reducing energy consumption and increasing citizen engagement in climate change discussions. The training program, piloted in 2012 with plans for expansion in 2013, is based upon the Master Gardener concept of engaging citizens in public education and demonstration roles around climate and energy related issues.

Results

Home and Farm Energy Production: No results to share at this time.

Switch grass Production: The CenUSA Bioenergy program has engaged over 80 Extension educators and crop consultant on professional development addressing establishment and production of switch grass and warm season perennials. At the Crop Management Diagnostic clinic, crop consultants influencing over 900,000 acres reported a 72% increase in basic agronomic knowledge of switch grass. The Bioenergy Friday Web Seminars engaged 250 live participants and nearly 1,000 archived viewings in 2012 from 16 States. Evaluation of the participants of these professional development sessions suggested that 35% plan to use the information to teach others while 15% plan to use it in written communications such as news columns.

Visibility of Wind Towers: Outputs include over 1500 views of two YouTube videos in the first two months (http://www.youtube.com/watch?v=Mc6TdFmqkE8 and http://www.youtube.com/watch?v=W9VmW3LIULo), contact with every wind measurement tower owner in Nebraska, and registration of one previously unregistered tower (registration is required by state law).

Youth Education: Wired for Wind curriculum has been taught to more than 100,000 youth nationally since it was published in 2011. In Nebraska, energy focused curriculum has been taught to more than 500 youth in 2012.

Energy Audits for Irrigation Systems: No results to share at this time.

Climate Masters Training: Project evaluation showed 19 participants completed the course, 88% of participants reported that the course led them to make informed changes in their lives to reduce

participants towards educating others in their community. In addition, these same faculty developed a climate change resource handbook and curriculum for extension educators and delivered to 130 extension educators across 12 states in the North Central United States through the North Central SARE professional development program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

Economy: 2012 was a year of record setting crop prices for crops and solid year for farm income levels for crop producers. Because of the high grain and forage costs and lack of range and pasture grass production, livestock farmers experience unparalleled feed costs. For ranchers, their ability to secure sufficient forage has forced many to move cows into dry lot production space or significantly down size cow herds. The historical trend of downsizing the beef cow herd as well as cattle placement on feed continued in 2012 and is expected to accelerate in Nebraska in 2013 due to drought conditions. Despite the challenges faced by Nebraska cattle producers, U.S. poultry, egg and pork shipments exceeded previous highs for value and volume set in 2011. International beef sales dipped slightly in volume but broke the previous value record.

According to Bruce Johnson (published in Cornhusker Economics, March 20, 2013, http://agecon.unl.edu/c/document_library/get_file?uuid=7fcaa994-3cda-4041-85e2-9e701058cb1b&groupId=2369805&.pdf) "Despite an extreme drought and indicators of weaker agricultural earnings on the horizon, the markets for agricultural land in Nebraska have remained strong into early 2013. Preliminary findings from the 2013 University of Nebraska-Lincoln Nebraska Farm Real Estate Market Developments Survey show the state's all-land average value rose **25 percent** over the 12-month period ending February 1, 2013 (Figure 1 on next page and Table 1 on page 3). Following on the advances for each of the previous two years of 22 percent and 32 percent, respectively, the 2013 all-land value of $3,040 per acre is more than double the value of just three years previously, in early 2010."

Public policy and Government Regulations: Loss of federal blending credits, implementation of California standards for biofuels, high corn prices and low energy prices have created considerable volatility in corn based ethanol productions. Electrical production ownership by public power authority and low Nebraska electrical rates have slowed wind energy development in Nebraska. However, changes in state law have begun to encourage public/private partnerships for wind energy development resulting in modest wind energy growth in 2012 and several proposed wind energy developments for 2013. 2012 EPA rules

for advanced biofuels is creating an increased demand for ethanol fuel based on sorghum production and creating renewed farmer interest in growing sorghum.

Energy Production in Nebraska: According to a recent Associated Press story by Brandon Nelson, "With corn becoming an increasingly scarce commodity, the ethanol business is feeling the pinch. The persistent drought is taking its toll on the industry and has forced about 20 ethanol plants nationwide to halt production on the corn-based fuel. Data recently provided to the Associated Press by The Renewable Fuels Association shows nearly two-dozen of the nation's 211 ethanol plants have stopped production during the past year. Production is unlikely to resume before the 2013 corn harvest in late August or September and the down time affects the state's production as six of the stalled plants are in Nebraska." At the beginning of 2013, seven of Nebraska plants were either shutdown or idled representing about 30% of the capacity in this state.

Appropriation Changes: Steady state tax collection and soaring federal deficits has led to static state and declining federal budget support in 2012 with significant federal reductions possible in 2013. Elimination of some research and extension program areas is anticipated.

Competing public priorities: The food vs. fuel debate continues to present some public relations challenges for the ethanol industry. However, other factors such as ethanol's high octane property and the need for higher octane fuels as the auto industry standards for fuel efficiency increase suggest a strong long-term future for ethanol demand. The current high prices for corn, due in part to ethanol demand, is creating a demand for additional acres for corn production resulting in fewer acres devoted to other row crops, small grains, and grassland.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UNL Extension has divided into five spires of excellence with four Extension faculty contributing to two action teams addressing energy related topics: 1) Water/Climate/Environment for Agriculture and 2) Water/Climate/Environment for Community. However, these Action Teams have not identified Energy related topics as Signature Outcomes for which statewide implementation of targeted. Our primary evaluation initiatives are focused on UNL Extension's Signature Outcomes. As such, only limited impact data is collected for Energy related UNL Extension programs.

Key Items of Evaluation

No evaluation plan exists for UNL Extension programs related to Energy.