



# Mississippi Takes The Lion's Share of Farm Bill Grant

The Department of Energy recognized the State of Mississippi at the Southern Alliance for the Utilization of Biomass Resources (SAUBR) Conference on October 25, 2004, for receiving the highest number of grants from the 2004 Farm Bill Solicitation and for creating a model for other states to follow. Grants were approved in a five-year program authorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill), Section 9006 to help farmers, ranchers and rural small businesses purchase and install renewable energy systems and to make energy efficiency improvements.

Mississippi received 42 of the 44 grants funded in the Southeastern Region. A total of \$1.27 million will fund Mississippi applicants who applied in the energy efficiency category out of \$1.8 million funded nationwide. In the renewable category, \$20.1 million was allocated nationally of which Mississippi applicants received \$347,140.

The success of Mississippi under this grant solicitation can be attributed to the concerted efforts of the following organizations for disseminating information: Alcorn State University, Mississippi Biomass Council, Mississippi Alternative Energy Enterprise, Mississippi Department of Agriculture and Commerce, Mississippi State University, Mississippi Development Authority-Energy Division, Farm Bureau, U.S. Department of Agriculture and the U. S. Department of Energy. These organizations coalesced to conduct three workshops to explain the application process, and to discuss eligible technologies. Grant writers and technical experts were introduced to aid in application preparation.

Recognition should go to the three

renewable projects funded, but the highest accolades should be offered to Bennie F. Hutchins, Coordinator of Southwest Resource Conservation and Development Inc., for organizing a team to assist 39 poultry producers. Assisting with the development of grant applications were Leslie Threadgill, Mississippi Poultry Association; Dr. Berry Lott, MSU Extension Service; Dr. Ken Hood, MSU Extension Service, and Donald Thompson staff engineer for Mississippi Development Authority.

Producers are expected to experience an average savings of 23 percent in annual energy costs. In the first year of the program, 2003, Mississippi received five grants under the efficiency category. Poultry producer, Roland Vanderweghe, reports that he uses 50 percent less gas to get the same Btu heating value because of the improvements to his brooder houses. The production benefits outweigh the energy reduction because the birds grow to the desired six or eight pounds faster with a 98-99 percent livability rate as opposed to a 96-97 percent livability rate.

Mitchell Hall, 2004 recipient, anticipates a 10 percent energy savings as well as production increases. Contract growers are required to upgrade facilities on a periodic basis. Mitchell acknowledged that if it were not for this grant he might not have been able to afford the upgrades and stay in business. According to Hutchins, the projected energy savings coupled with increases in production efficiency will result in

a projected payback period of just less than three years.

Grant funds can pay up to 25% of the total project costs under section 9006 of the Farm Bill solicitation. The success of the poultry producers points to the potential of securing grants for sustaining, swine, catfish and other animal husbandry, agribusinesses. Mississippians should focus on renewable energy usage for agribusiness under future grant solicitations of Section 9006 but they should



*Bennie F. Hutchins, Coordinator of Southwest Resource Conservation and Development Inc.*

also prepare for solicitations from [Section 9003 Biorefinery Development Grants](#), [9004 Biodiesel Fuel Education Program](#) and [9005 Energy Audit and Renewable Energy Development Program](#).

**Written by Wes Miller**

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*Roland Vanderweghe, poultry producer 2003 recipient*



*Mitchell Hall, poultry producer 2004 recipient*

## A NOTE FROM THE PRESIDENT

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A representative of the Jackson Convention and Tourism Bureau recently asked, "What is biomass and what does the Council do?" I wanted to tell her our story of creation, our history, our hard work, our good results, our dedication to Mississippi, our contribution to mankind... I pondered the short answer, but the delayed stress from a 15-year crusade to make "biomass" a household word kicked in. After a two-minute spiel, she politely interrupted, "That's enough! I was just curious." The confines of this publication again allow only the short answer.

Biomass is any organic substance which contains carbon and can be burned including land and water-based vegetation, organic components of municipal solid waste and industrial waste, agricultural waste and animal wastes. It is a growing field with frequent developments in bio-products and energy technologies that displace products and fuels derived from fossils. The Department of Energy's Office of Energy Efficiency and Renewable Energy estimates that 26.1 billion KWh of electricity can be generated using biomass fuels in Mississippi. This is enough electricity to fully supply the annual needs of 2,608,000 average homes or 180 percent of the residential electricity use in

Mississippi.

The Mississippi Biomass Council (MBC) was created in 1998 and incorporated in 2000 as a nonprofit corporation. It is the first state-wide organization of its kind in the nation. Its membership includes representatives from government, academia and private industries that are interested in reducing the biomass waste stream and increasing economic opportunities through biomass usage. You can learn more about biomass by reading the Bio Brief and by viewing our website at [www.ms-biomass.org](http://www.ms-biomass.org). If you are interested in research or practical application, consider membership. Membership provides a vehicle:

- to network with industry professionals,
- to form partnerships for research and grant opportunities,
- to hear regular presentations on financing, technology development and transfer and product development,
- to consult on designated projects, and

to advocate products, processes, technology and policy.

The long answer is much more interesting. Contact us to get answers at [infombsbiomass@email.com](mailto:infombsbiomass@email.com).



Wes Miller, President of MBC

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## BIOMASS COMMERCIALIZATION OPPORTUNITIES AND OBSTACLES

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With the passing of the 2002 Farm Bill, the US Government demonstrated a commitment to the commercialization of biomass energy and biobased products. New innovative programs and strategies were created and funded that provide new opportunities for the financing of these technologies. However, as with most legislation or funding programs, some "tweaking" is still needed to address some of the barriers to commercialization that remain.

USDA's Business & Industry Guarantee (B&I) loan program has been expanded to help provide funding for renewable energy projects that heretofore were too large for the program. The program now will guarantee loans as large as \$40 million for these projects. It is great news that the Program has been expanded. The bad news is that loans over \$25 million are limited to farmer cooperatives and not available to other private sector entrepreneurs. In addition, USDA requires 40% tangible equity for energy related loans.

The program should be changed to reflect the interest nonfarmers now have renewable energy. Also, USDA should make determinations regarding equity requirements on a case by case basis instead of placing such a high equity standard on energy-related companies. Loans to other rural companies typically require 20% tangible equity in order to qualify for the loan guarantee. One idea would be for USDA to require energy companies to present a "capital plan" that demonstrates how equity levels will be raised to a certain level over a multi-year period. This would provide much needed flexibility to renewable energy companies.

One other change in the B&I program that is needed has to do with biodiesel commercialization. Companies wishing to produce fuel with yellow grease as the feed stock are at a serious disadvantage. These companies typically obtain the grease from restaurants in urban areas and wish to sell the fuel to fleet vehicle companies or public entities also located

in urban areas. Therefore, with the feedstock and the market both in urban areas, manufacturing in an urban area makes the most sense. However, the B&I program requires companies to be domiciled in areas of 50,000 in population or less. USDA should consider changes in the program that will address this eligibility issue affecting the biodiesel industry or Congress should establish a similar program within USDA or elsewhere to help remove this critical barrier to commercialization.

Recently tremendous strides in the biomass commercialization have taken place. However, it is paramount that organizations like the Mississippi Biomass Council be vigilant in making sure that programs are adequately funding each year and updated from time to time to reflect paradigm shifts in the marketplace.

Written by Bruce Crain, President

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# THE PLANETS ALIGN FOR BIOMASS

The evening of October 25, 2004 was auspicious for scientific and social reasons. We witnessed a total eclipse of the moon during the last game of the World Series, an unprecedented coincidence. The eclipse occurred as the Earth's shadow completely obscured a full moon. The World Series was won as the Boston Red Sox swept the St. Louis Cardinals for their first national title since 1918.

In like manner, for scientific and socioeconomic reasons, the planets are aligned for a revolution in biomass energy. Across the board, current prices for fossil fuel have been volatile and unprecedented. The same week as the eclipse, the Energy Information Agency, a branch of the US Department of Energy, reports December contracts for natural gas are selling for \$8.775/MMBtu, and \$56.37/barrel for West Texas Intermediate Crude. At the same time, Central Appalachian low sulfur coal fetched \$63/ton, up from \$36/ton this time last year. No one knows if prices will remain this high in the short term, but the long term trend is clear. It appears that the days of cheap fossil fuel are over. High energy commodity prices, coupled with war and unrest in the Middle East

make domestically produced, renewable, biomass energy more appealing.

Technologies for sustainable production of energy from renewable sources have been available for years, but were not commercially viable when compared with fossil fuel. This was partly due to the high cost of gathering and transporting the raw feedstock. In recent years however, excess inventory of otherwise non-commercial plantation pine trees, as well as record amounts of agricultural waste such as peanut hulls and corn stalks are available for conversion to energy and other valuable products. At the same time, pulp mills for paper production face a looming crisis from depressed sales and pressure from foreign competitors.

In light of record fossil fuel prices, available biomass inventories, and weakness in the paper products, millions of dollars from state, federal, and private sources have been poured into research. The results are promising. The National Renewable Energy Laboratory has announced the development of new enzymes that can help break down complex organic chemicals into simple sug-

ars that can be readily converted into liquid ethanol fuel. The University of Georgia, together with its research partners, has developed and is now testing a scaleable "bio-refinery" that can produce a spectrum of fuels, chemicals, soil amendments, and other valuable products from crop waste much like crude oil is refined into a range of fuels and products. These breakthroughs and expansive on-going research point toward large scale commercialization in the near future.

As these developments race forward, awareness global climate change and the need to reduce atmospheric carbon is rapidly increasing. The American biomass industry may soon be able to profit from international trading in carbon credits. Fuels grown in the U.S.A. will keep dollars circulating in our own economy and help build a sustainable future. The planets are indeed aligning for the biomass industry.

Written by J. David Dunagan, Project Manager, United States Department of Energy [david.dunagan@ee.doe.gov](mailto:david.dunagan@ee.doe.gov)

# BIO-BASED PARTICLEBOARD ADHESIVES

Consumer products based upon intermediates produced from crude oil and natural gas have become indispensable to the standard of living currently enjoyed by modern civilization. However, the finite supply of crude oil and the accelerating global demand for energy along with the environmental and health concerns related to petroleum-based products make it clear that continued dependence upon petroleum feedstocks is not a sustainable economic development model for the long term. In response to these concerns, federal, state, and industrial research and development laboratories have begun to investigate the use of agricultural intermediates to replace petroleum-based products currently used in the manufacture of commercial materials. This strategy is particularly relevant to the state of Mississippi with its outstanding capability to produce agricultural crops combined with the technical and scientific expertise located at Mississippi universities. The development and commercialization of products based upon sustainable, agricultural intermediates create opportunities for rural development initiatives with obvious competitive advantages for Mississippi.

## Project description

The challenge and opportunity created by

the need to develop sustainable, environmentally acceptable alternatives to industrial chemical products prompted scientists at The University of Southern Mississippi to investigate the replacement of urea-formaldehyde adhesives used in the manufacture of particleboard building materials. Manufactured particleboard is a major article of commerce in the U.S. and is used in the manufacture of a variety of consumer products including residential and commercial furniture. Virtually all particleboard manufactured in the U.S. employs urea-formaldehyde adhesive resin to provide mechanical and hydrolytic stability to the finished particleboard. While urea-formaldehyde-based adhesives meet the cost and performance requirements of particleboard manufacturers, residual formaldehyde is a potential long term threat to human health. Formaldehyde is considered a "known carcinogen" by the World Health Organization.

## Raw material selection

With the objective of developing a formaldehyde-free particleboard adhesive based upon agricultural intermediates, the Thames Research Group at The University of Southern Mississippi chose soy protein as the preferred starting material. Soy protein is a

co-product produced when soybeans are crushed to produce soy oil and therefore is available in large quantities in the U.S. The complex chemical structure of soy protein provides a series of reactive functionalities useful in the design of a functional particleboard adhesive. It is also believed that the development of a high performance, value-added industrial product based upon soy protein can increase the value of soybean crops.

## Product performance

Soy protein-based particleboard adhesives were synthesized from a commercial source of soy protein isolate, applied to commercial grade wood particles, and pressed to form the particleboards. The following table shows the performance properties of the soy protein-based adhesive compared to established industry standards and to a commercial particleboard sample based upon urea-formaldehyde adhesive. The soy protein adhesive-based particleboard clearly meets or exceeds industry accepted performance requirements.

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Performance Properties						
	Density <sup>4</sup>	MC <sup>5</sup>	MOR <sup>6</sup>	MOE <sup>7</sup>	TS <sup>8</sup>	WA <sup>9</sup>
Soy Protein Adhesive <sup>1</sup> (B04-076)	50.1 – 52.4	7.2	2419	428367	3.8	9.2
ANSI Standard <sup>2</sup> (M2 Grade Particleboard)	40 - 50	< 10	>2103	>326300	Not Specified	Not Specified
Commercial <sup>3</sup> Particleboard	50.5	7.0	2314	398288	7.0	21.0

<sup>1</sup> USM's formaldehyde-free adhesive for particleboard applications. This adhesive is based primarily on protein obtained from soybeans.

<sup>2</sup> American National Standards Institute (ANSI) lists physical property requirements for particular grades of particleboard.

<sup>3</sup> The physical properties presented are an average of numerous commercial boards obtained through common retail outlets such as Lowe's or Home Depot.

<sup>4</sup> Density is recorded as pounds per cubic foot (lb/ft<sup>3</sup>) for particleboard.

<sup>5</sup> MC is moisture content. This is a measure of the water present in the particleboard after pressing and it is reported as a percentage.

<sup>6</sup> MOR is Modulus of Rupture. This is the force required to break the particleboard. This could be considered as a load capacity value and is reported in pounds per square inch (psi).

<sup>7</sup> MOE is Modulus of Elasticity. This is a measure of the flexibility of the particleboard and is reported in pounds per square inch (psi).

<sup>8</sup> TS is Thickness Swell. This is a measure of how much a 12" x 12" panel swells after being submerged in water for a 24-hour period. This value is presented as a percentage.

<sup>9</sup> WA is Water Absorption. This is a measure of the amount of water absorbed by a 12" x 12" panel swells after being submerged in water for a 24-hour period. This value is presented as a percentage.

#### Future work

Laboratory efforts are now directed to the scale-up and line trial of the developmental soy protein particleboard adhesive. The Thames Research team would like to thank Dr. Lester Spell and the Mississippi Land, Water, and Timber Board for their funding and support of this project. We would also like to thank the United States Department of Agriculture for their funding under Agreement Numbers 91-38202-5928 and 2001-38202-1042. **Written by Jim Evans, Mississippi Polymer Institute, The University of Southern Mississippi** [jim.evans@mpi-server.psrc.usm.edu](mailto:jim.evans@mpi-server.psrc.usm.edu)

## ANAEROBIC DIGESTION

The biological process of producing gas from organic wastes such as livestock manure, food processing waste, etc. is referred to as anaerobic digestion. This "biogas" is composed mainly of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) and trace amounts of other gases such as hydrogen sulfide, hydrogen, and ammonia. Anaerobic digestion is a natural process during which certain types of bacteria consume organic matter in an air starved environment and yield the biogas. The process can also occur in a controlled environment in an airtight vessel called a digester. Depending on the organic matter being "digested", otherwise known as feedstock and the system design, biogas can contain 55 to 75 percent pure methane.<sup>1</sup>

The process of anaerobic digestion consists of three steps as described by California Energy Commission. The first step is the decomposition (hydrolysis) of plant or animal matter. This step breaks down the organic material to usable-sized molecules such as sugar. The second step is the conversion of decomposed matter to organic acids. And finally, the acids are converted to methane gas.<sup>2</sup> Typically the process temperature ranges between 95 to 105 degrees Fahrenheit and is called the mesophilic range.

Other types of methane producing bacteria operate in the thermophilic range (135 to 145 degrees F).<sup>3</sup>

Many anaerobic digestion technologies are commercially available and have been demonstrated for use with agricultural wastes and for treating municipal and industrial wastewater. Anaerobic digesters can be in several different configurations such as a covered lagoon, complete mix, plug flow, and fixed film reactors. According to the US Department of Energy's (DOE-EERE) website, a digester can be made out of concrete, steel, brick, or plastic and can be shaped like silos, troughs, basins or ponds, and may be placed underground or on the surface. Even though all designs incorporate the same basic components: a pre-mixing area or tank, a digester vessel, a system for using the biogas, and a system for distributing or spreading the effluent (the remaining digested material), each digester system is somewhat different and has to be engineered for the specific location.<sup>3</sup> Proper design, operation, and maintenance of a digester will lend itself to the production of a consistent supply of usable biogas.

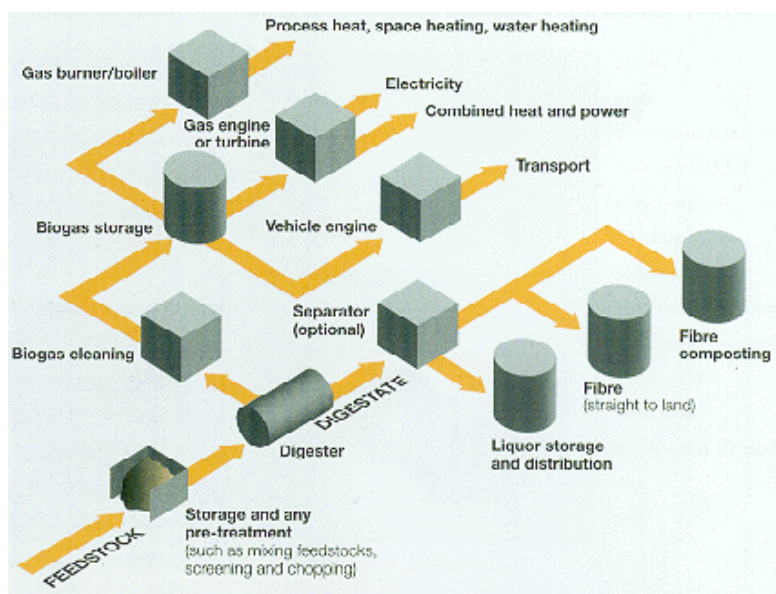
The anaerobic digester technology has a

number of benefits that include environmental, economic and energy generation. As shown in Figure 1, the biorefinery concept of an anaerobic digester can convert animal waste into several value added products such as concentrated liquid fertilizers, composted plant bedding materials, and methane gas, which can be combusted for producing useful electricity and heat for on-farm use. Excess electricity can also be sold back to the power utility grid. The value of these outputs can easily be 600 – 800 percent higher than the waste by itself according to preliminary in-house calculations. Implementation of such projects can greatly offset fossil fuel based energy consumption and convert a poultry, dairy or swine farmer's problematic waste into an asset while increasing environmental compliance by reducing waste and odors associated with manure. It may also create additional markets for farmers and industries for bio-based products.

#### Projects in Mississippi

Three anaerobic digester projects are currently underway in Mississippi. Each one has a different configuration and they will

## Continued from page 4 ANAEROBIC DIGESTION



Picture courtesy of: European Network of Energy Agencies.<sup>4</sup>

utilize swine manure, dairy cattle manure, and poultry litter respectively. The biogas produced from the digesters is expected to fuel electrical generators in the range of 50 to 100 kilowatts (KW) and should feed boilers or burners to produce heat for on-farm needs. The swine farm digester uses a covered lagoon design for the digester

whereas the dairy and the poultry farms have large glass-lined steel tanks on site that will serve as the digester vessels. The two steel tanks do not share a common internal design. Electricity and heat generated should be able to meet most of the on-farm energy demand in all three cases. In addition to generating heat and electricity, the poultry farm digester is also being designed to yield liquid fertilizers and organic biosolids that may be used as soil amendments.

### References:

<sup>1</sup>Golueke, Clarence. 2002. Principles of Anaerobic Digestion, *The BioCycle Guide to Anaerobic Digestion*, The JG Press: Pennsylvania, p 75.

<sup>2</sup>California Energy Commission  
<http://www.energy.ca.gov/development/biomass/anaerobic.html>

<sup>3</sup>Department of Energy: Energy Efficiency and Renewable Energy (EERE)  
<http://www.eere.energy.gov/consumerinfo/factsheets/ab5.html>

<sup>4</sup>European Network of Energy Agencies  
[http://europa.eu.int/comm/energy\\_transport/atlas/htmlu/ado\\_tech.html](http://europa.eu.int/comm/energy_transport/atlas/htmlu/ado_tech.html)

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## ALCORN STATE UNIVERSITY NATURAL PRODUCTS INITIATIVE

The **Mississippi Small Farm Development Center** has provided a broad range of services to small-scale farmers and ranchers in Mississippi during the last fiscal year. The Center employs a holistic agribusiness model to assist its clients. This model entails integrating multiple distinct functions in the food chain coupled with substantial involvement of farm business organizations, especially farmer cooperatives. The Center's services cover identification of market opportunities; enterprise selection; acquisition of resources; production technology; harvesting methods; post-harvest handling; value-added product development; market-



ing; international trade; management; organizational development; and new industry nurturing. The Center's expanding database on small-scale agriculture and biomass resources and its website have become invaluable resources to farmers, agricultural professionals and policymakers. The Center

provided services directly to approximately 600 farmers and indirectly to approximately 4,000.



The Center's **Natural Products Initiative (NPI)**, a major undertaking, involves collaborative projects with the National Center for Natural Products Research at The University of Mississippi, the Polymer Science Research Center at the University of Southern Mississippi, and the Mississippi Natural Products Association. It's purpose is to develop new enterprises for small-scale farm-

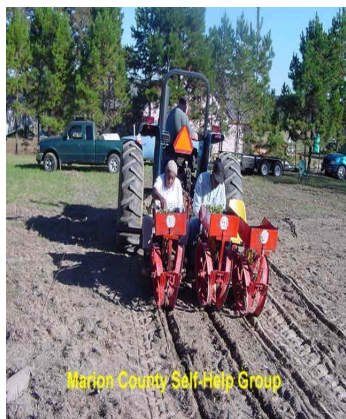
ers in the state. Since its initial funding and launch in FY 1999, this project has conducted field trials of 8 species of medicinal herbs (i.e., Barley, Catnip, Echinacea, Feverfew, Lemon Grass, Red Clover, Valerian, and Wheat Grass) on a commercial scale at Alcorn, Ole Miss and on 30 farms statewide. Shiitake (mushroom) has also been added as a major new crop. Additional new species such as Boneset and Joe Pye are in the experimental production phase since the industry requires a larger set of crops in order to effectively respond to fluctuating market demand. Chemical profiles of Mississippi-produced crops have been created in the lab at "Ole Miss" and found to be of higher quality than brands pulled randomly off the retail shelf.



The **Mississippi Natural Products Association (MNPA)**, a producer cooperative, is providing leadership to this new industry. This co-op presently organizes production; harvesting; post-harvest handling; processing; and marketing of commodities and products for its member-growers. Its present membership consists of 30 active growers, and it has the potential to grow to about 100 within a 2-year period. Significant production is also occurring in north Mississippi under the direction of the Medicinal Garden staff at Ole Miss. The industry has a critical mass that is essential for establishment, development and growth. The raw commodity production during FY04 was about 13 tons.



The MNPA has acquired an abandoned commercial building in New Hebron that consists of 17,000 square feet of usable space. It has partially renovated the facility which serves as headquarters and plant operation. The renovation activities are continuing. The co-op has produced some value-added sample products in the forms of capsule, dehydrated product and extract. Shiitake, produced on sawdust blocks under climate controlled conditions, is a major activity at the facility. The Shiitake operation is a designated profit center that is expected to begin supplying fresh product to major restaurants in October, 2004.



The MNPA is now working on securing product liability insurance and fine-tuning the value-added processes. The MNPA's products will carry the co-op's own brand name. Alcorn and Ole Miss will continue to provide technical support to this new industry through their research and outreach programs. The co-op and its producers are expected to substantially enhance their farm income as this industry grows. It is a multi-billion dollar industry nationally, recording approximately \$20 billion of sales in 2003. A small share of this market for Mississippi could be worth millions. Fifteen percent (15%) of Americans use dietary herbal supplements and the trend is continued growth.

Written by Magid A. Dagher, Ph.D., Director, Mississippi Small Farm Development Center

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## SOUTHERN BIO-PRODUCTS CONFERENCE

Plans are now being implemented for the Southern Bio-Products Conference scheduled for March 22-23, 2005 at the Holiday Inn-Jackson North in Jackson, Mississippi. The Mississippi Biomass Council, Mississippi State University and Alcorn State University are organizing the third conference to focus on products produced from biomass materials. As in the past, the conference will include research papers, updates on important federal bio-programs, equipment and service exhibitors, and discussion of the latest commercial technologies.

General Session on March 22, will bring special attention to new developments in federal bio-programs. Conference participants will have an opportunity to network with other professionals immediately following the general session at the Networking Reception. Concurrent Technical Sessions for March 23 will focus on the following tracks::

1. Feedstock Management
2. Bio-Fuels
3. Alternative Chemicals
4. Polymers
5. Bio-Power

### 6. Other Bio-Products

The Wrap-up Session will provide opportunities for participants to discuss new industry directions and opportunities with a panel of nationally recognized speakers. The conference will end with a Closing Reception where participants will be able to continue networking and discuss previously mentioned topics.

Persons who wish to present papers (limit to 20 minutes), or display posters or exhibits at the conference should complete the registration form by February 15, 2005. Abstracts for the papers are also due by February 15, 2005. Persons interested in attending the conference should complete the registration form and return it with payment to MBC no later than February 5, 2005 to take advantage of the early bird registration rate. The registration form can be found at:

[www.ms-biomass.org](http://www.ms-biomass.org).

A block of rooms has been reserved for attendees at the Holiday Inn-Jackson North. To receive conference room rates of \$65.00, please mention the Southern Bio-Products Conference when making reservations. Suites are available for \$85.00 per night. Contact the hotel at 1-800-465-4329 or (601) 366-9411.

The track chairs are:

1. Feedstock Management, Liam Leightley, Ph.D., [lleightley@cfr.msstate.edu](mailto:lleightley@cfr.msstate.edu)
2. Biofuels, Sumesh Arora, [sarora@technologyalliance.ms](mailto:sarora@technologyalliance.ms)
3. Alternative Chemicals, Kirk Schulz, Ph.D., [schulz@che.msstate.edu](mailto:schulz@che.msstate.edu)
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**BIO-BRIEF NEWSLETTER**

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