

**V(A). Planned Program (Summary)**

**Program # 5**

**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
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
125	Agroforestry			5%	10%
201	Plant Genome, Genetics, and Genetic Mechanisms			0%	5%
202	Plant Genetic Resources			5%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			10%	15%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			5%	5%
216	Integrated Pest Management Systems			10%	10%
402	Engineering Systems and Equipment			10%	0%
405	Drainage and Irrigation Systems and Facilities			10%	0%
601	Economics of Agricultural Production and Farm Management			5%	10%
603	Market Economics			10%	5%
605	Natural Resource and Environmental Economics			10%	10%
607	Consumer Economics			5%	5%
	<b>Total</b>			100%	100%

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

**1. Actual amount of FTE/SYs expended this Program**

**Auburn University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890

<b>Plan</b>	0.0	0.0	8.0	9.0
<b>Actual Paid</b>	0.0	0.0	6.9	0.0
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**Alabama A&M University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	8.0	9.0
<b>Actual Paid</b>	0.0	0.0	0.0	4.0
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**Tuskegee University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	8.0	9.0
<b>Actual Paid</b>	0.0	0.0	0.0	6.2
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**2. Institution Name:** Auburn University

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	359536	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	359536	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**2. Institution Name:** Alabama A&M University

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	217749
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	340854
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**2. Institution Name:** Tuskegee University

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	331058
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	304176
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**

Research was conducted to address issues related to renewable energy using bio-based feed stocks that ultimately contribute to the relief of energy dependence on foreign sources. The goal of this program is to increase knowledge of bioconversion of feed stocks to bioenergy and bio-products, bio-processing systems, biomass production, and conversion of byproducts into value-added products and to enhance understanding of the long-term sustainability of feedstock production and bio-conversion systems including economics, social issues, land use policies, and energy security and the environment. Specific areas of research include, but are not limited to: alternative crops for efficient production of bioenergy feed stocks, biotechnology of bioenergy crops to enhance production or to enhance its utilization as an energy source, development of agricultural practices for newly identified bioenergy crops, and technology development for bioenergy conversion. This priority is aligned with new initiatives on Bioenergy and Bio products Research in DOE, USDA, and several other federal agencies, and with the huge energy demands in the state and the nation.

**2. Brief description of the target audience**

Researchers, educators, extension personnel, community leaders, educators, 4H, youth centers, energy consumers, general public.

### 3. How was eXtension used?

eXtension was not used in this program

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

#### 1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

##### Patent Applications Submitted

Year: 2014

Actual: 1

##### Patents listed

TREATED BIODIESEL GLYCERIN

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

##### Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	41	41

### V(F). State Defined Outputs

#### Output Target

##### Output #1

##### Output Measure

- Publications

Year	Actual
2014	41

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased percentage of bioenergy in the overall consumption of energy
2	Development and demonstration of logistics for bioenergy production

**Outcome #1**

**1. Outcome Measures**

Increased percentage of bioenergy in the overall consumption of energy

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Development and demonstration of logistics for bioenergy production

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2014	0

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

**Issue (Who cares and Why)**

Efficiency of bioenergy crops have to be evaluated

**What has been done**

Several white flesh sweet potato germ plasm high in dry matter have been evaluated. Studies on bamboos and Miscanthus as potential energy crops have been initiated

**Results**

Several high dry matter and yielding and sweet potato germ plasm has been selected for their ethanol production potential. Genetic mapping of Miscanthus species is in progress. AAES researchers studying algae production have shown that benthic algae production is possible even in cold-weather seasons in Alabama. They have collaborated with an Alabama algae company to successfully produce diesel fuel from algae.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
125	Agroforestry
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
402	Engineering Systems and Equipment
405	Drainage and Irrigation Systems and Facilities
601	Economics of Agricultural Production and Farm Management
603	Market Economics
605	Natural Resource and Environmental Economics
607	Consumer Economics

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

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

##### Brief Explanation

Gas prices, national and global markets, and availability of other types and sources of energy can seriously affect the outcomes. Continued funding is required to produce meaningful results.

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

##### Evaluation Results

Auburn University is collaborating on a USDA Bioenergy CAP grants. Working with this CAP project consortium, various public-public, and public-private partnerships have been developed including: The Southeastern Partnership for Integrated Biomass Supply Systems (IBSS) will reduce risks surrounding sustainable, reliable, and predictable supply of lignocellulosic feedstock needed for commercial biofuels production. The IBSS Partnership, which includes ArborGen, Auburn University, Ceres, North Carolina State University, the University of Georgia, and The University of Tennessee, has three overarching goals are:

- Demonstrate solutions to economic and environmental barriers that limit biofuel production.
- Introduce new tools and metrics for effective decision-making in site selection and

regional deployment of biofuels production from lignocellulosic biomass.

- Provide credible, impactful, and integrated education, extension and outreach (E2O) programs that train the workforce needed, and inform stakeholders and policy makers with the knowledge necessary to enable the Southeast's biofuels industry.

The IBSS Partnership and Rentech are tightly integrating the IBSS sustainable biomass production and supply processes with Rentech's biomass gasification and drop-in fuels production processes. Rentech's clean energy portfolio includes biomass gasification technology that can produce synthesis gas for production of renewable power and fuels. They own the patented Rentech Process, based on Fischer-Tropsch chemistry, to produce hydrocarbon mixtures. Standard refining practices upgrade the hydrocarbon to diesel or jet fuels or industrial chemicals process and we are nearing the end of a DOE-funded project to design and build a 20 ton/day biomass gasifier to provide synthesis gas.

Specific outcomes include 1. Demonstrated performance of IBSS feedstock in the Rentech pilot plant for production of diesel and jet fuels. This could include four 60-day demonstrations on four separate IBSS feedstocks producing ca. 9000 gallons of fuel from each feedstock. (1,200 tons of IBSS feedstocks would be required for each 60-day run). 2. Availability of Rentech's drop-in diesel to IBSS feedstock partners for planting, harvesting and chipping operations, as well as jet fuel for certification and demonstration.

The IBSS-Rentech partnership will advance additional education, Extension and outreach efforts in local communities to assess their viability as a biomass to liquid fuels host site. The first group of SEED Fellows from Auburn and Tuskegee Universities recently spent 10 days at Rentech's BioEnergy Center of Excellence learning about the Rentech processes and experiencing technology development environment, providing a foundation for further work.

This multi-institutional project involves researchers and outreach specialists from academic, government, and industry organizations across the southeastern U.S. It leverages significant prior investment and extensive expertise in producing alternative liquid fuels from cellulosic biomass. The IBSS Partnership is uniquely qualified to accelerate the deployment of a drop-in fuels industry in the region

### **Key Items of Evaluation**

The IBSS Partnership is currently operating under a grant funded by USDA's National Institute of Food and Agriculture. The grant was independently peer-reviewed and awarded a total of \$15 million in funding over 5 years; however, the total funding was \$30 million less than requested for the complete project. Bioenergy research depends on continued funding. Its long-term impact will depend on many factors, in particular the gas prices, and availability and economics of many different types of energy sources such as wind, solar, natural gas, etc.