

**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 |
|---------|---|-----------------|-----------------|----------------|----------------|
| 133     | Pollution Prevention and Mitigation                               | 0%              |                 | 15%            |                |
| 201     | Plant Genome, Genetics, and Genetic Mechanisms                    | 0%              |                 | 17%            |                |
| 203     | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | 0%              |                 | 17%            |                |
| 205     | Plant Management Systems  | 30%             |                 | 11%            |                |
| 511     | New and Improved Non-Food Products and Processes                  | 70%             |                 | 40%            |                |
|         | <b>Total</b>  | 100%            |                 | 100%           |                |

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

| Year: 2013               | Extension |      | Research |      |
|--------------------------|-----------|------|----------|------|
|                          | 1862      | 1890 | 1862     | 1890 |
| Plan                     | 13.0      | 0.0  | 7.0      | 0.0  |
| Actual Paid Professional | 5.0       | 0.0  | 12.0     | 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    |
| 144428              | 0              | 245555         | 0              |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 91803               | 0              | 168492         | 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?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

| 2013          | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| <b>Actual</b> | 900                    | 23000                    | 2365                  | 0                       |

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

**Patent Applications Submitted**

Year: 2013

Actual: 1

**Patents listed**

Taurine production in wild type algal strains and genetically modified *Chlamydomonas reinhardtii*

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| 2013          | Extension | Research | Total |
|---------------|-----------|----------|-------|
| <b>Actual</b> | 1         | 17       | 18    |

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

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

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 6             |

**Output #2**

**Output Measure**

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

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 100           |

**Output #3**

**Output Measure**

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

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 1             |

**Output #4**

**Output Measure**

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

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 3             |

**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**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 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**

#### **Results**

### **4. Associated Knowledge Areas**

| <b>KA Code</b> | <b>Knowledge Area</b>   |
|----------------|---|
| 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**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 250           |

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Nebraska has 304 operational wind turbines with a total capacity of 534.18 megawatts (or 534,180 kilowatts for comparison purposes). The average annual output could power about 184,880 homes. In 2013, Nebraska ranked second in ethanol production capacity, There are currently 24 active ethanol production plants in Nebraska, with a combined production capacity of over 2.1 billion gallons of ethanol each year, and requiring more than 700 million bushels of grain in the process. As of December 2013, Nebraska's operating production was 1.82 billion gallons per year, approximately the same level as this same time the previous year. Commercial biodiesel plants in Nebraska currently have the capacity to produce 5,400,000 gallons although both plants are no in operation.

#### **What has been done**

Bioenergy: Bioenergy Friday Web Seminars website and complimentary YouTube channel (Cropwatch Bioenergy) are maintained by UNL faculty. In addition, UNL is a cooperator with an Iowa State University led CenUSA grant (USDA NIFA AFRI) that engages farmers and crop consultants in developing an understanding of switchgrass production. Finally, a biofuel youth curriculum with a hands on experiment was piloted in 2013 with over 250 Nebraska youth. The experiment teaches youth about biofuel production and specifically sugar chemistry where youth test foods and fibers for the presence of sugars, starches, and cellulose.

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>). New products created in

include Home Energy Efficiency Series (seven videos) produced in cooperation with the Nebraska Energy Office, Small Wind Turbine Raising and Construction videos, and a Nebguide on Economics of Solar PV Systems will help people understand the complexity electricity price inflation in their economics calculations.

Energy Literacy: Energy Literacy has become part of the science literacy lexicon. Starting in 2011 with the Wired for Wind curriculum, Nebraska youth have been introduced to engineering and science using wind turbines as our experiment. In 2013 Wired for Wind and other energy curriculum have been shared with 1,450 youth.

### **Results**

Bioenergy: Bioenergy Friday Web Seminars 2013 Highlights include:

- Eight Web Seminars (130 live participants)
- 55% would use the information to teach others
- 23% would use the info for written communications such as newspaper articles
- 575 views of archived videos (of 2013 videos) and 2,500 views since 2011
- 17% from academia, 55% from Extension, 6% from biofuels or renewables industry, and 9% from government agencies.

UNL's bioenergy website had over 16,000 views in 2013 and the complimentary YouTube channel (Cropwatch Bioenergy) over 5,000 views. Through 2013 250 farmers and crops consultants have been engaged in educational programs about switchgrass and bioenergy crop production agronomics and future opportunities through the GenUSA Project. Additionally, a biofuel youth curriculum with a hands on experiment was piloted in 2013 with over 250 Nebraska youth.

## **4. Associated Knowledge Areas**

| <b>KA Code</b> | <b>Knowledge Area</b>                            |
|----------------|--|
| 133            | Pollution Prevention and Mitigation              |
| 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**

Natural disasters: Extreme drought conditions arrive in Nebraska during the spring of 2012 and persisted all year. Residual effects of this drought reoccurred in central and southern regions of in Nebraska into 2013. Most grasslands recovered but reduced grass productions was common in 2013. An early winter storm in northwest Nebraska caused the death of several thousand head of cattle.

**Economy:** As the 2013 fall harvest neared, prices declined compared to 2012's record-setting prices. Because of the high grain and forage costs through the first half of the year, livestock farmers experience continued high feed costs and losses until late in 2013. In addition, the decline in cow numbers, in part, from the 2012 drought resulted in fewer calves and yearlings for placement in feedlots and declining meat supplies. By the end of 2013, beef prices were setting record highs. In addition, the appearance of the PED virus in Nebraska swine herds as well as in many other swine producing regions, is producing smaller supply of pork and record pork prices by the end of 2013. As a result of declining crop prices, land value increased by only 5% in 2013 and land rental rates declined.

There are currently 24 active ethanol production plants in Nebraska, with a combined production capacity of over 2.1 billion gallons of ethanol each year, and requiring more than 700 million bushels of grain in the process. These ethanol plants represent more than \$5 billion in capital investment in the state and provide direct employment for some 1,200 Nebraskans. As of December 2013, Nebraska's operating production was 1.82 billion gallons per year, approximately the same level as this same time the previous year. With the decline in corn prices, Nebraska plants are expected to return to production levels closer to full capacity. However, California restrictions, RFS policy debates in Washington, and limitations of ethanol sales resulting from E-10 mixes of ethanol and gasoline are currently restricting growth of ethanol production.

**Public policy and Government Regulations:** Lack of a five-year farm bill was the primary public policy discussion in 2013. Disappearance of all USDA safety nets for ranchers experiencing extreme drought and other weather related losses will prevent cow numbers from recovering anytime into the near future.

**Appropriation Changes:** Steady state tax collection and soaring federal deficits have led to static state and declining federal budget support in 2012. The end of federal sequester should allow Extension programs to hold steady into 2014. However, the continued growth in student enrollment has resulted in UNL adding 36 new positions in 2013, with approximately six having Extension responsibility, with more faculty position additions anticipated in 2014.

**Competing public priorities:** A customer base that has little connection and no understanding of modern agricultural production systems and a desire to use public policy to design agricultural systems continues as a frustration within the agricultural community. Some aspects of this public oversight of food production is seen as beneficial such as local organic food production, because of potential for premium prices. However, the lack of acceptance by some groups of many production technologies for reducing inputs ( e.g. genetically modified seeds) or increasing production efficiencies and yields (e.g. use of antibiotics and growth promotants in animal production) comes at the same time that society is asking for greater production to meet a growing food and energy feedstock need. These competing public priorities are leaving farmers frustrated with consumer and policy maker scrutiny.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

UNL Extension has 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.