

MARKET DEVELOPMENT FOR COMMERCIALIZATION OF BIOPOWER IN ALABAMA

FINAL REPORT



**Project Administrative Director: Glen D. Zorn, CCA, Associate Commissioner,
Alabama Department of Agriculture and Industries,
Richard Beard Building, 1445 Federal Drive, Montgomery, AL 36107-1100
Phone: (334) 240-7100, Email: Gzorn@agi.state.al.us**

**Project Technical Director: David I. Bransby, Professor, Energy Crops and Bioenergy,
Department of Agronomy and Soils, 202 Funchess Hall, Auburn University, AL 36849.
Phone: (334) 844-3935, Email: bransdi@auburn.edu**

**Funded by the Federal-State Marketing Improvement Program (FSMIP)
Agricultural Marketing Service, USDA
Janise Zygmunt, Staff Officer
1400 Independence Avenue, SW., Room 4009-South, Washington, DC 20250
Telephone: (202) 720-2704 E-mail: janise.zygmunt@usda.gov**

Project Period: 09/01/04 to 12/31/05

CONTENTS

	Page
Abstract	1
1. Goal and Objectives	2
2. Procedures and Results by Task	2
Task 1. Outreach Activities	2
Task 2. Evaluation of Milling and Transporting Biomass Feedstocks	6
Task 3. Biomass Supply Analysis	14
Task 4. Biopower Market Analysis	26
3. Project Conclusions	34
4. Recommendations for Future Work	34
Appendix A: Field day/seminar programs	35
Appendix B: Focus group PowerPoint presentation	38
Appendix C: Focus Group Materials and Detailed Results	44
Appendix D: Distribution List	62

Cover Photo: Switchgrass bales prior to being co-fired with coal to produce biopower, or green power at the Alabama Power Company electric generation plant in Gadsden, Alabama.

**MARKET DEVELOPMENT
FOR COMMERCIALIZATION OF BIOPOWER IN ALABAMA**

FINAL REPORT

Project Period: 09/01/04 to 12/31/05

Project Administrative Director: Glen D. Zorn, CCA, Associate Commissioner,
Alabama Department of Agriculture and Industries,
Richard Beard Building, 1445 Federal Drive, Montgomery, AL 36107-1100
Phone: (334) 240-7100, **Email:** Gzorn@agi.state.al.us

Project Technical Director: David I. Bransby, Professor, Energy Crops and Bioenergy,
Department of Agronomy and Soils, 202 Funchess Hall, Auburn University, AL 36849.
Phone: (334) 844-3935, **Email:** bransdi@auburn.edu

Table 1. Project participants, their affiliations and their project involvement by task.

Individual/Entity	Task#			
	1*	2	3	4
Mr Glen Zorn, Administrative Director, Al Dept of Ag & Ind.	x	x	x	x
Dr. David Bransby, Technical Director, Auburn University**	x	x	x	x
Dr. Patricia Duffy, Farm Budget Economist, Auburn University	x	x		x
Dr. Diane Hite, Environmental Economist, Auburn University				x
Mr. Matt McArdle, Mesa Reduction Engineering Inc.		x		
Mr. Ken Muehlenfeld, Forestry Specialist, Auburn University	x	x	x	x
Ala. Dept. of Corrections and Wilson Farms	x			

* Task 1 = Outreach Activities, Task 2 = Milling Tests, Task 3 = Biomass Market Analysis, and Task 4 = Biopower Market Analysis.

Abstract

The goal of this project was to encourage market development and commercialization of biopower in Alabama. We addressed this goal in four separate tasks: (1) field demonstrations of biomass crop production; (2) research on processing and transporting biomass feedstocks; (3) biomass supply analysis; and (4) market analysis for green electricity. In Task 1 seminars, field days and demonstrations were very highly rated by attendees, and several PowerPoint presentations were developed for further use in the future. Studies conducted on switchgrass, bahiagrass and wood chips by Mesa Reduction Engineering in Task 2 indicated that size reduction of biomass in the field will increase bulk density and reduce transport costs. The analysis of biomass availability in Task 3 revealed that on average, only 8.8% of biomass available within 50 miles of the 9 coal fired power plants in Alabama would be needed to replace 5% of the energy provided by coal in co-firing operations. This suggested that biomass supply was definitely not

a limitation to co-firing biomass with coal. Focus group work in Task 4 suggested that low participation in green power programs was more due to ineffective advertising than to a reluctance of the public to pay a premium for green power. We conclude that commercialization of biopower offers a major market opportunity in Alabama and results from this project will be extremely helpful in pursuing this goal.

1. Goal and Objectives

The overall goal of this project was to conduct activities that will lead to market development and commercialization of biopower in Alabama, neighboring states, and other regions of the country. In accordance with the needs listed above, **specific objectives** of the project were to:

- 1) Condition the biopower market for commercialization by conducting field demonstrations of biomass crop production and harvesting on a commercial scale, and by arranging seminars and field days for county agents, producers and industry;
- 2) Conduct research on processing and transporting a range of different biomass feedstocks;
- 3) Conduct biomass market analysis, including documentation of location and size of coal fired power plants in the state, and an inventory of different biomass feedstocks by county; and
- 4) Evaluate the market for biopower by determining expectations of utilities and producers of biomass, responses of consumers to green labeling and pricing, and impacts of government incentives on commercial viability of electricity produced from biomass.

2. Procedures and Results by Task

The work plan for this proposed project was divided into four main tasks which were directly related to the four project objectives listed above.

Task 1. Outreach Activities to Condition the Biopower Market for Commercialization (Lead PI: Bransby)

Production of biomass crops and bioenergy constitute an emerging industry which is still not well defined, which differs from existing agricultural industries, and which is completely unfamiliar to almost all county agents, producers, utilities and the general public. Furthermore, even though research efforts on herbaceous biomass crops have focused mainly on switchgrass, a wide range of both annual and perennial crops can be used to produce energy, and this needs to be demonstrated and clearly communicated to potential stakeholders. Demonstration and outreach activities are therefore a critical component of effective market conditioning.

Task 1a. Demonstration harvesting

Harvesting of energy and traditional crops was conducted and demonstrated as scheduled at the Fountain Farm of the Alabama Department of Corrections, Atmore, South Alabama, and at the Wilson Farms near Talladega (Figure 1).

Task 1b. Economic analysis

Economic analysis of different energy and traditional cropping practices was conducted, both with and without use/modification of the switchsym computer model. These analyses were presented in the seminars held at each location.

Task 1c. Seminars, field days

Seminars and field day programs (Appendix A) were held as follows:

October 18, 2004: Atmore seminar and field day (Figures 1 and 2). Attendance was disappointing (17), probably due to the advent of Hurricane Ivan right before this meeting and cotton harvesting season. However, several county agents attended and there was strong interest among attendees.

October 22, 2004. Childersburg, Gadsden (Figures 3 and 4). A 3-hour morning Seminar was held at Childersburg, with afternoon visits to the Wilson Farm and the Alabama Power coal fired power plant at Gadsden to observe co-firing switchgrass with coal to produce electricity. Attendance at this meeting was better (32) and the evaluation of the program by participants was again excellent.

October 25, 2004. Montgomery seminars for state legislators and state agency personnel. Attendance: 26.

(a)



(b)



Figure 1. Participants at the Atmore field day observing (a) dry bahiagrass being chopped with a silage chopper and blown into a dump truck, and (b) a pile of chopped bahiagrass that had received over 2 inches of water from a sprinkler, but which was wet to a depth of only 2 inches

(a)



(b)



Figure 2. Participants at the Atmore field day (a) discussing annual energy crops, with a giant reed (*Arundo donax*) demonstration in the background, and (b) observing a switchgrass plant and its extensive root system.

(a)



(b)



Figure 3. (a) Participants from the Childersburg field day discussing annual energy crop demonstrations at the Wilson farm, and (b) a tractor operator removing a bale of hay from the biomass storage area at Alabama Power's Plant Gadsden.

(a)



(b)



(c)



Figure 4. (a) Participants from the Childersburg seminar observing (b) a tractor operator loading a bale of switchgrass into a tub grinder at Plant Gadsden before it is co-fired with coal to produce green electricity, and (c) a plot of “Alamo” switchgrass in winter.

Task 2. Evaluation of Milling and Transporting Biomass Feedstocks (Lead PI: M. McArdle, Mesa Reduction Engineering and Processing, Inc.)

Biomass is one of the most promising renewable energy resources available to Alabama and the nation at large. The development of biomass as a feedstock for use as a biofuel (ethanol) or for biopower (electricity) has been receiving a substantial amount of attention. A major component of the economics of biomass is the transportation and processing requirements of the materials for use in a conversion process/facility to make fuel, power, or other value added products.

One of the major obstacles to widespread use of biomass resources is the cost to transport the material from where it is grown to the conversion facility. Due to the low bulk density and energy content of biomass materials when compared to fossil based resources like coal and oil, the adoption of biomass energy systems has been slow to develop. Overcoming the low bulk density of the biomass materials through the use of a new milling technology is a potential way to address this problem.

Three potential biomass resources were evaluated: switchgrass, bahiagrass, and wood chips. These materials were chosen because of their extremely different physical properties, wide availability and/or potential availability: switchgrass has the potential to be a high yielding crop but currently is not grown on a large scale, bahiagrass is already grown on millions of acres and could be put to use immediately, and wood chips and wood residues are another type of opportunity feedstock, like bahiagrass, that could be put to immediate use.

Objective

The objective of this study was to run pilot scale tests on three energy feedstocks through a new size reduction mill developed by Mesa Reduction Engineering (Mesa) called the Collision Mill.

Procedure

Mesa performed a feedstock evaluation for three types of biomass materials: switchgrass, bahiagrass and wood chips. The switchgrass and bahiagrass were received in bales. The wood was received in a chipped form. All of the materials were evaluated based on their as received bulk density and moisture content, both before and after processing. Switchgrass is a warm season grass with very thick stems. It grows well in marginal soils and produces very high yields with very low inputs. While switchgrass previously grew in rangeland over millions of acres in the United States, it has been substantially reduced in many rangeland areas by heavy grazing, and is now restricted largely to Conservation Reserve Program (CRP) land in the Mid-west and Great Plains. Very little is grown in the Northeast and Southeast. Bahiagrass, is a common warm season pasture grass in the Southeast, and has significantly more leaf material when compared to the stem consistency of switchgrass. It is already widely established on millions of acres in the Southeast and is a good candidate for immediate use in a bioenergy enterprise. Wood chips are a completely different feedstock from a processing perspective when compared to the two herbaceous crops, and represent another significant opportunity fuel for a bioenergy facility.

One bale of switchgrass and one bale of bahiagrass were shipped to Mesa in Geneva, New York. The grasses were received in round bales with the switchgrass weighing 1,000 pounds and the bahiagrass weighing 750 pounds. Wood chips were acquired from a local lumber mill in New York. The chips were delivered to the plant in a walking floor tractor-trailer.

The objective of the test program was to determine the ability to reduce in size the three feedstocks in the prototype mill developed by Mesa. The prototype mill used in the tests can process feedstocks with a wide range of moisture content, from very dry bulky materials to wet slurry materials. The flexibility of the Collision Mill technology is extremely valuable to a bioenergy operation because it can handle virtually any type of feedstock.

For the size reduction tests conducted for this study, the ability to process the material to a form desirable for use in a bioenergy operation was assessed by means of the following:

1. Grinding ability
2. Feed rate to the mill
3. Residence time in the mill
4. Airflow through the mill
5. Moisture content of the biomass
6. Particle size of the processed biomass

The tests were conducted using a 150 Horsepower Collision Mill manufactured by Mesa and located in a biomass processing building located in Geneva, New York, where the following equipment is housed:

1. Weigh scale for incoming deliveries
2. Outdoor unloading and storage area
3. Front end loader
4. Raw material feed bin
5. Metal detection and removal system
6. Mill feed conveyor and feed hopper
7. Milling equipment
8. Pneumatic mill discharge equipment
9. Cyclone
10. Dust collector
11. Metering bin
12. Pneumatic transport to coal boiler

Key aspects of the processing system are shown in Figure 5.

The baled switchgrass and bahiagrass were broken up separately with the use of a tub grinder. Wood was delivered already in chipped form and unloaded from the walking floor trailer. Each of the materials was

separately fed into the raw material feed bin by the front-end loader. For each trial run 250 pounds of material were fed to the Collision Mill. An ATM Corporation Sonic Sieve Sifter was used to perform the size distribution analysis on each of the processed materials. Samples of each of the trial runs were collected and analyzed at different size fractions.

Each of the materials was separately fed into the raw material feed bin and conveyed to the feed hopper leading to the Collision Mill. The feed hopper was continually replenished to provide a continuous material feed to the mill. Residence time of the material in the mill was controlled by the pneumatic air discharge system.

Once the processed materials exited the mill the pneumatic discharge system transported the material into the cyclone separator where it dropped out of the transport air to the bottom of the cyclone. A rotary airlock discharged the processed material to a pneumatic line that delivered the material to the metering bin where the finished material was collected.

The pneumatic transport air that carried the material from the mill to the cyclone separator was collected along with any fines by a bag house filter system. Fine dust particles were separated from the air prior to the discharge of the clean air to the atmosphere. Dust particles collected in the bag house filter fell to the bottom hopper and were discharged through a rotary airlock to the pneumatic discharge line that feeds the metering bin.

The entire system is capable of collecting 100% of the processed material with no loss of fines or dust particles. The milling of biomass materials creates a significant amount of dust, and a closed system such as this is critical for capturing all of the processed material and maintaining a dust free environment.

Results

1. Switchgrass

The switchgrass was fed into the raw material feed bin in 250 pound batches and conveyed to the feed hopper leading to the Collision Mill. The conveyor was set to continually replenish the feed hopper as material was being fed into the mill. As the material entered the mill it was reduced in size through a series of high-speed head on collisions. The amount of time the material stayed in the mill was controlled by the pneumatic transport air that is pulled through the inlet of the machine with the raw material.

Overall analysis of the pre and post processing of the switchgrass sample indicated the following:.

Material: Switchgrass, received in a round Bale.

Bale Weight: 1,000 pounds

Moisture Content: 15%

Temperature: Ambient

Bulk Density: Bale form = 10 lb/ft³, debaled = 5 lb/ft³, Milled = up to 10 lb/ft³.

Particle Length: 5 feet in Bale, 1 foot after debaling, 100% minus 0.5" after milling.

	
<p>Bale Grinder</p>	<p>Raw Material Bin</p>
	
<p>Milling Equipment</p>	<p>Pneumatic Air Discharge</p>
	
<p>Cyclone and Bag House</p>	<p>Processed Switchgrass</p>

Figure 5. Processing equipment for size reduction tests.

The switchgrass was run in four different batches in order to vary the residence time of the material in the mill. The pneumatic transport air system was varied between 3,000 cubic feet per minute (CFM) to 12,000 CFM. At the different airflow rates the switchgrass was being processed at rates between 1.5 and 5 tons per hour.

At the lower airflow rates the switchgrass remained in the mill for a longer period of time enabling significantly more collision grinding to take place. As a result, a much finer material was produced once the material exited the mill. At 3,000 CFM the mill processed the first batch of material in approximately 5 minutes.

Table 2. Switchgrass throughput tests

CFM	Pounds Per Test	Test Duration (Min)	Pounds Per Minute	Pounds Per Hour	Tons Per Hour
3000	250	5	50.00	3,000	1.50
6000	250	3	83.33	5,000	2.50
9000	250	2	125.00	7,500	3.75
12000	250	1.5	166.67	10,000	5

At the higher airflow rates the switchgrass residence time was significantly less allowing for a reduced amount of size reduction to occur. However, the mean particle size of the material at the higher airflow rates was still under 0.5-inch, which is well below the desired particle size for most bioenergy plant applications. As a result, the increased throughput rates create a much more economical process that will produce a final product that is easy to convert to either a fuel or power.

Table 3. Capacity, particle distribution, bulk density and moisture content of the switchgrass samples.

Throughput Capacity	Average Particle Size	Bulk Density (lb/ft ³)	Moisture Content Before Processing	Moisture Content After Processing
1.5 Tons Per Hour	.125"	12	15	10
2.5 Tons Per Hour	.250"	10	15	12
3.75 Tons Per Hour	.375"	10	15	12
5 Tons Per Hour	.500"	9	15	15

2. Bahiagrass

Overall analysis of the pre and post processing of the bahiagrass sample indicated the following:

Material: Bahiagrass, received in a round bale.

Bale Weight: 750 pounds

Moisture content: 18%

Temperature: Ambient

Bulk Density: Bale form = 8 lb/ft³, debaled = 3 lb/ft³, milled = up to 10 lb/ft³.

Particle Length: 3 feet in bale, 1 foot after debaling, 0.5-inch minus after milling.

The bahiagrass was run in three different batches in order to vary the residence time of the material in the mill. The pneumatic transport air system was varied between 6,000 cubic feet per minute to 12,000 cubic feet per minute. At the different airflow rates the bahiagrass was being processed between 1.8 and 4 tons per hour.

Table 4. Bahiagrass throughput tests

CFM	Pounds Per Test	Test Duration (minutes)	Pounds Per Minute	Pounds Per Hour	Tons Per Hour
6000	250	4	62.50	3,750	1.88
9000	250	3	83.33	5,000	2.50
12000	250	2	125.00	7,500	4

The lower throughput of the bahiagrass compared to switchgrass is attributed primarily to the leafy nature of the material and lower bulk density. The material appeared to remain loosely packed in the hopper leading to the Collision Mill and did not flow as readily as the switchgrass stalks. Bahiagrass also appeared to be more buoyant, allowing it to remain suspended in the mill before it was discharged with the transport air. Further trials will be conducted to ascertain if a different feed system would assist in increasing the volumetric feed rate to the mill as well as increasing the overall throughput.

At the lower airflow rates the bahiagrass remained in the mill for a longer period of time when compared to the same airflow rates used during the switchgrass trials. While the size distribution of the finished product between the bahiagrass and switchgrass was similar, the overall throughput for bahiagrass was lower. At 6,000 CFM the mill processed the first batch of bahiagrass in approximately 4 minutes compared to 3 minutes for switchgrass.

Table 5. Capacity, particle distribution, bulk density and moisture content of the bahiagrass samples.

Throughput Capacity	Average Particle Size	Bulk Density (lb/ft ³)	Moisture Content Before Processing	Moisture Content After Processing
1.8 Tons Per Hour	.250"	10	18	12
2.5 Tons Per Hour	.375"	9	18	18
4 Tons Per Hour	.500"	8	18	18

3. Wood chips

Overall, the throughput capacity of the Collision Mill was significantly increased while processing woodchips at similar airflow rates. The primary reason for this was the very high bulk density of the woodchips when compared to the switchgrass and bahiagrass. The primary factor for the difference in densities is the extremely high (40%) moisture content of the wood. There were also some slightly larger pieces of wood that exited the mill at the higher throughput rates, with a few pieces close to $\frac{3}{4}$ of an inch in size. Additional trials will be conducted to determine if these larger particles were the result of the lack of material flow at the beginning or end of the trial runs at higher velocities.

Overall analysis of the pre and post processing of the wood chip sample indicated the following

Material: Wood, received in chipped form.

Moisture content: 40%

Temperature: Ambient

Bulk Density: Chipped form = 15 lb/ft³, Milled = up to 25 lb/ft³.

Particle Length: 2-inch chip, $\frac{3}{4}$ inch and under after milling.

Table 6. Wood chip throughput tests

CFM	Pounds Per Test	Test Duration (minutes)	Pounds Per Minute	Pounds Per Hour	Tons Per Hour
3000	250	4	62.50	3,750	1.88
6000	250	2.5	100.00	6,000	3.00
9000	250	1.5	166.67	10,000	5.00
12000	250	0.75	333.33	20,000	10

The wood chips were run in four different batches in order to vary the residence time of the material in the mill. The pneumatic transport air system was varied between 3,000 CFM to 12,000 CFM. At the different airflow rates the wood chips were being processed between 1.8 and 10 tons per hour. The higher throughput rate for the woodchips was primarily due to the greater bulk density of the material.

Table 7: Capacity, particle distribution, bulk density and moisture content of the wood samples.

Throughput Capacity	Average Particle Size	Bulk Density (lb/ft ³)	Moisture Content Before Processing	Moisture Content After Processing
1.8 Tons Per Hour	.250"	25	40	30
2.5 Tons Per Hour	.375"	25	40	30
3.75 Tons Per Hour	.500"	20	40	35
5 Tons Per Hour	.750"	20	40	40

Transportation

One of the focal points of this study was to evaluate the impact of milling the biomass materials and the corresponding increased bulk density. The processing trials indicate that at the higher throughput rates and increased bulk densities, processing in the field may be a way to decrease the total delivered cost of the different feedstocks. Previous work has shown field chopping is one of the most economic means of material collection. The drawback to this approach is the low bulk density of the chopped material. Milling at the point of harvest or at a satellite facility increases the bulk density, thereby reducing the cost of transportation and making the economics of biomass more attractive.

By milling the material after field chopping you can almost double the bulk density of the biomass material. Additional densification in a briquette, cube, or pellet form can further increase bulk density. For example, a tractor-trailer will hold about 10 to 13 tons of herbaceous field chopped biomass. A milled biomass material in the same tractor-trailer can hold up to 20 tons of material. By increasing the bulk density of the material it can be transported a greater distance to the plant. This will allow for a larger area and number of acres that could potentially enter the supply chain.

Further, having a remote processing system would eliminate the need for separate handling and processing equipment at the processing facility. A finished ready to use material could be delivered directly to the plant or stored at a satellite facility and delivered when needed. Milling at the point of production is possible and would have the benefit of delivering a ready to use feedstock to multiple end use conversion facilities.

Summary and Conclusions

The main conclusions that can be drawn from this size reduction study are:

- The Collision Mill is capable of producing a fuel ready to use at a conversion facility.
- The Collision Mill is fuel flexible, allowing for a wide range of biomass materials with different bulk densities and moisture contents to be processed in a single machine.
- Transportation costs for field chopped material can be reduced by 30-40% due to greater bulk densities.
- In-field processing can reduce handling costs and the need for redundant handling systems at end use facilities.
- Increased residence time in the Collision Mill does allow for greater size reduction of all biomass materials.
- Increased residence time reduced overall moisture content.
- Higher throughput rates resulted in slightly larger particles and no reduction in moisture content.
- Energy consumption per ton was greatly reduced at higher throughput rates.
- Herbaceous crops with lower moisture contents and bulk densities were reduced to a finer consistency.
- Both of the herbaceous samples performed in a very similar manner during the milling trials.
- Size distribution of the herbaceous materials was essentially equal once the material was milled.
- Wood chips had the overall highest throughput along with the highest moisture content. As a result, the cubic foot density of the wood resulted in greater bulk density per unit processed.

Task 3. Biomass Supply Analysis (Lead PI: Muehlenfeld)

Justification: In order to establish the locations in the state where biopower offers the greatest opportunities, potential demand for biomass feedstocks needs to be established in terms of size and location of existing coal fired power plants. Similarly, the potential to meet these demands needs to be established by determining the availability of both herbaceous and woody feedstocks at the county level.

Task 3a. Survey of coal fired power plants: A survey was conducted to determine the location and size of all the coal fired power plants in the state. This included plants belonging to Alabama Power Company, the Tennessee Valley Authority and members of the Alabama Rural Electric Cooperative. Data were obtained mainly by searching the Energy Information Agency (EIA) website (<http://www.eia.doe.gov/>) and are summarized in Figure 6.

Task 3b and 3c. Survey of biomass availability: A survey was conducted to also determine the availability of agricultural and woody biomass within a 50-mile radius of each power plant, along with other potential competing consumers of biomass, such as pulp mills and saw mills. This was done mainly by acquiring data from the USDA agricultural statistics website.

Results are summarized in Table 8 and Figures 6 – 15. Apart from the Colbert and Widows Creek plant which are near the Tennessee Valley cropping region in the northern, there was more forest related biomass available when compared to agricultural biomass. Of particular interest is the relative amount of biomass needed from within 50 miles of plants in order to replace 5% of the coal by means of co-firing. On a state wide basis, 28.5 million tons of coal are used each year, and 23.9 million tons of biomass are available within 50 miles of power plants. If it is assumed that coal contains 13,000 Btu/lb, and biomass 8,000 Btu/lb, then in order to replace 5% of the coal energy in the state with energy from biomass by co-firing, only 8.8% of the total available biomass would be needed. This figure varies among the different plants as follows: Barry, 9.8%; Colbert, 8.7%, Gadsden, 1.3%; Gaston, 17.7%; Gorgas, 9.9%; Greene Co., 2.1%; Lowman, 2.5%, Miller, 20.6%; and Widows Creek, 9.4%. Not surprisingly, smaller plants needed a much lower proportion of available biomass to co-fire 5 % than did larger plants. This suggests that even with competing demands for biomass from competitors, co-firing 5% is entirely feasible from a supply point of view, probably at all plants, but especially at the smaller ones. In addition, just 5% co-firing on a state wide basis would create a market for 2.1 million tons of biomass, and at a price of \$50/ton delivered, this would amount to a new market of \$105 million along with stimulation of transport and other related activities.

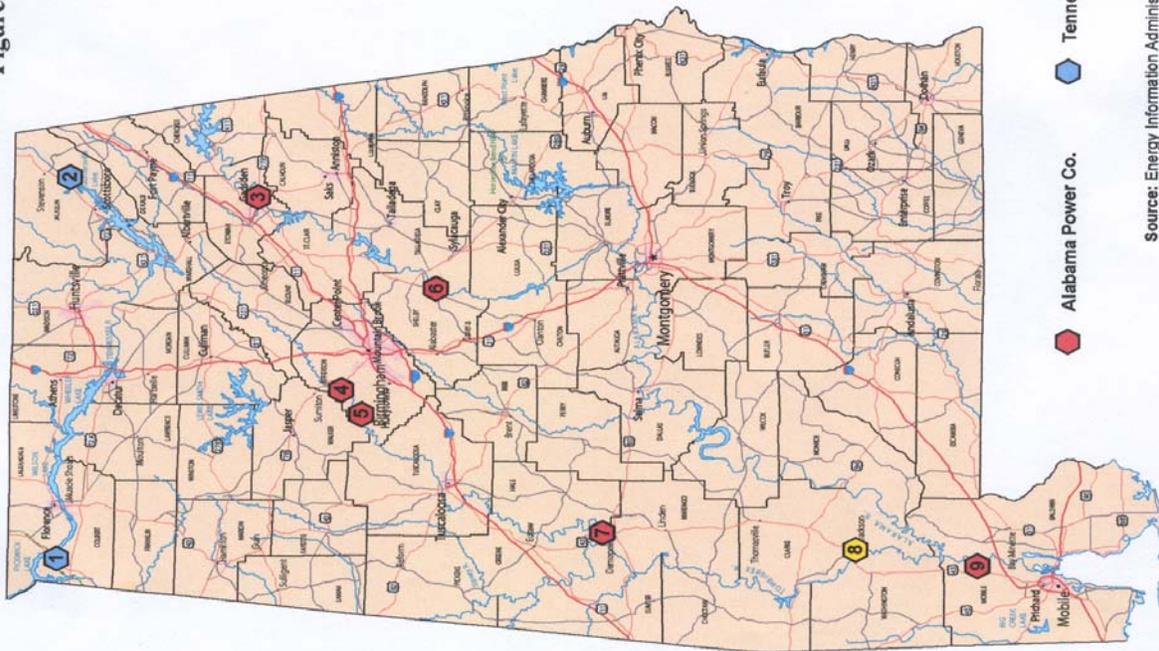
Table 8. Location, capacity, and coal consumption of coal fired power plants in Alabama, and available biomass within a 50 mile radius of each.

Power Plant	Capacity (Megawatts/yr)	Coal Consumption (tons x 1000/yr)	Forest Biomass	Agricultural Biomass	Total Biomass
			------(dry tons x 1000/yr)-----		
Barry	1,617	3,510	2,317	588	2,905
Colbert	1,350	3,250	1,150	1,890	3,040
Gadsden	138	300	1,040	873	1,913
Gaston	2,013	4,370	1,668	333	2,001
Gorgas	1,417	3,075	2,127	399	2,526
Greene Co.	299	650	2,129	362	2,491
Lowman	538	1,170	3,408	325	3,733
Miller	2,822	6,125	1,965	454	2,419
Widows Creek	1,828	3,350	1,067	1,830	2,898

Figure 6. Location, generating capacity, and coal consumption of coal fired power plants in Alabama

Alabama's Coal-Fired Generating Plants

	PLANT NAME	COAL-BASED GENERATING CAPACITY (megawatts/yr.)	COAL CONSUMPTION (thous. tons/yr.)
1	Colbert Plant	1,350	3,250
2	Widows Creek Plant	1,828	3,650
3	Gadsden Plant	138	300
4	J. H. Miller, Jr. Plant	2,822	6,125
5	W. C. Gorgas Plant	1,417	3,075
6	E. C. Gaston Plant	2,013	4,370
7	Greene County Plant	299	650
8	C. R. Lowman Plant	538	1,170
9	J. M. Barry Plant	1,617	3,510



Source: Energy Information Administration, U.S. Department of Energy; Tennessee Valley Authority; Alabama Power Company; and Alabama Electric Cooperative

J. M. Barry Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

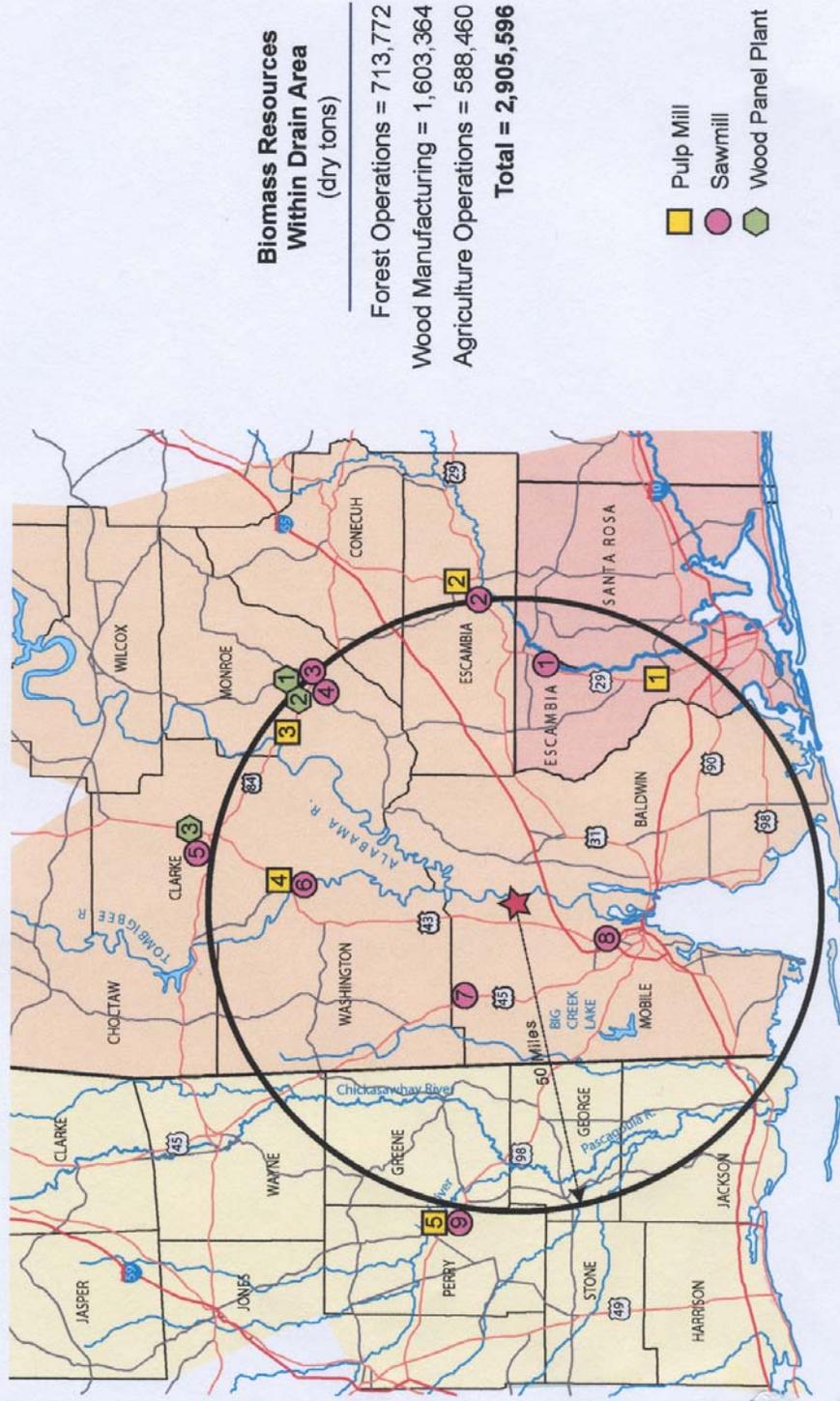


Figure 7. Biomass resources and potential competing facilities within 50 miles of the Barry Plant.

Gadsden Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

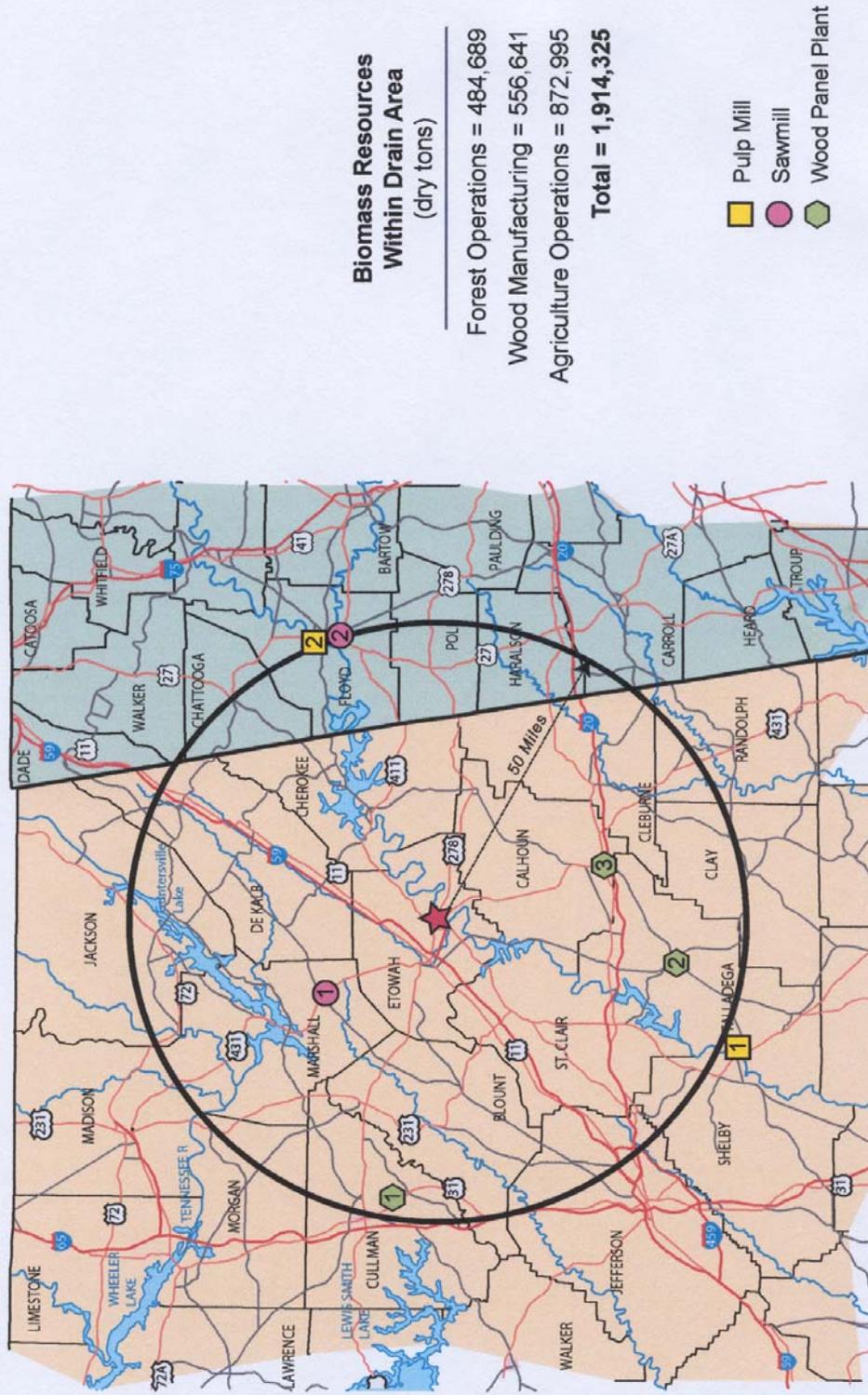


Figure 8. Biomass resources and potential competing facilities within 50 miles of the Gadsden Plant.

E. C. Gaston Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

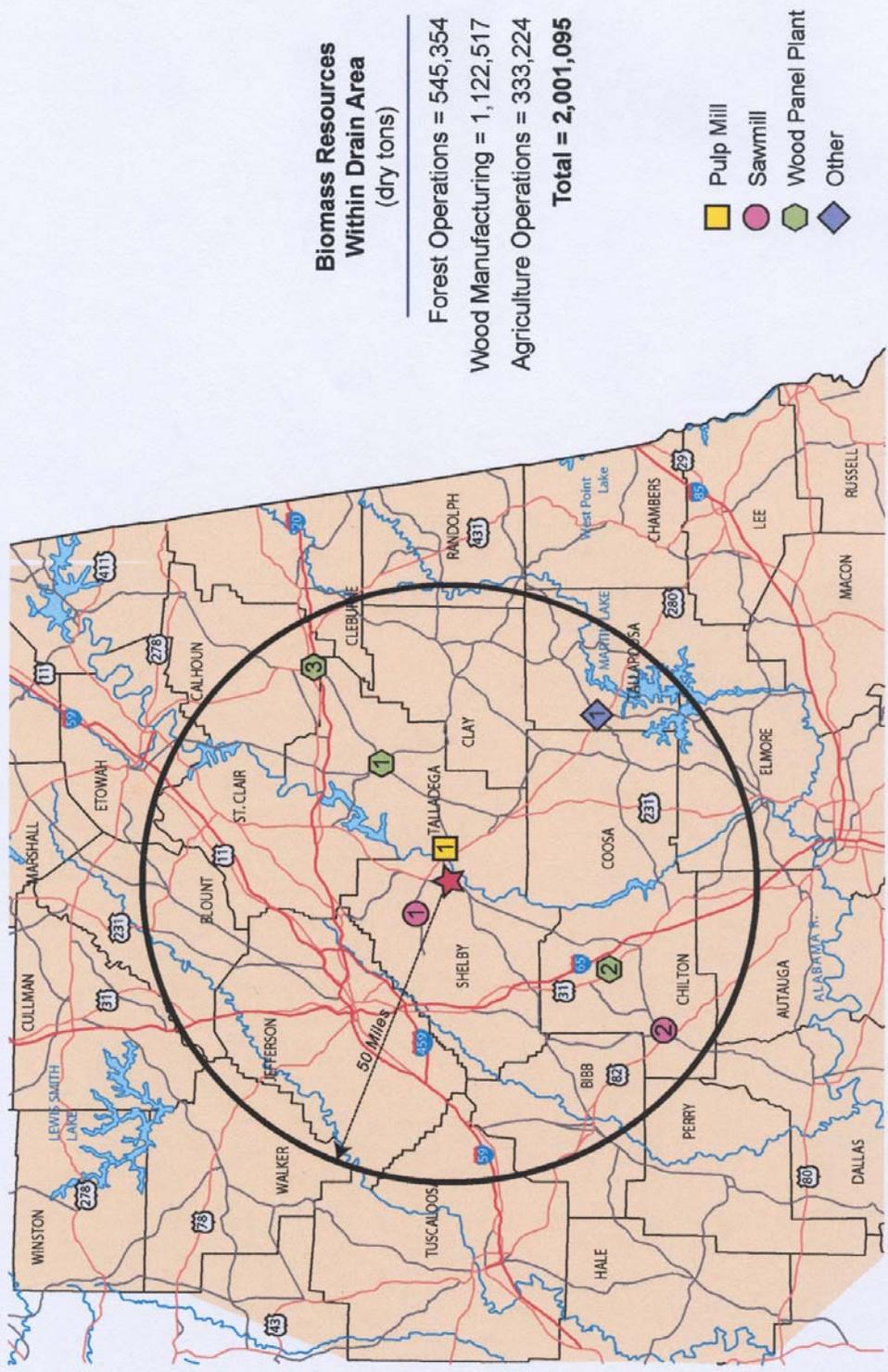


Figure 9. Biomass resources and potential competing facilities within 50 miles of the Gaston Plant.

W. C. Gorgas Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

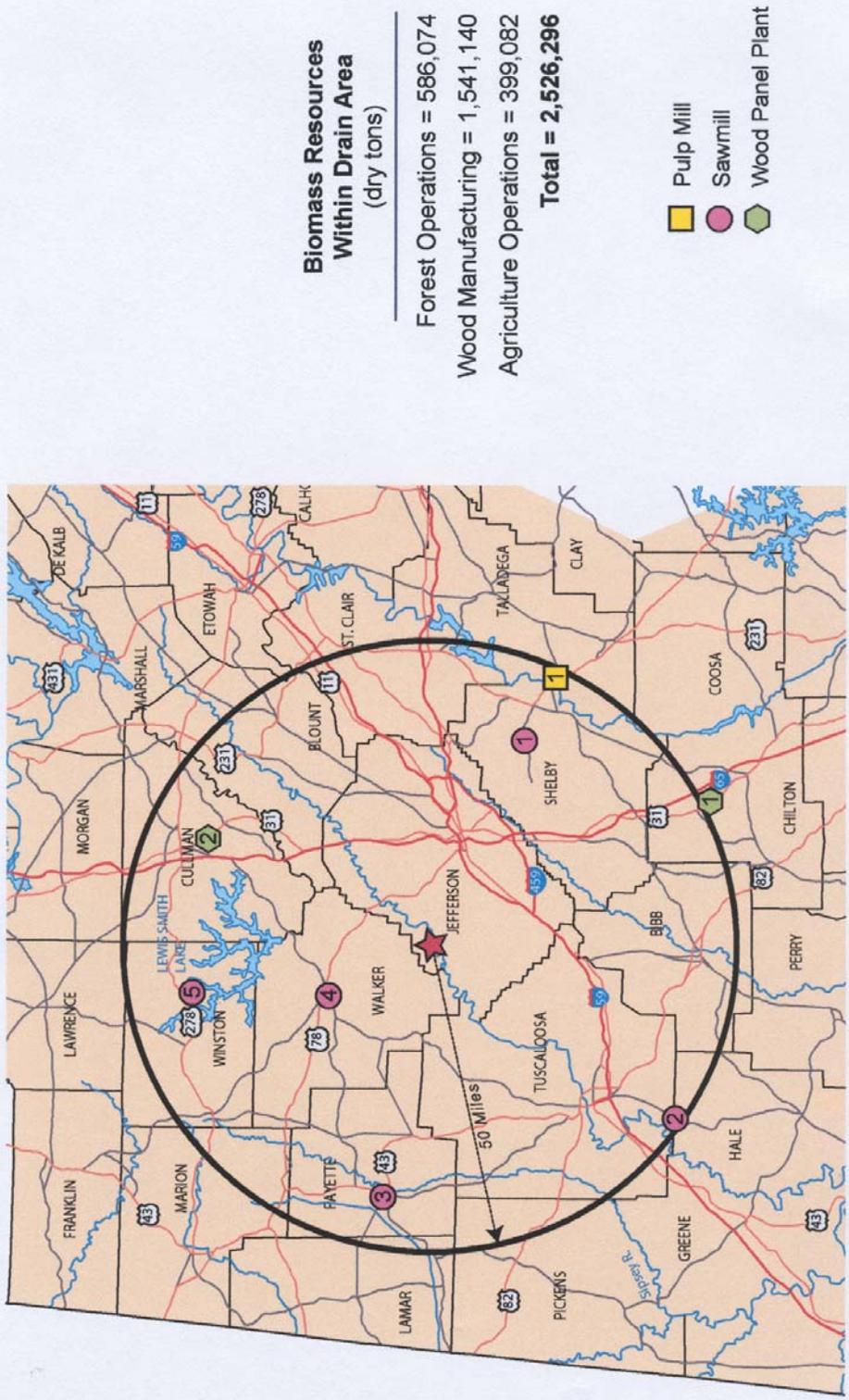


Figure 10. Biomass resources and potential competing facilities within 50 miles of the Gorgas Plant.

Greene Co. Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

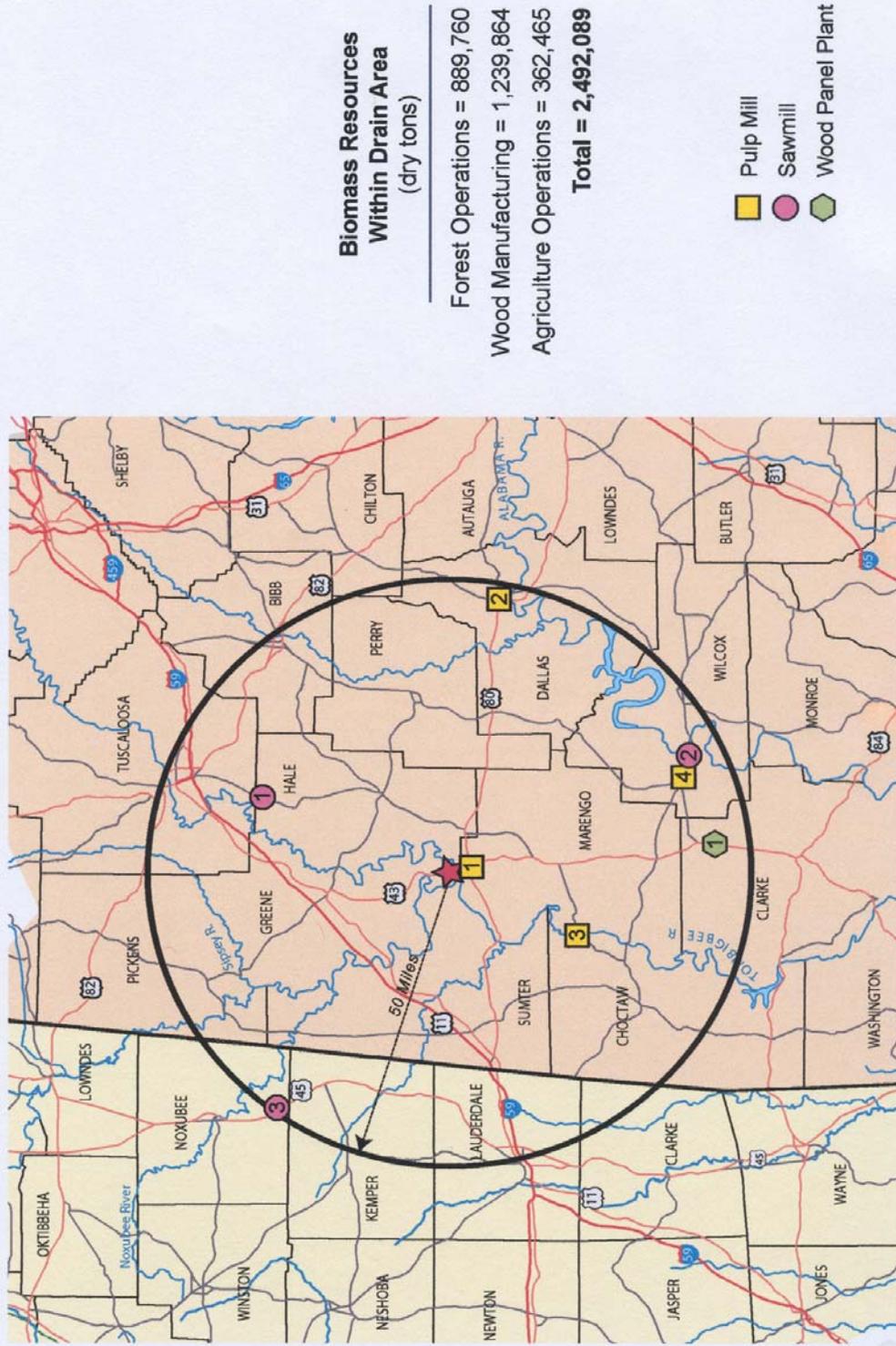


Figure 11. Biomass resources and potential competing facilities within 50 miles of the Greene County Plant.

Colbert Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

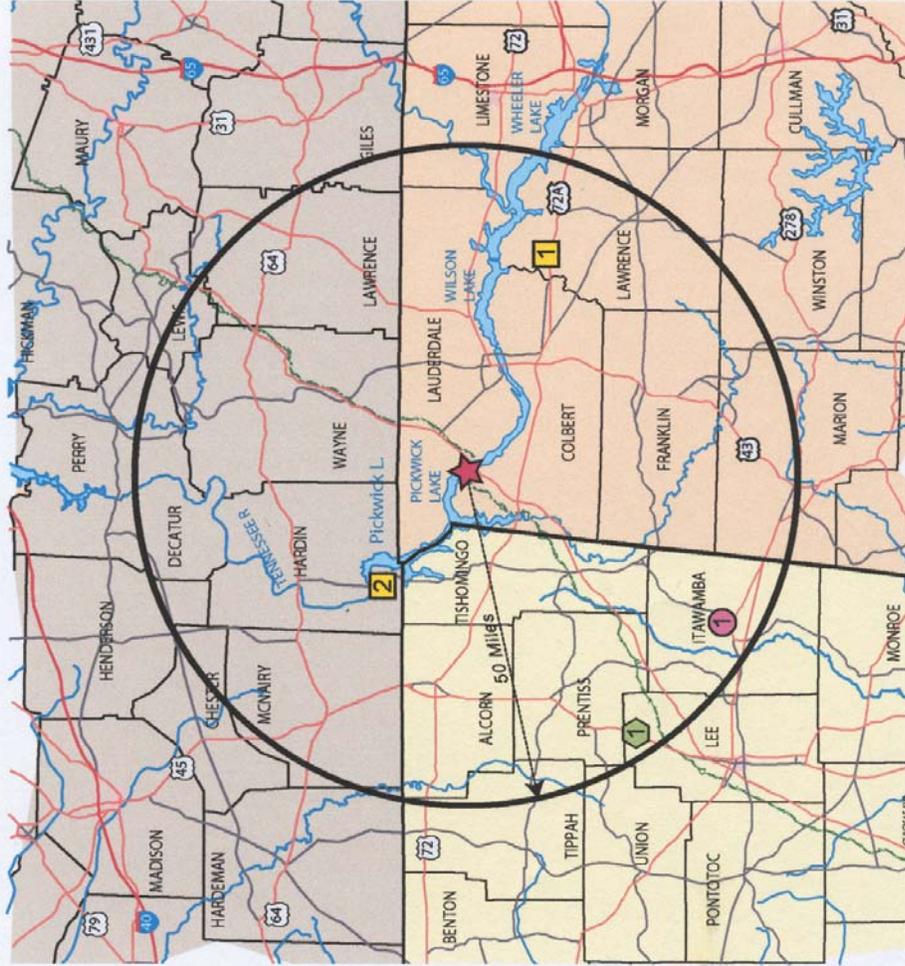


Figure 12. Biomass resources and potential competing facilities within 50 miles of the Colbert Plant.

C. R. Lowman Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

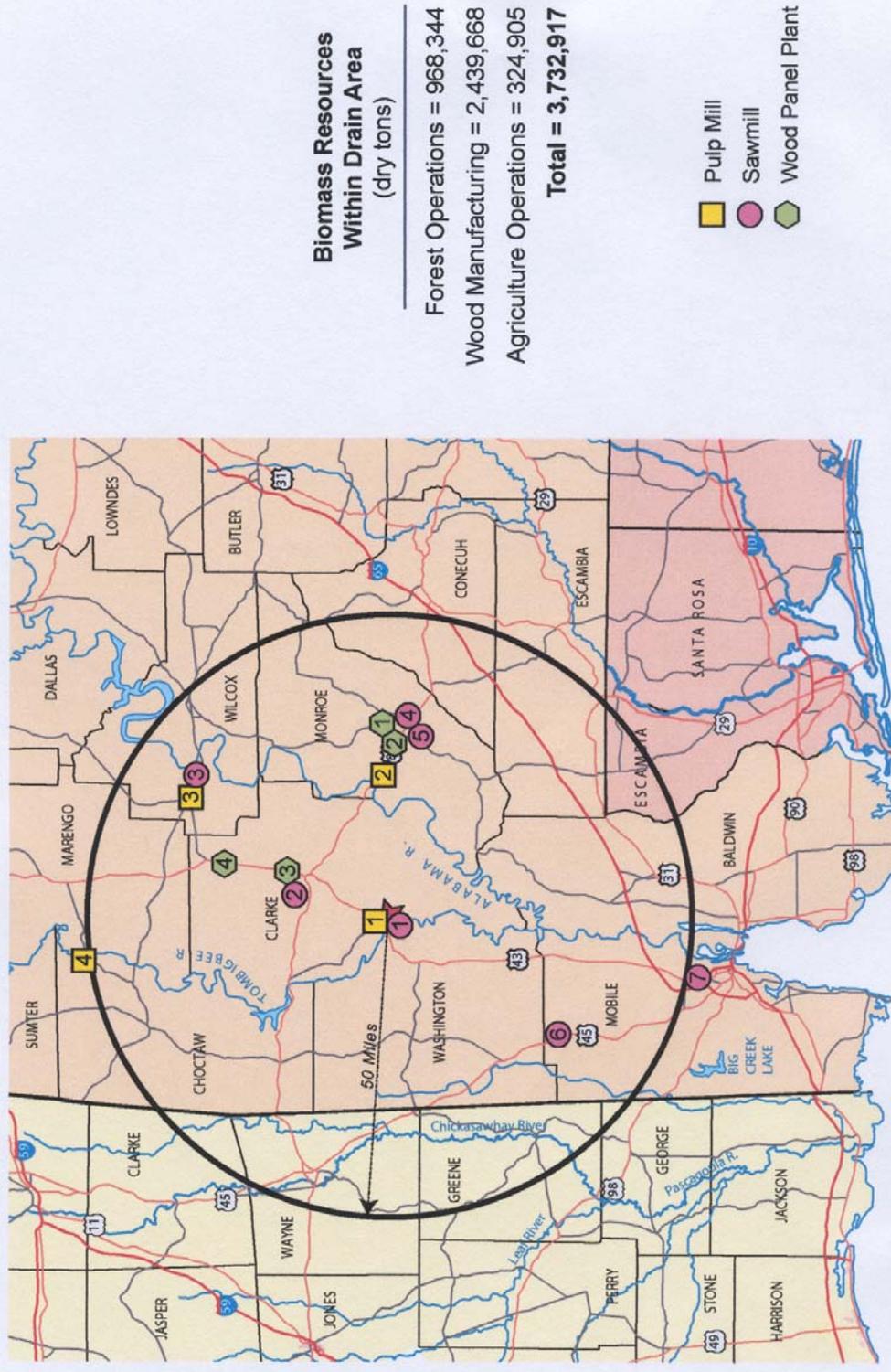


Figure 13. Biomass resources and potential competing facilities within 50 miles of the Lowman Plant.

J. H. Miller, Jr. Plant

Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

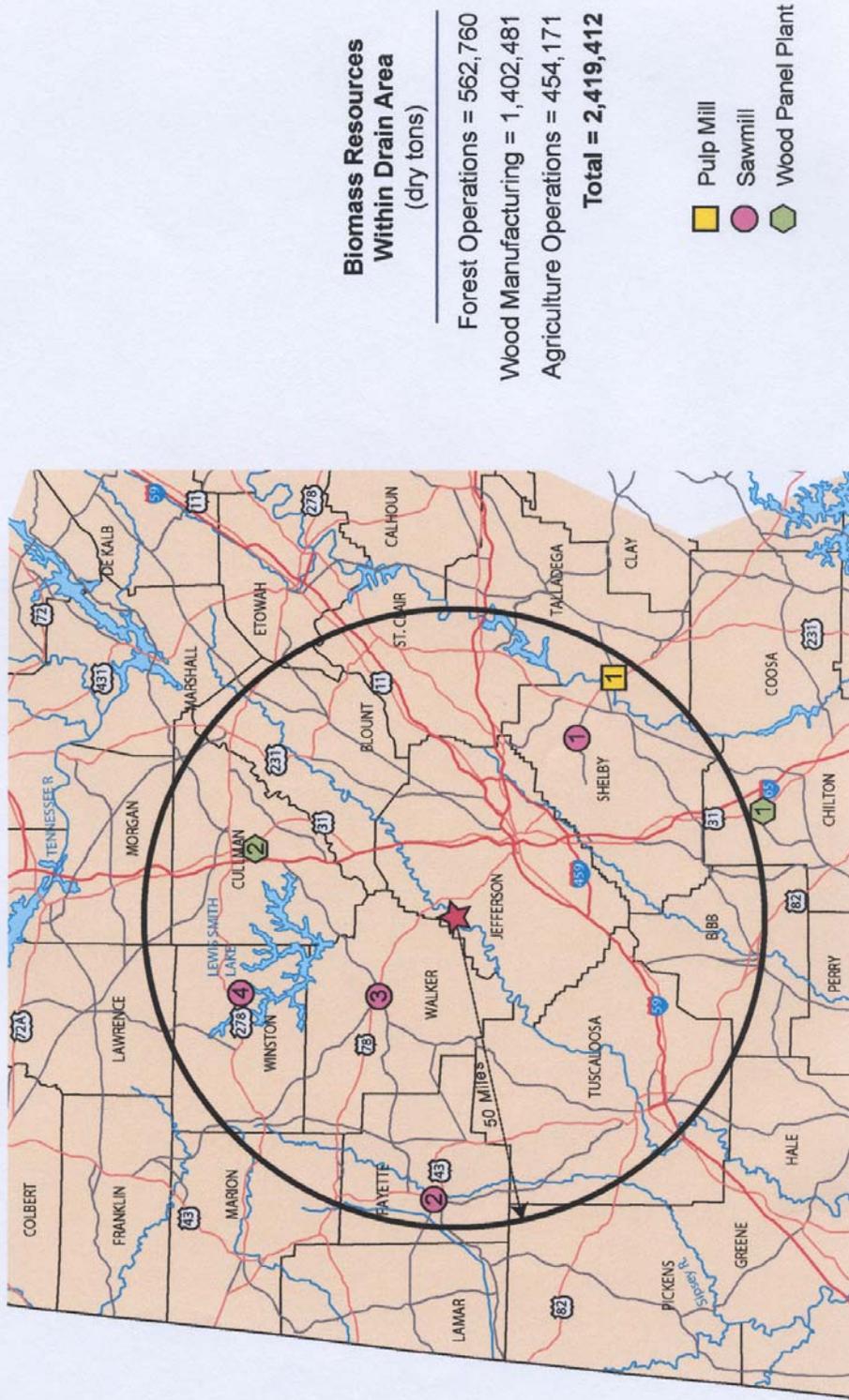


Figure 14. Biomass resources and potential competing facilities within 50 miles of the Miller Plant.

Widows Creek Plant Biomass Resources and Key Biomass Fuel Consumers Within 50-Mile Drain Area

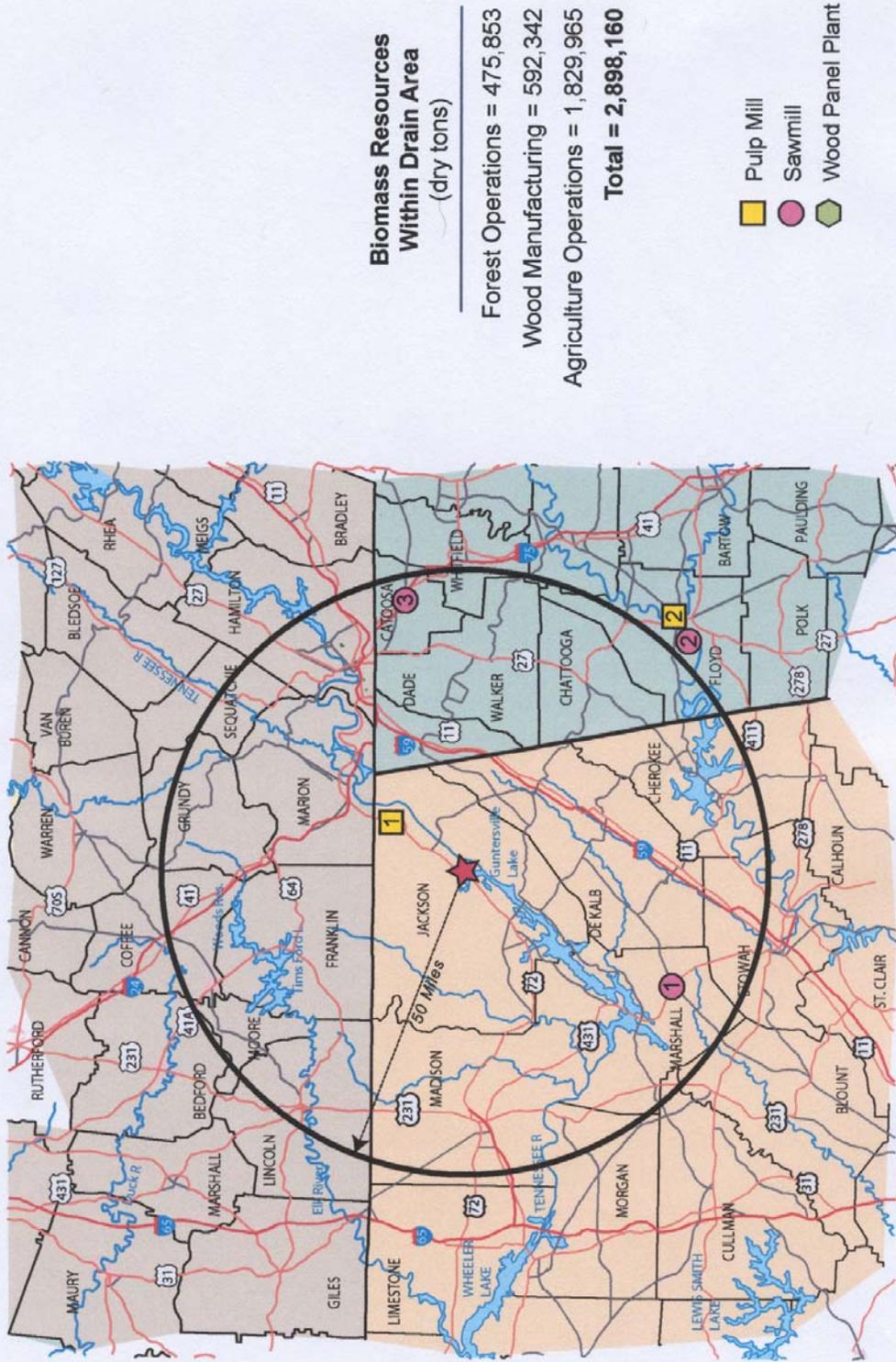


Figure 15. Biomass resources and potential competing facilities within 50 miles of the Widows Creek Plant.

Task 4. Biopower Market Analysis (Lead PI: D. Hite)

Procedure

Between May 24 and June 25, 2005, four focus group meetings were conducted by the Auburn University research team of David Bransby (professor, Agronomy), Patricia Duffy (professor, Agricultural Economics), Diane Hite (associate professor, Agricultural Economics). Christa Slayton (professor, Political Science) joined the team as a professional focus group moderator. The focus groups were conducted after a careful research design, obtaining input from industry and government officials; the Auburn University Center for Government Studies was engaged to scientifically recruit participants for the groups.

The research team members met in early February, 2005, to outline the course of action to be taken to conduct four statewide focus groups. It was decided that the groups would be conducted in Auburn-Opelika, Montgomery, Huntsville and Mobile, Alabama, in the spring of 2005. About 20 individuals were to be recruited from the area surrounding each location. Accounting for no-shows, we expected to have about 12-15 individuals at any group.

Results

1. Industry Group Meeting

Prior to the groups, an industry meeting was held in Montgomery at the Beard Federal Building. In attendance were Mr. Glen Zorn, representatives from Alabama Power and the Public Service Commission office, and the Auburn research team. The purpose of the meeting was to narrow down the types of questions that would be asked at the focus group, and to obtain input from the participants as to any questions they might think appropriate.

After the industry meeting was conducted, Professors Bransby and Duffy, with input from Slayton and Hite, created a power point presentation that would be used by Dr. Slayton to guide the focus group discussion. A copy of the final presentation used by Dr. Slayton in the focus groups is attached in Appendix B.

2. Recruiting of Participants

The next step in the process was to work with Ms. Robin Salter to develop a screening questionnaire. The screening questionnaire was to be used as a script for recruiting participants. A sample of the Screening Survey can be found in Appendix B attached. To recruit participants, the Center for Government Services (CGS) purchased random phone number lists. Individuals on the lists were called at random by a team of phone survey specialists. Calls were made in the early evening hours, and an attempt was made to obtain a representative mix of citizens of each of the counties where the groups were to take place, including those living in unincorporated surrounding areas.

In the initial calls, participants were tentatively recruited. Because of unbalanced acceptance rates, it was necessary to over-recruit, then to make a second call in which the desired individuals were confirmed. On average, the CGS tentatively recruited about 25 individuals for each group, of whom 20 were ultimately invited to participate. Potential participants were offered a \$25 payment, along with either a meal for the two evening groups (Auburn-Opelika and Montgomery), or snacks for the morning groups (Huntsville and Mobile).

Focus Groups

With input from other team members, Dr. Hite developed two questionnaires to be used at the focus groups (see Appendix C for copies of the questionnaires). The purpose of the questionnaires was to elicit knowledge about alternative energy sources of the focus group participants before and after the group discussion. After the first two groups, Dr. Hite wrote executive reports with survey results summarized; survey results were also summarized for the last two groups. The purpose of the reports and summaries was to informally share information with the research team. Copies of the preliminary reports and initial questionnaire summaries are in Appendix D.

It should be noted that sample sizes for the individual groups are too small to make statistical inferences about the data. It should also be emphasized that although the participants were randomly recruited, certain types of people are generally more likely to agree to participate in focus groups. This is true even though participants received compensation. Generally, individuals willing to participate in focus groups may be considered to be more publicly aware, or they may be seeking social interaction. Nonetheless, focus groups are still the norm in exploratory analysis of potential policies or for market research. The focus groups were deemed an overwhelming success by the research team. Participant demographics were well balanced, consisting of individuals from a wide variety of social backgrounds. Christa Slayton is trained as a professional moderator; and she used the power point presentation to explain concepts of and provide background to participants.

Statistical Results

The data from each of the focus groups was ultimately combined and used to examine statistical properties of the focus groups. The combined data included responses from sufficiently many individuals (47) to perform some simple analyses. Tables 9-11 contain means and standard errors summarizing certain key responses from the initial and follow up questionnaires. Tables 9 and 10 are for individual groups, and Table 11 includes statistics from the 4 groups overall.

Participants: The group participants were fairly old, in their late 40's overall (49.5 years). This is to be expected, as we had a fairly high rate of participation by retired individuals (10%), whose schedules would be more flexible. In addition, only 44.67 of participants were employed full time, and average education levels fell between 'some college' and 'associate degree'.

Table 9: Summary of Questionnaires, Auburn-Opelika and Huntsville

Group Location (AL)	_N_	Survey Questions	Mean	Std Error
<u>Auburn-Opelika</u>	<u>14</u>	Pre group WTP/mo for 10% of electric from biopower (\$)	9.7857	11.7223
		Post Group WTP/mo for 10% of electric from biopower (\$)	5.7500	3.9515
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.4286	0.5135
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.5000	0.5189
		Believe global warming is real (0,1)	0.4286	0.5135
		Believe only individuals who want biopower should pay excess cost (0,1)	0.1429	0.3631
		Believe electric companies alone should pay excess cost (0,1)	0.4286	0.5135
		Believe federal government should help electric companies pay excess cost (0,1)	0.2143	0.4258
		Age	48.892	14.7142
		Employed full time (0,1)	0.5000	0.5189
		Retired/disabled (0,1)	0.0714	0.2673
		Education level of household head (3=some college, 4=associate)	3.2857	1.7289
		White (0,1)	0.5000	0.5189
		Black (0,1)	0.4286	0.5135
<u>Huntsville</u>	<u>8</u>	Pre group WTP/mo for 10% of electric from biopower (\$)	4.8125	4.1743
		Post Group WTP/mo for 10% of electric from biopower (\$)	4.9375	3.4479
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5000	0.5345
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.6250	0.5175
		Believe global warming is real (0,1)	0.7500	0.4629
		Believe only individuals who want biopower should pay excess cost (0,1)	0.1250	0.3536
		Believe electric companies alone should pay excess cost (0,1)	0.6250	0.5175
		Believe federal government should help electric companies pay excess cost (0,1)	0.1250	0.3536
		Age	46.625	14.9445
		Employed full time (0,1)	0.7500	0.4629
		Retired/disabled (0,1)	0	0
		Education level of household head (3=some college, 4=associate)	5.0000	1.3093
		White (0,1)	0.5000	0.5345
		Black (0,1)	0.2500	0.4629

Table 10: Summary of Questionnaires, Mobile and Montgomery

Group Location (AL)	_N_	Survey Questions	Mean	Std Error
<i>Mobile</i>	<u>12</u>	Pre group WTP/mo for 10% of electric from biopower (\$)	5.8500	4.8879
		Post Group WTP/mo for 10% of electric from biopower (\$)	6.4444	4.1642
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.6667	0.4924
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.6667	0.4924
		Believe global warming is real (0,1)	0.7500	0.4523
		Believe only individuals who want biopower should pay excess cost (0,1)	0.0833	0.2887
		Believe electric companies alone should pay excess cost (0,1)	0.41667	0.5149
		Believe federal government should help electric companies pay excess cost (0,1)	0.3333	0.4924
		Age	49.4167	14.1435
		Employed full time (0,1)	0.3333	0.4924
		Retired/disabled (0,1)	0.2500	0.4523
		Education level of household head (3=some college, 4=associate)	3.6667	0.7785
		White (0,1)	0.2500	0.4523
		Black (0,1)	0.7500	0.4523
<i>Montgomery</i>	<u>13</u>	Pre group WTP/mo for 10% of electric from biopower (\$)	8.4444	8.7050
		Post Group WTP/mo for 10% of electric from biopower (\$)	5.5417	3.4076
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5385	0.5189
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	1.0000	0
		Believe global warming is real (0,1)	0.6923	0.4804
		Believe only individuals who want biopower should pay excess cost (0,1)	0.2308	0.4385
		Believe electric companies alone should pay excess cost (0,1)	0.3846	0.5064
		Believe federal government should help electric companies pay excess cost (0,1)	0.3846	0.5064
		Age	52.1538	14.6321
		Employed full time (0,1)	0.3077	0.4804
		Retired/disabled (0,1)	0.0769	0.2773
		Education level of household head (3=some college, 4=associate)	4.0769	1.4979
		White (0,1)	0.4615	0.5189
		Black (0,1)	0.4615	0.5189

Table 11: Summary of Questionnaires, All Groups

<u>Group Location (AL)</u>	<u>N</u>	Survey Questions	Mean	Std Error
<u>All</u>	<u>47</u>	Pre group WTP/mo for 10% of electric from biopower (\$)	7.5633	7.8580
		Post Group WTP/mo for 10% of electric from biopower (\$)	5.7314	3.7696
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5319	0.5132
		Worth \$6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.7021	0.3684
		Believe global warming is real (0,1)	0.6383	0.4801
		Believe only individuals who want biopower should pay excess cost (0,1)	0.1489	0.3633
		Believe electric companies alone should pay excess cost (0,1)	0.4468	0.5126
		Believe federal government should help electric companies pay excess cost (0,1)	0.2766	0.4528
		Age	49.5426	14.5850
		Employed full time (0,1)	0.4468	0.4920
		Retired/disabled (0,1)	0.1064	0.2718
		Education level of household head (3=some college, 4=associate)	3.8936	1.3509
		White (0,1)	0.4255	0.5046
		Black (0,1)	0.4894	0.4908

Willingness to Pay: Two responses that were of considerable interest to the project were those related to the extra cost of green power.

How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? \$_____

The above question was asked at the beginning and the end of the focus group, to try to assess the way that information received, and interactions with group members, affected basic willingness to pay (WTP) for green energy. The responses were unguided and open-ended. Two interesting results emerged. First, willingness to pay for the Auburn-Opelika and Montgomery groups decreased from the initial questionnaire to the follow up. Second, the dispersion of answers (as measured by standard error) significantly decreased in the follow up questionnaires for all four groups. The lowering of dispersion suggests that during the group, the participants obtained enough information to help them make better

informed responses. The fact that WTP decreased in two groups is not of concern, as it is clear from the standard errors from those responses that individuals lacked knowledge to make reasonable guesses about the worth of green electricity. By the end of the group, participants had more knowledge on which to base their valuations. Overall, post-session WTP is calculated to be \$5.73/month to have 10% of electric coming from alternative energy sources.

A second question on WTP, to which participants could respond ‘yes/no’ was considerably more stable across groups and across the pre and post session questionnaires. This type of question has been shown to elicit less biased estimates of WTP than do open ended questions as above. Precise wording of the question follows:

Do you think that it would be worth it to pay \$6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources?
Yes No

Positive response to the yes/no question increased in each group, with a majority of respondents overall responding that they think it is worth it to pay an additional \$6/month for green power. Note that the question was designed to track with information provided to us on average KWh usage per household.

We wanted to match fairly realistically the amount of electricity Alabama Power’s green subscribers are purchasing. The weighted average proportion of yes votes for all participants is 0.7021; as is common in valuation methods using yes/no responses to a fixed price, we can calculate the expected WTP for 6-7% of household electricity to \$4.21. Note that the implied amount for 10% of energy from green sources is proportionately somewhat higher than estimated from the open-ended WTP question: using the mid-point of percentage range (6.5%) results in WTP of \$6.48 for 10% green power (i.e. $10\%/6.5\% \times \$4.21 = \6.48).

Attitudes: We probed participants’ attitudes on energy-related issues. Several key questions were asked on our questionnaires to enable us to examine answers statistically. We found that the majority of participants (63.8%) believe that global warming is a real phenomenon. We asked who the participants felt should be responsible for paying for excess costs of green power. A majority felt that electric companies alone should pay (44.7%) followed by 27.8% who felt the federal government should help electric companies pay, and 14.9% who felt that only those who wanted to buy green power should pay. These attitudes were borne out in group discussions. Participants exhibited a strong distrust of the electric companies, expressing doubt that if individuals were to pay that the companies would actually deliver green energy. In the Montgomery group, especially, these attitudes were prevalent, and the participants felt strongly that the electric companies need to work with the government to educate the public about biopower and other alternative energy sources.

We found that there was a significant misunderstanding of energy delivery—many participants throughout the state expressed concerns that the electric company would not be able to deliver the green power *they* paid for to *their* house. This misunderstanding perhaps gave rise to the expressed distrust of power companies. Clearly, there is an opportunity for electric companies to educate the public about electric usage and potential benefits of alternative sources.

Though our research shows that a majority of Alabama's electric customers believe that it is worth purchasing, the reality is that Alabama Power's program for green energy is undersubscribed, as is likely the case with TVA's program. We were able to use the focus groups to probe reasons why the green program is not more successful. Clearly, our findings show that it is primarily lack of consumer awareness about the existing programs that is hampering their success. Almost none of the participants had ever heard of biopower, and not one was familiar with Alabama Power's program. All participants were surprised to find out such a possibility exists. This suggests that a much greater effort must be made to educate the public about alternative energy sources, and to make them aware of existing programs.

Regression analysis: In addition to the mean statistics reported in Tables 9-11, we wanted to explore statistical relationships between WTP and a number of different respondent characteristics and attitudes. To this end, we used multivariate regression analysis to see which of these factors might contribute positively and negatively to WTP for green energy. As above, we examine answers to the pre and post session open ended WTP. We were especially interested to see if a given characteristic had a different influence before and after the session. In Table 12 we report results from two models. It should be noted that because of nonresponse to certain questions, the results are based on only 41 respondents.

As in the raw statistics, we found that the estimated WTP range was considerably better understood by participants after they were exposed to our presentation. The models can be used to predict values of WTP for each respondent; the predicted values of WTP can then be compared to the actual WTP respondents filled in on their questionnaires. The ability of a regression to predict values is thus a measure of goodness of fit, or R^2 . As can be seen in Table 12, the R^2 value for the post-session WTP is 40 times higher than the pre-session WTP, suggesting that attitudes and demographics contributed much more to explaining variations in WTP after participants received information about biopower.

In the pre-session surveys, the only variable that had a nonzero effect on WTP was a dummy variable (1=yes, 0=no) for people who thought it worth a \$6.00/ month payment for biopower amounting to about 6-7% of a household's total monthly electric usage; a yes response is positively related to WTP. After the session, the number of variables having a significant effect on stated WTP increased from one to four: variables indicated retired individuals and individuals responsible for paying household bills, along with the dummy variable for 'worth \$6 per month' question above all positively contributed to stated WTP for biopower. Surprisingly, the coefficient for the variable representing individuals who were aware of alternative energy programs was negative, meaning that these individuals were associated with lower than average WTP. It should be noted, however, that so few individuals had ever heard of the programs that the net negative effect is very small. Another important result of the regression analysis is that there is no

Table 12: Regression Analysis

Variable	Dependent Variable is Pre-Group WTP Dependent Mean=7.5610			Dependent Variable is Post-Group WTP Dependent Mean=5.68293		
	Parameter Estimate	Standard Error	P Value	Parameter Estimate	Standard Error	P Value
Intercept	4.8866	13.33485	0.7171	-2.8458	4.4933	0.5323
<i>Beliefs/Attitudes</i>						
Believe Global Warming is Real (1,0)	-4.5462	3.39077	0.1921	-0.6000	1.1464	0.6053
Believe only those who want biopower should pay all for it (1,0)	-6.9181	6.38077	0.2886	-1.2932	2.3526	0.5874
Believe electric companies should pay all for biopower (1,0)	-6.2938	5.30986	0.2470	0.9855	2.1156	0.6454
Believe fed government should help electric companies pay for biopower (1,0)	-1.7499	4.83873	0.7206	-2.4309	1.9188	0.2169
Believe it's worth \$6/mo to have 6-7% of electric come from biopower (1,0)	9.0200	3.29885	0.0113*	5.4998	1.1992	0.0001*
Participant was aware of green power electric programs in AL (1,0)	3.9799	5.44642	0.4717	-4.5407	1.8012	0.0185*
Participant had heard of Green Power (1,0)	-3.0744	4.53051	0.5036	-0.5485	1.3435	0.6866
<i>Participant Demographics</i>						
# in Household	53928	1.05013	0.1552	0.2329	0.3367	0.4954
Age of respondent	-0.0485	0.15368	0.7551	0.0322	0.0476	0.5045
Race=Asian/Other (1,0)	1.6609	5.94712	0.7823	0.7892	1.9024	0.6818
Education level of household head (1-5)	0.4426	1.25389	0.7271	0.1920	0.3963	0.6323
Full time worker (1,0)	-3.2828	4.53984	0.4763	1.2267	1.4322	0.3998
Retired /disabled (1,0)	-4.0563	6.08055	0.5108	3.7750	1.9079	0.0590*
Participant pays for electric bills (1,0)	0.5724	4.88824	0.9077	2.6829	1.4805	0.0820*
AL Power is electric provider (1,0)	4.2570	3.07876	0.1790	-0.3609	1.0334	0.7299
Adj R-Sq 0.0117; N =41			Adj R-Sq 0.4030; N =41			

difference in WTP among different ethnic and socioeconomic groups. This suggests that alternative energy programs may be widely accepted across the state's population, if properly promoted.

In all, the results of the focus groups demonstrate a few key points. First, citizens have not been made aware of the potential for alternative energy. It was pointed out in the groups that individuals with K-12 age children had gotten some second hand information from their children, who had learned about it in school. This indicates that the next generation of Alabamians may be much better educated in environmental and sustainability issues. However, the lack of knowledge of adults was quite surprising. Second, it is clear that Alabama Power's and TVA's efforts to promote sales of green energy have been completely inadequate. The final point to be made is that once the respondents received some information, they became quite interested in the possibility of biopower. In addition, they made the clear point that they believe the government, industry and educators should act quickly to bring the public information about alternative energy.

3. Project Conclusions

In Task 1 seminars, field days and demonstrations were very highly rated by attendees, and several PowerPoint presentations were developed for further use in the future. Studies conducted on switchgrass, bahiagrass and wood chips by Mesa Reduction Engineering in Task 2 indicated that size reduction of biomass in the field will increase bulk density and reduce transport costs. The analysis of biomass availability in Task 3 revealed that on average, only 8.8% of biomass available within 50 miles of the 9 coal fired power plants in Alabama would be needed to replace 5% of the energy provided by coal in co-firing operations. This suggested that biomass supply was definitely not a limitation to co-firing biomass with coal. Focus group work in Task 4 suggested that low participation in green power programs was more due to ineffective advertising than to a reluctance of the public to pay a premium for green power. We conclude that commercialization of biopower offers a major market opportunity in Alabama and results from this project will be extremely helpful in pursuing this goal. This report will be distributed as indicated in Appendix D.

4. Recommendations for Future Work

- a) Focus: This project focused on biomass power (electricity). However, liquid fuels such as ethanol are of higher priority than electricity because of their ability to replace imported oil, and therefore, their potential role in national security. Future work should therefore focus on emerging technologies for producing liquid fuels from biomass in Alabama and neighboring states.
- b) Outreach: Additional outreach activities should include more on technologies to convert energy crops to energy, and how landowners might participate in ventures aimed at doing this.
- c) Processing: Tests need to be conducted on how suitable biomass processed by means of the Mesa Reduction Engineering technology is for co-firing and other energy applications.
- d) Advertising: Alabama Power should be encouraged to develop an alternative approach to advertising their green power program to include TV and billboard advertisements with the goal of increasing the number of consumers who are willing to purchase green electricity at a premium.

APPENDIX A

OPPORTUNITIES TO PRODUCE ENERGY FROM AGRICULTURE AND FORESTRY IN ALABAMA

Date: October 11, 2004

Place: Creek Family Restaurant/Best Western, Exit 57 off I-65, Atmore, AL

Time: 8:30 am

Background

Auburn University, Southern Research Institute, the Southern Company, Alabama Power and other organizations in Alabama have conducted considerable research to investigate the potential for producing energy in the form of electricity or biofuels such as ethanol from crops, crop residues, animal waste and forestry. This is one of a series of seminars and field days to present what is now known about this opportunity and to discuss and solicit opinions on how this opportunity can be pursued to the benefit of the agricultural and forestry communities in Alabama. There is no charge for attending and lunch is complementary. However, please call in and register with Ms. Reida Spear at (334) 240-7100.

Program

8:30 – 9:00 Registration

9:00 – 9:10 Introduction and Welcome, Mr. Glen Zorn, Deputy Commissioner, Alabama Department of Agriculture and Industries.

9:10 – 9:40 Overview of Bioenergy Opportunities for Alabama Producers. David Bransby, Professor, Energy Crops and Bioenergy, Auburn University.

9:40 – 10:20 Economic Perspectives of Energy Crops. Patricia Duffy, Professor, Farm Management, Auburn University.

10:20 – 10:40 Break

10:40 – 11:20 The Potential of Bioenergy to Alleviate the Current Crisis in Forestry. Ken Muehlenfeld, Director, Forest Products Institute, Auburn University

11:20 – 12:00 The Nuts and Bolts of Bioenergy. David Bransby, Professor, Energy Crops and Bioenergy, Auburn University.

12:00 – 1:00 pm. Complementary lunch.

1:00 – 2:00 pm. Field tour of energy crop production and harvesting at the Department of Corrections' Fountain Farm.

**OPPORTUNITIES TO PRODUCE ENERGY
FROM AGRICULTURAL AND FORESTRY RESOURCES IN ALABAMA**

Date: October 18, 2004

Place: Whiskers Catfish Restaurant, 34355 US Hwy 280, Childersburg

Time: 8:30 am

Background: Auburn University, Southern Research Institute, the Southern Company, Alabama Power and other organizations in Alabama have conducted considerable research to investigate the potential for producing energy in the form of electricity or biofuels such as ethanol from crops, crop residues, animal waste and forestry. This is one of a series of seminars and field days to present what is now known about this opportunity, and to discuss and solicit opinions on how this opportunity can be pursued to the benefit of the agricultural and forestry communities in Alabama. There is no charge for attending and lunch is complementary. However, please call in and register with Ms. Reida Spear at (334) 240-7100.

Program

8:30 – 9:00 am. Registration

9:00 – 9:10 am. Introduction and Welcome, Mr. Glen Zorn, Deputy Commissioner, Alabama Department of Agriculture and Industries.

9:10 – 9:40 am. Overview of Bioenergy Opportunities for Alabama Producers. David Bransby, Professor, Energy Crops and Bioenergy, Auburn University.

9:40 – 10:10 am. Economic Perspectives of Energy Crops. Patricia Duffy, Professor, Farm Management, Auburn University.

10:10 – 10:30 am. Break

10:30 – 11:00 am. The Potential of Bioenergy to Alleviate the Current Crisis in Forestry. Ken Muehlenfeld, Director, Forest Products Institute, Auburn University

11:00 – 11:30 am. The Nuts and Bolts of Bioenergy. David Bransby, Professor, Energy Crops and Bioenergy, Auburn University.

11:30 – 12:00 am. Essential Elements for Successful Commercialization of Bioenergy Projects. Gary Elliot, Consulting Engineer, International Applied Engineering, Marietta, GA.

12:00 – 1:00 pm. Complementary lunch.

1:00 Travel to the Wilson Farm south of Talladega to tour and discuss energy crops: switchgrass, johnsongrass, improved forage sorghum. David Bransby and David Wilson.

2:30 Travel to Alabama Power electric plant at Gadsden to observe co-firing of switchgrass with coal.

**OPPORTUNITIES TO PRODUCE ENERGY
FROM AGRICULTURAL AND FORESTRY RESOURCES IN ALABAMA**

Date: October 22, 2004

Place: Alabama Department of Agriculture and Industries,
Richard Beard Building,
1445 Federal Drive, Montgomery, AL

Time: 10:30 am

Background: The Southern Company, Alabama Power, Southern Research Institute, Auburn University and other organizations in Alabama have conducted considerable research to investigate the potential for producing energy in the form of electricity or biofuels such as ethanol from crops, crop residues, animal waste and forestry. This is one of a series of seminars and field days to present what is now known about this opportunity, and to discuss and solicit opinions on how this opportunity can be pursued to the benefit of the agricultural and forestry communities in Alabama. Please RSVP by phone to Ms. Reida Spear (334) 240-7100.

Program

10:30 – 10:50 am. Coffee and Registration

10:50 – 11:00 Introduction and Welcome, Mr. Ron Sparks, Commissioner, Alabama Department of Agriculture and Industries.

11:00 – 11:30 am. Overview of Bioenergy Opportunities for Alabama. David Bransby, Professor, Energy Crops and Bioenergy, Auburn University.

11:30 – 12:00 am. Actions Needed for Commercialization of Bioenergy. Gary Elliot, Consulting Engineer, International Applied Engineering, Marietta, GA.

12:00 – 1:00 pm. Complementary lunch.

1:00 pm. Discussion on developing a plan to commercialize bioenergy in Alabama.

APPENDIX B: FOCUS GROUP POWER POINT PRESENTATION

BACKGROUND

- This meeting is part of a study sponsored by the USDA through the Alabama Department of Agriculture and Industries.
- The aim of the study is to explore opportunities to produce and market green electricity in Alabama.

Purpose of Meeting

- The purpose of this meeting is to determine the interest of residential consumers of electricity in purchasing green power.
- Those of us involved in this part of the study are professors at Auburn University, but this is not an Auburn University project.
- We are contracted privately to the Alabama Department of Agriculture and Industries.

For More Information

If you have questions about this study that we do not answer tonight, please contact Mr. Glen Zorn, Associate Commissioner of Agriculture at (334) 240-7100.

Energy Demand Forecasting Questionnaire

I think you did a great job of running this meeting. We received all the information from this group meeting, and we will be working on it. We will be able to answer your questions about the study and the results of the study. We will be able to answer your questions about the study and the results of the study.

1. How long did you spend on this meeting? (Please check one box)
2. How long did you spend on this meeting? (Please check one box)
3. How long did you spend on this meeting? (Please check one box)
4. How long did you spend on this meeting? (Please check one box)
5. How long did you spend on this meeting? (Please check one box)
6. How long did you spend on this meeting? (Please check one box)
7. How long did you spend on this meeting? (Please check one box)
8. How long did you spend on this meeting? (Please check one box)
9. How long did you spend on this meeting? (Please check one box)
10. How long did you spend on this meeting? (Please check one box)
11. How long did you spend on this meeting? (Please check one box)

Fossil Fuel Facts

- Oil, coal and natural gas are fossil fuels.
- There is a fixed amount of each of these, so we will eventually run out of all of them.
- All contribute to increased greenhouse gasses, and therefore, to the risk of global warming.

COAL

- Alabama produces 70% of its electricity from burning coal.
- In 1992 Alabama mined all the coal we needed in the state, but our coal is high in sulfur.
- By 2002, we were importing over 60% of the coal we need from out of state, mainly Wyoming, because this coal is low in sulfur.
- This costs the state over \$500 million a year.

COAL continued

- Burning coal results in pollution and human health problems.
- Co-firing biomass with coal to produce electricity can reduce these problems.



DEFINITION OF BIOMASS ENERGY

- Renewable energy includes biomass energy, but also energy from wind, solar, hydro and geothermal sources.
- Biomass energy is energy produced from biomass, which is usually plant-based material such as wood, energy crops, hay, straw, but also animal waste.



Biopower vs Biofuels

- Biopower is electricity produced from biomass, while biofuels are fuels like ethanol produced from biomass.
- In this meeting we will be talking only about biopower.
- Biopower can substitute for some of the electricity that is produced from coal.



Green Power Programs in Alabama

- Alabama Power offers green electricity at an extra cost to only those who want it. This electricity is generated by co-firing switchgrass with coal at Gadsden.
- TVA offers renewable power at an extra cost to those who want it. This power is generated from wind.



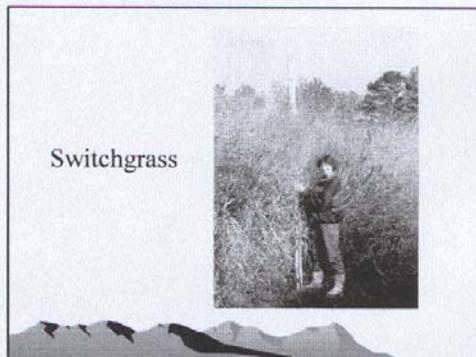
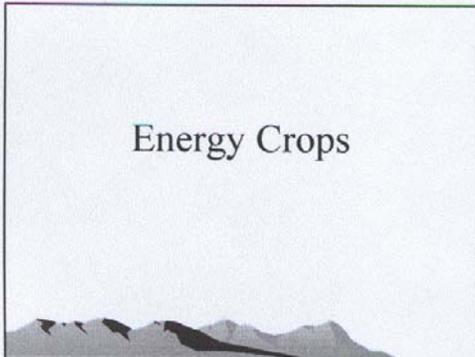
Biomass Resources

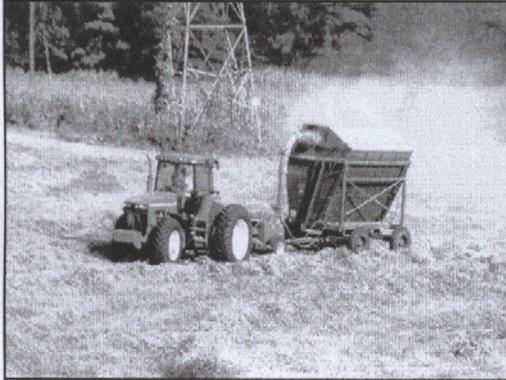
- Crop residues
- Energy crops
- Wood
- Animal waste



Crop Residues







Switchgrass Summary

Advantages

- Low input
- High yield
- Native, many environmental benefits
- Good fuel

Limitations

- Needs to be planted
- Slow to establish
- Limited seed available
- Mid-term opportunity

A silhouette of a mountain range at the bottom of the text box.

We have a surplus of Wood!



Saw Mill and Paper Mill Closures, 1989-2003



Economic Development

POTENTIAL TO USE BIOENERGY FOR ECONOMIC DEVELOPMENT

State Level

If: 10% of the coal were replaced with biomass and all that coal was imported,

Then: \$72 million would be kept from leaving the state each year, and there would be a new biomass market of \$234 million per year.



POTENTIAL TO USE BIOENERGY FOR ECONOMIC DEVELOPMENT

Local Level

If: The Alabama Power plant at Demopolis in the impoverished Black Belt region of the state co-fired 10% biomass with coal,

Then: 316,000 tons of biomass and 63,000 acres would be needed, and a new market of \$15.8 million annually would be created.



The Problem?

- Biopower is more expensive than electricity produced from coal.
- Depending on consumer responses, this could be solved by:
 - Charging extra for only those who want to buy biopower.
 - Spreading the cost of biopower across all consumers.
 - Getting government subsidies to pay the extra cost.



Summary of Issues

- Electricity from coal is cheap, but coal pollutes and a lot comes from out of state, which hurts the state economy.
- Biopower is cleaner and will stimulate local economies, but is more expensive.
- If only some (maybe 10%) of the coal power is replaced by biopower, there will be considerable benefit at limited extra cost.
- If all of us pay the extra cost of using some biopower, the cost per person is fairly low, but if only those who want it pay the extra cost, the cost per person is a lot higher.



Questions

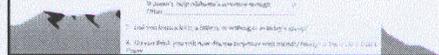
- Should we use some biopower to replace maybe 10% of the power produced from coal?
- If so, should all of us, or only those who want it, pay the extra cost for biopower?
- How much extra are we willing to pay for biopower?



Current Power Source Choice Problem - Up-Questionnaire

Note: that you have participated in this survey, and that you have been selected to be one of the 100 people who will be interviewed in the future. If you changed your mind after participating in this survey, please let us know by returning the survey to the address below.

1. Do you think that it would be worth it to pay an extra cost to use biopower?
 - Yes, it would be worth it to pay an extra cost to use biopower.
 - No, it would not be worth it to pay an extra cost to use biopower.
2. How much extra would you be willing to pay for biopower?
 - 0% of my electricity bill.
 - 10% of my electricity bill.
 - 20% of my electricity bill.
 - 30% of my electricity bill.
 - 40% of my electricity bill.
 - 50% of my electricity bill.
 - 60% of my electricity bill.
 - 70% of my electricity bill.
 - 80% of my electricity bill.
 - 90% of my electricity bill.
 - 100% of my electricity bill.
 - More than 100% of my electricity bill.
 - Other.
3. Do you think it is important to have a power source that is clean and renewable?
 - Very important.
 - Important.
 - Not important.
 - Other.
4. Do you think it is important to have a power source that is locally produced?
 - Very important.
 - Important.
 - Not important.
 - Other.
5. Do you think it is important to have a power source that is produced in Alabama?
 - Very important.
 - Important.
 - Not important.
 - Other.
6. Do you think it is important to have a power source that is produced in the Black Belt region of Alabama?
 - Very important.
 - Important.
 - Not important.
 - Other.
7. Do you think it is important to have a power source that is produced in the Black Belt region of Alabama?
 - Very important.
 - Important.
 - Not important.
 - Other.



APPENDIX C: FOCUS GROUP MATERIALS AND DETAILED RESULTS

Alabama Department of Agriculture and Industries Draft Focus Group Screener Center for Governmental Services, May 2005

Hello, my name is _____ and I'm calling from the Auburn University Survey Research Lab. We are putting together a panel discussion for the Alabama Department of Agriculture and Industries to gather people's opinions on electricity and other alternative energy sources. The meeting will take place on DATE at LOCATION, and I'd like to ask you a few questions to see if you qualify to participate.

We are not trying to sell you anything, and this discussion is being done to benefit Alabama and your community. If you do qualify, you will receive \$25 to attend.

May I ask you some questions?

1. About how far would you say you live from (Auburn/Opelika; Montgomery; Huntsville; Mobile)?
 - Live within city limits
 - Within 10 miles of the city
 - Within 11 to 25 miles of the city
 - More than 25 miles away from the city (**THANK AND DISCONTINUE INTERVIEW**)

2. How old are you? (**RECRUIT A GOOD MIX**)
 - Under the age of 19 (**THANK AND DISCONTINUE INTERVIEW**)
 - 19 to 34
 - 35 to 44
 - 45 to 54
 - 55 to 64
 - 65 or older
 - No response/refusal (**THANK AND DISCONTINUE INTERVIEW**)

3. Do you or any members of your immediate family work for any of the following types of employers?
 - A public utility company or service provider
 - A newspaper, radio or television station
 - The College of Agriculture at Auburn University or Alabama A&M University
 - The Alabama Department of Agriculture and Industries
 - The Alabama Cooperative Extension System

IF YES TO ANY OF THE ABOVE LISTED EMPLOYERS, THANK AND DISCONTINUE INTERVIEW.

4. What race do you identify with? **(RECRUIT A GOOD MIX)**
- African-American
 - Asian
 - Hispanic
 - Native-American
 - White
 - Other (please specify) _____
 - No response/refusal **(THANK AND DISCONTINUE INTERVIEW)**
5. Gender: **(RECRUIT A GOOD MIX)**
- Male
 - Female

Invitation to qualified participants:

Thank you for answering our questions. You qualify to participate in our panel discussion. As I mentioned earlier, this meeting is being conducted by Auburn University and the Alabama Department of Agriculture and Industries on DATE at LOCATION. The discussion will last no more than 2 hours, and you and about 15 other panelists will be asked to talk about the electric service you have in your home, and alternative sources of energy. We are only interested in your opinions, and no one will try to sell you anything.

If you choose to participate, you will be paid \$25 for attending. In addition, (DINNER/REFRESHMENTS WILL BE SERVED). Will you be able to participate in this panel discussion?

**IF NO, THANK AND DISCONTINUE INTERVIEW.
IF YES, CONTINUE WITH THE INFORMATION BELOW.**

Thank you. Someone will be sending you a confirmation letter and driving directions in the mail. In addition, we will call you the day before to remind you about this discussion. We will be counting on your attendance, because we will only be inviting 15 people. May I please get your (NAME, ADDRESS, and ZIP)?

Name: _____
 Street Address: _____
 City: _____, Alabama, Zip: _____

If you have any questions, or do not receive a confirmation letter within the next week, please call us at 334-844-1914.

Green Power Focus Group Questionnaire
May 24, 2005

Thank you for participating in this group discussion. Remember, all information from this group will be held in strictest confidence. To get an idea how much you are aware of the topics we will discuss, we would appreciate your filling in the brief questionnaire below.

1. Are you the person who usually pays the electric bills in your house?
 Yes No

2. Which utility provides electricity to your house?
 _____ (Company or public utility) *or* Don't Know

3. Have you ever heard of 'Green Energy' or 'Biopower'? Yes No

4. Are you aware of electric company programs in Alabama that offer alternative energy sources for sale for an additional fee? Yes No

5. Do you believe that Global Warming is real? Yes No Don't Know

6. A number of members of society contribute to air pollution, and lots of money is spent every year to clean it up. Please rank the groups below for whom you think should be most responsible for clean air (1=most responsible, ... 4=least responsible)

	Federal government	State/Local government	Individuals who use energy (i.e. society at large)	Corporations that sell and market energy
Rank—please fill in at right				

7. Do you think that it would be worth it to pay \$6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources? Yes No

8. How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? \$_____

9. How many people live in your household?_____

10. What is the highest level of education of the head of your household?
 Not a high school graduate High school graduate Some College
 Associate/technical degree Bachelor's degree Post-graduate

11. What is your employment status?
 Working fulltime Working part time Unemployed Retired or disabled

Green Power Focus Group Follow-Up Questionnaire
May 24, 2005

Now that you have participated in this group discussion, we would like to ask you a few more questions. Some of the questions are the same as we asked at the beginning. If you changed your mind after participating in the discussion, that's fine. Just answer according to how you feel about the topic nos.

1. Do you think that it would be worth it to pay \$6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources? Yes No

2. How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? \$_____

3. Do you think that most of the cost of providing alternative energy should be paid by (choose one):
 - Only people who want to buy it from the electric utility
 - Everyone who buys and uses electricity
 - Electric companies
 - Electric companies with help from Government
 - Other (explain)_____

4. If everyone who buys electric from one company had to accept having 6-7% of their electric provided by biopower, do you think it would be worth it for everyone in the company (except for very poor people) to pay an additional \$2.50/month for their electric? Yes No Don't Know

5. What would be the main reason you would support paying for use of biopower by electric companies?
 - Helps farmers by providing a new crop
 - I care about the environment in general
 - I am worried about the health effects of pollution
 - Helps Alabama's economy
 - Helps eliminate dependence on foreign oil
 - Other _____

6. What would be the main reason you would *not* support paying for use of biopower?
 - It's too expensive
 - I don't think there are energy problems at present
 - I think it's the government's responsibility
 - It doesn't help Alabama's economy enough
 - Other _____

7. Did you learn a lot , a little , or nothing in today's group?

8. Do you think you will now discuss biopower with friends/family? Yes No Don't Know

Executive Summary, Biopower Focus Group 1 Opelika, AL Public Library

The first focus group to examine attitudes and awareness of biopower in Alabama was convened at 5:30 PM in the Opelika Public Library. The meeting was attended by 14 participants—19 individuals agreed by phone to participate, but 1 called to report that she had to work overtime, and the other 4 were no-shows. Overall, this was an expected rate of participation.

Group Composition: The group members represented a fairly diverse cross section of individuals from Lee County. The racial, age and gender breakdowns were as follows:

Of the individuals attending, 100% were the household member responsible for paying utility bills. The education levels of participants were almost uniformly spread across different educational categories, with slightly more individuals having a bachelor's degree. 50% were full time workers, while nearly 36% were disabled or retired.

Group Organization: Two questionnaires were administered at the beginning and end of the group to gauge awareness of green energy in Alabama.

Questionnaire 1 Summary (before the session began) --Opelika

- q1 100% of participants were responsible for paying bills
- q2 64.29% were AL Power Customers
21.43% were Opelika City Customers
7.14% were Rural Coop Customers
7.15% did not know
- q3 28.57% of participants had heard of biopower
- q4 7.14% had heard of green energy programs being offered to AL residents
- q5 35.71% believe global warming is real
7.14% believe global warming is not real
all others don't know
- q6 21.43% believe federal government should be most responsible for clean air with respect to energy production
0% believe state and local government should be most responsible for clean air
7.14% believe society at large should be most responsible for clean air
35.71% believe corporations should be most responsible for clean air
- q7 42.86% believe that it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
- q8 \$9.79/mo = Mean value to participants of having 10% of their electric generated by renewable sources
- q9 2.28 is average household size

q10 Education levels
14.29% No HS 28.57% HS Grad
14.29% Some College 14.29% Assoc/Tech Degree
14.29% Bachelor's Degree 14.29% Post Grad

Q11 Employment status
50.00% Work full time 7.14% Work part time
7.14% Unemployed 35.71% Retired/disabled

Questionnaire 2 Summary -- Opelika

At the end of the session:

- q1 50.0% of respondents feel it's worth \$6/mo to buy 6-7% green energy
- q2 \$4.93 is the average of what respondents think they should pay for 10% of their power to be from environmentally friendly sources
- q3 7.14% believe only people who want to buy green energy should pay for most of its cost
35.71% believe everyone who buys electricity should pay for it
14.29% believe the electric company should shoulder the cost
28.57% believe the cost should be shouldered by the electric company with help from the government
- q4 64.29% believe it would be worth it to have an extra \$2.50 added to their bill if everyone had to pay for green power
- q5 Primary reasons for support paying for use of biopower
21.43%-'I care about the environment in general'
28.57%-'I am worried about the health effects of pollution'
7.14%-'Helps Alabama's economy'
14.29%-'Helps eliminate dependence on foreign oil'
- q6 Primary reasons for not supporting biopower
57.14% - 'Too expensive'
24.43% - 'I think it's the government's responsibility'
14.29% - 'It doesn't help Alabama's economy enough'
14.29% answered open ended question that there would be no reason for them not to support
- q7 85.71% learned 'a lot' from the group
7.14% learned 'a little'
- q8 85.71% will now discuss biopower with friends and family
7.14% will not discuss

--Note, there was some item nonresponse, so not every category adds up. Next time, need to read each question with them on the questionnaire, I think some participants couldn't read fast enough to fill them in.

--The amount of value dropped at the end (q8 on 1st vs q3 on 2nd). My feeling is that before receiving information, participants were simply 'stabbing in the dark' on their responses. We see this a lot in contingent valuation – i.e. overvaluation when respondents are unfamiliar with an issue.

**Executive Summary, Biopower Focus Group 2
Montgomery, AL--Richard Beard Federal Building**

Our second focus group on biopower was convened at 5:30 PM in the Richard Beard Federal Building. The meeting was attended by 13 participants—21 individuals agreed by phone to participate, with 8 no-shows. The participation rate was good considering that the weather was very bad that day and there were some traffic complications.

Group Composition: The group members represented a fairly diverse cross section of individuals from Lee County. The racial, age and gender breakdowns were as follows:

White	46.15%
Black	46.15%
Other	7.69%
Average of Age Categories -- 52.15	
Male	30.77%
Female	69.23%

Of the individuals attending, 76.92% were the household member responsible for paying utility bills. All participants had at least a high school educational, with slightly more individuals having a bachelor's degree. 30.77% were full time workers, while over 46% were disabled or retired. Thus, compared to the Opelika group, the Montgomery group was somewhat older and better educated.

Group Organization: The format of the group was the same as in the first group, with two surveys administered. Because of some problems with the 1st group's ability to follow the instructions for filling out the survey, more care was taken to stress how the survey should be filled out in this second group. Descriptive statistics drawn from the surveys are attached following this summary.

Key Points of Interest: Once again most of the respondents were Alabama Power (AP) customers. In this group one participant knew of the specific biopower option offered by AL Power and two respondents were aware that there were some programs offering green energy options. One of the participants (a middle-aged African American male) said that a lot of interest in such issues is being generated in the public schools, and offered that his own children were exposed to the concept of renewable energy. Otherwise, those who had heard of biopower weren't sure if they'd read about it in the newspaper, or if there had been a TV commercial they might have been exposed to some time in the past. Participants said they would not buy biopower without having information about what biopower does.

A much higher percentage in Montgomery believed that global warming is real than did Lee County participants (69.23% vs 35.71%). This may be attributable to the fact that this group appeared to be much more concerned about environmental and other public issues.

Once again, participants were unanimously in agreement that the vehicle (bill insert) which AP uses to promote bioenergy is completely ineffective. In addition this set of participants expressed considerable skepticism that the company would indeed produce biopower with the extra money spent by consumers. This result is not that different from the Opelika group, except that the Montgomery group appeared to be much more outspoken on the issue. In addition, this group offered some concrete ideas about how the power companies could gain credibility by starting programs such as a one to promote switchgrass production to Alabama farmers. They also suggested that the power companies should partner with the government to develop biopower. In all, this group was very adamant that biopower would be a worthy pursuit, but that it should be developed in such a way that the power companies can gain the public's trust.

Participants suggested that a market for switchgrass needs to be developed, preferably with the participation of power companies.

Statistics: The following two pages report average statistics from the two questionnaires administered. These are a small sample, not valid for predictions and inference, and should be regarded as such. There are two items of note. 1) There is rounding error, and participants did not always answer all questions, so there may be cases where percentages do not add up to 100%. 2) stated willingness to pay for biopower dropped between the first and second questionnaires. It is extremely common in valuation questions of this sort that people place much higher values when they are uninformed; this is particularly reflected in looking at the individual answers in which by far the majority of participants suggested \$10 would be a fair payment for 10% of the electricity generated by green sources. The fact that this fell in the follow up demonstrates a more realistic understanding of the issues.

Questionnaire 1 Summary (before the session began)--Montgomery

- q1 76.92% of participants were responsible for paying bills
- q2 92.31% were AL Power Customers
7.69% were Dixie Electric customers
- q3 15.38% of participants had heard of biopower
- q4 7.69% had heard of green energy programs being offered to AL residents
- q5 69.23% believe global warming is real
all others don't know
- q6 38.46% believe federal government should be most responsible for clean air with respect to energy production
0% believe state and local government should be most responsible for clean air
23.08% believe society at large should be most responsible for clean air
38.46% believe corporations should be most responsible for clean air
- q7 53.84% believe that it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
23.08% don't know if it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
all others think it isn't worth it
- q8 \$5.85/mo—Mean value to participants of having 10% of their electric generated by renewable sources
- q9 2.29 is average household size

q10	Education levels
0.00%	No HS
23.08%	HS Grad
15.38%	Some College
7.69%	Assoc/Tech Degree
38.46%	Bachelor's Degree
15.38%	Post Grad

Q11	Employment status
30.77%	Work full time
15.38%	Work part time
7.69%	Unemployed
46.15%	Retired/disabled

Questionnaire 2 Summary --Montgomery

At the end of the session:

- q1 100.0% of respondents feel it's worth \$6/mo to buy 6-7% green energy
- q2 \$5.12 is the average of what respondents think they should pay for 10% of their power to be from environmentally friendly sources
- q3 15.12% believe only people who want to buy green energy should pay for most of its cost
69.23% believe everyone who buys electricity should pay for it
0.00% believe the electric company should shoulder the cost
15.38% believe the cost should be shouldered by the electric company with help from the government
- q4 100.00% believe it would be worth it to have an extra \$2.50 added to their bill if everyone had to pay for green power
- q5 Primary reasons for support paying for use of biopower
23.08%-'I care about the environment in general'
30.77%-'I am worried about the health effects of pollution'
7.14%-'Helps Alabama's economy'
15.38%-'Helps eliminate dependence on foreign oil'
7.69%- other
- q6 Primary reasons for not supporting biopower
23.08% - 'Too expensive'
30.77% - 'I think it's the government's responsibility'
7.69% - 'It doesn't help Alabama's economy enough'
30.77% answered open ended question that they were suspicious that the company might not use the money to actually create biopower
- q7 84.62% learned 'a lot' from the group
7.69% learned 'a little'
7.69% learned 'nothing'

Summary Statistics for Huntsville 1st Questionnaire

- q1 87.5% of participants were responsible for paying bills
- q2 62.5% were Huntsville City Power Customers
12.5% were AL Power customers
12.5% were TVA customers
12.5% didn't know their electric provider
- q3 25% of participants had heard of biopower
- q4 25% had heard of green energy programs being offered to AL residents
- q5 75% believe global warming is real
12.5% believe global warming is not real
all others don't know
- q6 12.5% believe federal government should be most responsible for clean air with respect to energy production
0% believe state and local government should be most responsible for clean air
12.5% believe society at large should be most responsible for clean air
62.5% believe corporations should be most responsible for clean air
- q7 50% believe that it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources all others think it isn't worth it
- q8 \$4.81/mo Mean value to participants of having 10% of their electric generated by renewable sources
- q9 3.75 is average household size
- q10 Education levels
- | | |
|--------|-------------------|
| 0.00% | No HS |
| 0.00% | HS Grad |
| 25.00% | Some College |
| 0.00% | Assoc/Tech Degree |
| 25.00% | Bachelor's Degree |
| 50.00% | Post Grad |
- Q11 Employment status
- | | |
|--------|------------------|
| 75.00% | Work full time |
| 12.50% | Work part time |
| 0.00% | Unemployed |
| 12.50% | Retired/disabled |
- D1 46.25 is average age
- D3
- | | |
|-------|--------|
| white | 25.00% |
| black | 50.00% |
| other | 25.00% |
- D4
- | | |
|--------|--------|
| male | 62.50% |
| female | 37.50% |

Huntsville Group Follow Up

- q1 62.5% of respondents feel it's worth \$6/mo to buy 6-7% green energy
- q2 \$4.94 is the average of what respondents think they should pay for 10% of their power to be from environmentally friendly sources
- q3 25% believe only people who want to buy green energy should pay for most of its cost
62.5% believe everyone who buys electricity should pay for it
0.00% believe the electric company should shoulder the cost
0.00% believe the cost should be shouldered by the electric company with help from the government
- q4 75% believe it would be worth it to have an extra \$2.50 added to their bill if everyone had to pay for green power
- q5 Primary reasons for support paying for use of biopower
50.00%-'I care about the environment in general'
25.00%-'Helps Alabama's economy'
25.00%- other
- q6 Primary reasons for not supporting biopower
12.5% - 'Too expensive'
12.5% - 'No energy problem at present'
37.5% - 'I think it's the government's responsibility'
The rest were other, open ended.
- q7 62.5% learned 'a lot' from the group
37.5% learned 'a little'
0.00% learned 'nothing'
- q8 75% will now discuss biopower with friends and family
12.5% will not discuss

Summary Statistics for Huntsville 1st Questionnaire

- q1 87.5% of participants were responsible for paying bills
- q2 62.5% were Huntsville City Power Customers
12.5% were AL Power customers
12.5% were TVA customers
12.5% didn't know their electric provider
- q3 25% of participants had heard of biopower
- q4 25% had heard of green energy programs being offered to AL residents
- q5 75% believe global warming is real
12.5% believe global warming is not real
all others don't know
- q6 12.5% believe federal government should be most responsible for clean air with respect to energy production
0% believe state and local government should be most responsible for clean air
12.5% believe society at large should be most responsible for clean air
62.5% believe corporations should be most responsible for clean air
- q7 50% believe that it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
all others think it isn't worth it
- q8 \$4.81/mo Mean value to participants of having 10% of their electric generated by renewable sources
- q9 3.75 is average household size
- q10 Education levels
- | | |
|--------|-------------------|
| 0.00% | No HS |
| 0.00% | HS Grad |
| 25.00% | Some College |
| 0.00% | Assoc/Tech Degree |
| 25.00% | Bachelor's Degree |
| 50.00% | Post Grad |
- Q11 Employment status
- | | |
|--------|------------------|
| 75.00% | Work full time |
| 12.50% | Work part time |
| 0.00% | Unemployed |
| 12.50% | Retired/disabled |
- D1 46.25 is average age
- D3
- | | |
|-------|--------|
| white | 25.00% |
| black | 50.00% |
| other | 25.00% |
- D4
- | | |
|--------|--------|
| male | 62.50% |
| female | 37.50% |

Huntsville Group Follow Up

- q1 62.5% of respondents feel it's worth \$6/mo to buy 6-7% green energy
- q2 \$4.94 is the average of what respondents think they should pay for 10% of their power to be from environmentally friendly sources
- q3 25% believe only people who want to buy green energy should pay for most of its cost
62.5% believe everyone who buys electricity should pay for it
0.00% believe the electric company should shoulder the cost
0.00% believe the cost should be shouldered by the electric company with help from the government
- q4 75% believe it would be worth it to have an extra \$2.50 added to their bill if everyone had to pay for green power
- q5 Primary reasons for support paying for use of biopower
50.00%-'I care about the environment in general'
25.00%-'Helps Alabama's economy'
25.00%- other
- q6 Primary reasons for not supporting biopower
12.5% - 'Too expensive'
12.5% - 'No energy problem at present'
37.5% - 'I think it's the government's responsibility'
The rest were other, open ended.
- q7 62.5% learned 'a lot' from the group
37.5% learned 'a little'
0.00% learned 'nothing'
- q8 75% will now discuss biopower with friends and family
12.5% will not discuss

Mobile Focus Group 1st Questionnaire

- q1 58.33% of participants were responsible for paying bills
- q2 91.67% were AL Power Customers
- q3 33.33% of participants had heard of biopower
- q4 0% had heard of green energy programs being offered to AL residents
- q5 75% believe global warming is real
all others don't know
- q6 33.33% believe federal government should be most responsible for clean air with respect to energy production
16.67% believe state and local government should be most responsible for clean air
8.33% believe society at large should be most responsible for clean air
41.67% believe corporations should be most responsible for clean air
- q7 66.67% believe that it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
25% don't know if it's worth it to pay an additional \$6 per month for 6-7% of their electricity coming from renewable sources
all others think it isn't worth it
- q8 \$5.85/mo Mean value to participants of having 10% of their electric generated by renewable sources
- q9 2.67 is average household size
- q10 Education levels
- | | |
|--------|-------------------|
| 0.00% | No HS |
| 0.00% | HS Grad |
| 50.00% | Some College |
| 33.33% | Assoc/Tech Degree |
| 16.67% | Bachelor's Degree |
| 0.00% | Post Grad |
- Q11 Employment status
- | | |
|--------|------------------|
| 33.33% | Work full time |
| 0.00% | Work part time |
| 25.00% | Unemployed |
| 41.67% | Retired/disabled |
-
- | | |
|--------|--------|
| 41.67% | Male |
| 58.33% | FemAle |

Mobile Follow Up Questionnaire

- q1 66.67% of respondents feel it's worth \$6/mo to buy 6-7% green energy
- q2 \$6.44 is the average of what respondents think they should pay for 10% of their power to be from environmentally friendly sources
- q3 0% believe only people who want to buy green energy should pay for most of its cost
41.67% believe everyone who buys electricity should pay for it
16.67% believe the electric company should shoulder the cost
41.67% believe the cost should be shouldered by the electric company with help from the government
- q4 66.67% believe it would be worth it to have an extra \$2.50 added to their bill if everyone had to pay for green power
- q5 Primary reasons for support paying for use of biopower
58.33%- 'I care about the environment in general'
16.67%- 'I am worried about the health effects of pollution'
16.67%- 'Helps Alabama's economy'
8.33%- 'Helps eliminate dependence on foreign oil'
7.69%- other
- q6 Primary reasons for not supporting biopower
50% - 'Too expensive'
8.33% - 'I don't think there are energy problems at present'
0% - 'I think it's the government's responsibility'
8.33% - 'It doesn't help Alabama's economy enough'
ALL OTHERS - answered open ended question
- q7 83.33% learned 'a lot' from the group
16.67% learned 'a little'
- q8 92.31% will now discuss biopower with friends and family
7.69% don't know

APPENDIX D: DISTRIBUTION LIST

- 1. USDA FSMIP**
- 2. Alabama Department of Agriculture and Industries**
- 3. Auburn University**
- 4. Alabama Department of Economic and Community Affairs**
- 5. Alabama Public Service Commission**
- 6. Alabama Power Company**
- 7. Southern Company**
- 8. Tennessee Valley Authority**
- 9. Alabama Electric Cooperative**
- 10. US DOE Office of the Biomass Program**