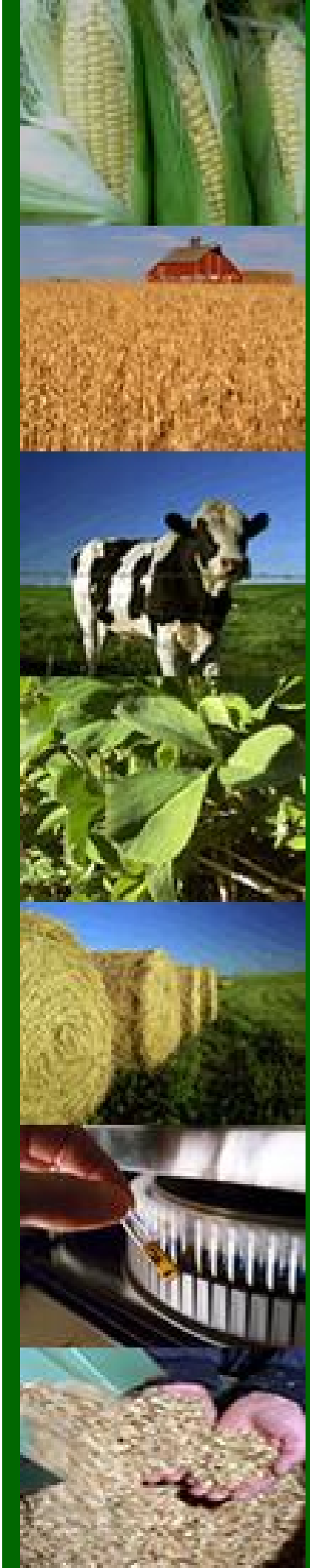

SOUTHERN

Bio-Products Conference

HOLIDAY INN – JACKSON NORTH

JACKSON, MISSISSIPPI

MARCH 22 – 23, 2005

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Southern Bio-Products Conference
Holiday Inn – Jackson North
Jackson, Mississippi
March 22-23, 2005
A G E N D A

TUESDAY, MARCH 22, 2005

8:00 a.m. – 12:00 p.m.	**Exhibitor/Poster Setup**, Trinity Room IV
10:00 a.m.	**Registration**, Pre-Function Area
1:00 p.m. – 1:15 p.m.	**Welcome,** General Session, Oak Ballroom *Wes Miller, President, Mississippi Biomass Council* *Harvey Johnson, Mayor, City of Jackson* **Moderator:** *Byron Wilson, Board of Directors Chair, Mississippi Biomass Council*
1:15 p.m. – 2:00 p.m.	**"Farm Bill Energy Title: Opportunities for Mississippi Farmers"** *Charlie Kubert, Environmental Law and Policy Center*
2:00 p.m. – 2:45 p.m.	**"Financing for Renewable Energy & Value-Added Products"** *W. Bruce Crain, Crain Consulting, Incorporated*
2:45 p.m. – 3:00 p.m.	**BREAK,** Pre-Function Area **Moderator:** *Monte Reeves, Mississippi Biomass Council*
3:00 p.m. – 3:45 p.m.	**"MDA Loan and Grant Programs"** *Chance Carter, MDA Financial Resources Division*
3:45 p.m. – 4:30 p.m.	**"Federal Financial Resources and Opportunities"** *David Dunagan, United States Department of Energy, Southeast Regional Office*
4:30 p.m. – 5:00 p.m.	**Wrap-Up** *Wes Miller*
5:00 p.m. – 8:00 p.m.	**Networking Reception,** Oak Ballroom
7:00 p.m. – 8:00 p.m.	**Board of Directors Meeting – Shapley's Restaurant** *Byron Wilson, Chair,Mississippi Biomass Council*

WEDNESDAY, MARCH 23, 2005

7:00 a.m. – 8:00 a.m. **Continental Breakfast,** Pre-Function Area

8:00 a.m. – 11:30 a.m. **Morning Concurrent Technical Sessions**

10:00 a.m. – 10:15 a.m. **Break**, Pre-Function Area

TRACK 1: FEEDSTOCK MANAGEMENT, TRINITY I

Chair, Dr. Liam Leightley, Mississippi State University

"Opportunities and Challenges related to Production of Energy and Bio-Products from Agricultural Feedstocks in the South"
Dr. David Bransby, University of Auburn

"Forest Biomass Feedstock Availability"
Dr. Phil Steele, Mississippi State University

"Warm Season Grasses for Mississippi Biomass: The Choices and Decisions"
Dr. Brian Baldwin, Mississippi State University

"Mixed Species Hardwood Planting in the Lower Mississippi Alluvial Valley: A Source for Bio-Products, and more than Residue"
Dr. Theodor Leininger and Emily Gardiner, USDA Forest Service, Stoneville, MS

"Grazing No-Till Corn with Steers in an agro-Forestry Environment: Advantages for Land Owners, Wildlife and Timber Producers"
Dr. Michael Boyd et al., Mississippi State University

TRACK 2: BIO-FUELS, TRINITY II

Chair, Sumesh Arora, S3N Consulting/Mississippi Technology Alliance

"Federal Policies and Programs Driving the Development of Biofuels"
Bill Holmberg/Doug Durante, Clean Fuels Development Coalition

"Technology Advances in Biobased Fuels"
John Jechura, National Renewable Energy Laboratory

"Overview of Biogas Production Facilities: An Engineering Assessment"
Dr. Mark Zappi et al., Mississippi State University

"Bioenergy from Agricultural Residues and Animal Wastes"
Dr. Chandra S. Theegala, Louisiana State University

"Opportunities for Bio-fuels in U.S. Southeastern Region"
Mr. Gerald Sherfy, Frazier Barnes and Associates

"Biodiesel Production in Mississippi"
Mr. Tommy Johnson, Earth BioFuels

"Ethanol Fermentation of Sugars Present in Acid Hydrolyzates of a Wood Biomass"
Dr. Huey-Min Hwang, Jackson State University, Jackson, MS

TRACK 3: ALTERNATIVE CHEMICALS, TRINITY III

Chair, Dr. W. Todd French, Mississippi State University

"Converting Animal Manure into Activated Carbon for Metals Remediation"
Dr. Isabella Lima, USDA Agricultural Research Service

"Poultry House Distributed Generation Using Recycled Vegetable Oils"
Mr. Shannon Vinyard, Vinyard Technology Company, Inc.

"Organic Waste Treatment Using Thermophilic Anaerobic Digestion (BIOPLEX)"
Dr. Mark Chatfield, West Virginia State University

"New Uses for the Glycerol Byproduct from Biodiesel Production"
Dr. W. Todd French, Mississippi State University

"Biological Treatment of Lignin to Improve Biomass Conversion to Ethanol and Biopolymers"
Dr. Clint Williford, University of Mississippi

"Value Added Compounds from Energy Crops"
Danielle Julie Carrier and Ed Clausen, University of Arkansas

"Development of an Innovative Water treatment Process using Biobased Adsorbents"
Dr. Mark Zappi, Mississippi State University

11:30 a.m. – 1:00 p.m. **Lunch**, Oak Ballroom

Moderator:
Duane Motsenbocker, Board Member and Interim Treasurer, Mississippi Biomass Council

Introduction of Keynote Speaker:
Dr. Lester Spell, Commissioner, Mississippi Department of Agriculture and Commerce

Keynote Speaker:
Robert Fireovid, National Program Leader, USDA Agricultural Research Service

Student Poster Contest Winner Announcement
Byron Wilson, Board of Directors Chair, Mississippi Biomass Council

1:00 p.m. – 4:30 p.m. **Afternoon Concurrent Technical Sessions**

3:00 p.m. – 3:15 p.m. **Break,** Pre-Function Area

TRACK 4: POLYMERS, TRINITY I

Chair, Dr. Robert Lochhead, University of Southern Mississippi

"Fish Collagen"
Peter Bernegger, We Gel, LLC

"Production and Use of Thermal Polyaspartic Acid"
Larry P. Koskan, Global Green Products LLC

"POSS Nanocomposites"
Joseph Lichtenhan, Hybrid Plastics

"Secondary Structural Changes During Adhesive Processing of Soy Protein Isolate via ATR –IR"
J. N. Shera, University of Southern Mississippi

"The High Throughput Investigation of Polyphenolic Couplers in Biodegradable Packaging Materials"
Robert Y. Lochhead, University of Southern Mississippi

TRACK 5: BIO-POWER, TRINITY II

Chair, Robert Harris, Tennessee Valley Authority

"The TCP Waste & Energy Solution"
Brian Appel, Changing World Technologies

"Potential for Ash Value to Make or Break a Poultry Litter Energy Project"
Dr. Bert Bock, B.R. Consulting, Inc.

"Landfill Gas Energy – An Untapped Resource in Mississippi"
Pradip Bhowal, Mississippi Department of Environmental Quality

"The Impact of SO_x and NO_x Credits and Other Incentives on the Economics of Co-firing Biomass with Coal"
Gerald (Gary) Elliot, International Applied Engineering

"Biorefinery Approach to a Poultry Litter Anaerobic Digester"
Sumesh Arora, S3N Consulting LLC/Mississippi Technology Alliance

"Bioenergy from Biomass Gasification"
Dr. Mark Bricka, Mississippi State University

TRACK 6: OTHER PRODUCTS, TRINITY III

Chair, Phillip C. Badger, General BioEnergy/Southern States Energy Board

"A Status Report on Federal Government Promotion of Bio-based Products"
Roger Conway, United States Department of Agriculture

"Biodryer Improves Performance and Economics of Biomass Energy Projects"
Russell Blades, Wright Tech Systems Inc.

"Boiler Combustion Improvement and NOx Reduction Technology"
Daniel Palomino, Synterprise Global Consulting Services

"Introduction and Application of Innovative Mobile C&D Waste Recycling System"
Bob Brickner, Gershman, Brickner & Bratton, Inc.

"Extraction of Valuable Products from Rice Bran using Non-Traditional Techniques"
Dr. Rafael Hernandez et al., Mississippi State University/Agra Pure

"Small Farm Distributed Power Opportunities"
Mr. Shannon Vinyard, Vinyard Technology Company Inc.

4:30 p.m. – 5:30 p.m. **Wrap-Up,** Oak Ballroom
Wes Miller

The Mississippi Biomass Council seeks to provide information about biomass resources, research, development, technology, and use. We encourage the use of biomass crops and waste for bio-energy bio-fuels, and other bio-based products through personal contact with members, newsletters, education programs, workshops, and conferences. As a member of the Council, you will receive the *Bio Brief* newsletter and other information related to biomass, uses, research, and projects.

If you can help this statewide effort, by becoming a member of the Council and share your knowledge and expetise with other members.

JOIN TODAY

To become a member, complete the application form enclosed in your conference material.

MEMBERSHIP DUES: INDIVIDUAL $50.00 CORPORATE $100.00

2005 SOUTHERN BIO-PRODUCTS CONFERENCE
S P O N S O R S

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Alcorn State University
Small Farm Development Center
www.alcorn.edu/outreach/sfdc/index.htm

Mississippi State University
Industrial Outreach Service
www.ios.msstate.edu

United States Department of Energy
www.energy.gov

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Electric Power Association of Mississippi
www.epaofms.com

Mississippi Development Authority –
Energy Division
www.mississippi.org

Mississippi Technology Alliance
www.technologyalliance.ms

TUESDAY, MARCH 22, 2005

General Session Topics and Speaker Bio's

Moderators: Byron Wilson and Monte Reeves

"Farm Bill Energy Title: Opportunities for Mississippi Farmers"

Abstract: Presentation on the "Farm Bill Energy Title: Opportunities for Mississippi Farmers". The discussion may include some of the World Trade Organization (WTO) issues arising from the recent cotton ruling, the implications of that on traditional commodity subsidies and the alternatives presented by clean energy funding.

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CHARLIE KUBERT is an Environmental Business Specialist with the Environmental Law and Policy Center, an environmental and energy policy and advocacy group based in Chicago. At ELPC, Charlie has been actively involved in the development and promotion of the Energy Title of the Federal Farm Bill. Before joining ELPC, he was a management consultant with PricewaterhouseCoopers and KPMG Consulting. He has a B.A. in political science from Williams College and an MBA from The University of Chicago.

"Financing for Renewable Energy & Value-Added Products"

Abstract: This presentation highlights financing that is available to Alternative Energy Companies. Types of financing available are: (1) Grants, (2) Equity, (3) Tax Credits, (4) Special Tax Exempt Bond Programs, (5) Government Guarantee Loans, (6) Government Direct Loans, (7) Congressional Earmarks and various other programs.

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BRUCE CRAIN is the president of Crain Consulting, Incorporated, based in Jackson, Mississippi. Crain Consulting is a financial consulting firm founded in February 2001 to assist firms and individuals by helping facilitate the acquisition of nontraditional financing for commercial, residential and agribusiness ventures. Crain has 20 years of experience in debt and equity finance, business development, management, government relations on the national and state levels, public relations and consensus building. Since its inception, Crain Consulting has assisted clients in thirty-six different states.

Prior to establishing Crain Consulting, Crain served as director of Fannie Mae's Mississippi Partnership Office that was in charge of administering HouseMississippi, Fannie Mae's five -year, $2.5 billion investment plan designed to increase affordable rental and homeownership opportunities for low-, moderate- and first-time homebuyers in Mississippi.

Bruce previously served as executive director of the AARC Corporation, vice president of legislative affairs for the Savings &Community Bankers of America (now known as America's Community Bankers) in Washington, D.C, and he served as the director of industry relations for the Federal Home Loan Bank of Dallas.

He received his bachelor's degree in public administration from the University of Mississippi and is a graduate of the Institute for Organization Management University of Notre Dame and attended the Graduate School of Savings Institutions Management, University of Texas.

"MDA Loan and Grant Programs"

Abstract: This presentation will address loan and grant programs offered by the Mississippi Development Authority. These programs include: (1) Agribusiness Enterprise Loan Program, (2) Land, Water and Timber Resources Program, (3) Development Infrastructure Program, (4) Energy Investment Program, and (5) Small Business Assistance Loan Program.

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CHANCE CARTER, a Pelahatchie native, has been working with the Mississippi Development Authority's Financial Resources Division since October 2000. Primary duties include: Agribusiness Enterprise Loan Program; Land, Water and Timber Resources Program; and the Mississippi Small Business Assistance Loan Program. Prior to working with MDA, Carter spent 4 years as a loan officer with a local commercial bank.

Carter received a B.S. degree in Agricultural Economics from Mississippi State University in 1995 and an M.B.A from MSU in 1996. Chance also graduated from the Mississippi School of Banking at the University of Mississippi in 1999.

Professional associations include: Mississippi Economic Development Council, Mississippi Poultry Association, National Council of State Agricultural Finance Programs, and the Mississippi Young Bankers Association.

"Federal Financial Resources and Opportunities"

Abstract: Congress has authorized several annual Funding Opportunities to advance the use of energy efficiency and renewable energy technologies and to encourage development of a sustainable biomass industry in the U.S. Learn what Funding Opportunities are anticipated, who will be eligible, applicable cost share requirements, and application procedures. Being informed will help you prepare winning project proposals. Bring your thoughts and questions to this informative session presented by the U.S. Department of Energy's Southeast Regional Office.

J. David Dunagan, *Project Officer*
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DAVID DUNAGAN is the Project Officer for the Transportation and Biomass Programs for the Southeast Regional Office of the U.S. Department of Energy.

The office is part of the Office of Energy Efficiency and Renewable Energy and covers 9 southeastern states, Puerto Rico and the U.S. Virgin Islands. For the past 4 years, Dunagan had been responsible for managing the Clean Cities Program (alternative fuels and vehicle efficiency), FreedomCAR (Cooperative Automotive Research), and renewable transportation fuels (ethanol and biodiesel). In July 2004, these duties were expanded to include the remainder of the Biomass Program.

Dunagan came to the Department of Energy in 2000 from the Fulton County Environment Division where his work focused on water quality issues and conservation.

David graduated from Mississippi State University with a B.S. in Forest Resources in 1977, and then worked for 9 years with the U. S. Department of Agriculture's Forest Service. During this portion of his conservation career, he wrote environmental assessments for a wide variety of forest management activities before becoming the Public Information Officer for the Mount Rogers National Recreation Area in Virginia.

Dunagan received a Master of Science in Public Policy (Environmental Concentration) from Georgia Tech in March 1998. As a Graduate Research Assistant, he worked on a study of implementation of the 1990 Clean Air Act Amendments, Title V permitting program. During his graduate studies, he completed a seasonal appointment with the DOE Atlanta Regional Office, which led to his current position.

WEDNESDAY, MARCH 23, 2005

Concurrent Sessions

TRACK 1: Feedstock Management — *Chair: Dr. Liam Leightley*

"Opportunities and Challenges related to Production of Energy and Bio-Products from Agricultural Feedstocks in the South"

Dr. David Bransby, ***Professor of Agronomy and Soils***
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Abstract: Agricultural feedstocks are extremely diverse, and can be categorized on the basis of several criteria. One of these criteria is whether the feedstock is currently available, or whether it simply has potential to be available some time in the future. This paper focuses only on those feedstocks that are currently available. Within this group of feedstocks, potential energy crops, crop residues and animal wastes constitute the most important categories. Attributes of a good feedstock vary with conversion technology, but generally include high yield and/or bulk density, and low inputs, moisture, ash, silica and soil contamination. In addition, the feedstock must be easy to harvest or collect, easy to handle, transport and process, and able to undergo long term storage without spoiling. The most widely used perennial pasture grasses are the crops that offer the best near term potential in the crops category. These include tall fescue (*Festuca arundinacea*; 35 million acres), bermudagrass (*Cynodon dactylon*; 10 million acres) and bahiagrass (*Paspalum notatum*; 10 million acres), with some less widely grown species such as johnsongrass (*Sorghum halapense*) also offering opportunities in certain areas. While most of the land on which these grasses exist is currently being used for livestock production, a considerable proportion of it could be diverted to feedstock production immediately if an economically attractive biomass market were to develop. However, grasses typically have higher levels of silica than wood, and therefore, lower ash fusion temperatures. This needs to be taken into account with any conversion technology that involves high temperature. Cotton stalks are the most abundant crop residue across most of the South, but their value as a feedstock is limited by low yields and a high moisture content. In the sugar producing regions of Florida and Louisiana, sugarcane bagasse offers considerable opportunities as a feedstock. The most abundant animal waste in the South is broiler litter. It is available in large quantities at relatively low prices, but high and extremely variable levels of ash and silica, and harmful emissions when it is burnt or gasified are major obstacles to its widespread use to produce energy and/or bioproducts. At a delivered price of $55/dry ton or less, biomass feedstocks can often compete favorably with natural gas and propane at the current prices of these fuels, but will not be competitive with coal without an incentive. To date, no technology for producing ethanol from cellulosic feedstocks has been demonstrated on a commercial scale.

DAVID BRANSBY is Professor of Energy Crops and Bioenergy in the College of Agriculture at Auburn University. He has 18 years of experience in this field. His early research focused mainly on optimizing production from switchgrass and other energy crops. More recently he has expanded this effort to address both technical and policy issues that are obstacles to commercialization of bioenergy, with special emphasis on co-firing biomass with coal to produce electricity.

"Forest Biomass Feedstock Availability in Mississippi"

Dr. Phil Steele,
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Abstract: Between the mid-1980s and the mid-1990s a revolutionary change in timber growing practices occurred in the 13 southern U. S. states. The percentage of forested land converted from natural stands into plantations increased by 52 percent in only 8 years. In Mississippi the change was an astounding 92 percent increase, that is, plantation acreage nearly doubled. As a result of loblolly pine genetic improvement for faster growth, combined with silvicultural changes that encouraged faster growth through wider between- seedling spacing, a dramatic increase in pine growth rate occurred. For the 13 southern states the average annual pine growth increased by 22 percent over the 8 years. For Mississippi, the cumulative annual pine growth was 34 percent over the same period. This increase in pine growing volume resulted from both an increased acreage of pine plantations but also from the increased growth rates on these acres. Average growth per acre increased from 65 to 77 cubic feet per acre or a 2.6 percent annual increase.

Coincident with the increased supply of pine volume in the south was a reduction in demand for small-diameter timber. Numerous paper and pulp producers have closed their doors over this period as a result of intense international competition. The result of increased supply and reduced demand produced a reduction in pulpwood prices that is expected to continue though 2030. The outcome and potential impact of both increased supply and reduced demand for small diameter pine in the south and Mississippi will be reviewed.

DR. PHILLIP STEELE has been a Professor in the Dept. of Forest Products, College of Forest Resources, Mississippi State University for 17 years. He teaches an undergraduate/graduate level course in Lumber Manufacturing. Dr. Steele's expertise is in computer simulation of the sawmilling and furniture manufacturing processes; production economics; and development of dielectric devices for characterizing wood types. His computer simulation work has led to the development and distribution of five software packages to assist managers with manufacturing analysis.

Dr. Steele has recently initiated research in production of bioenergy from woody biomass and to this end he has coordinated development of a laboratory-scale bio-oil reactor. Based on development of the bio-oil reactor Dr. Steele has attracted funding of more that $2,000,000 in 2004 from USDA and DOE grants. Dr. Steele coordinates a group of on-campus collaborators in chemistry, chemical engineering and forest products to develop proposals to investigate the development of specialty chemicals and fuels from bio-oils made from various types of wood feed stocks.

Dr. Steele holds four patents in the field of nondestructive testing with dielectric devices. One device is licensed to a company that has commercialized the technology. This device is being sold to accurately detect knots as a supplement to the capabilities of other technologies that are less accurate in knot identification.

"Warm Season Grasses for Mississippi Biomass: The Choices and Decisions"

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Abstract: Warm season grasses have been targeted as a carbon dioxide-neutral source of energy for direct combustion or syn-gas and ethanol production. The key to sustainable biomass production is maximizing yield with minimal inputs. Ease of establishment and tonnage per acre are determining factors for the producer. At the consuming side, availability and quality are the determining factors. Quality of biomass is determined by ash concentration, components of ash and caloric value.

Three concurrent studies have been established to address these factors. Ten warm season grasses were established to determine appropriate harvest regime, yield, caloric value and ash. These ten species were narrowed to the four highest yielding species for further analysis. Weathering of the highest yielding species indicated that two, switchgrass and giant miscanthus, were innately low in potassium and total ash. Weathering in an attempt to further decrease ash concentration caused yield to drop by 20-40% within the first 30-day weathering period, depending on species. The best two species (based on yield and ash) are innately hard to establish. Giant miscanthus is vegetatively propagated, while switchgrass is notoriously slow to establish from seed. Efforts to enhance establishment have been addressed with a nurse-crop of sorghum-sudangrass or sequential planting to determine the most appropriate spring/summer planting date.

"Mixed-species Hardwood Plantings in the Lower Mississippi Alluvial Valley: A Source for Bio-Products, and more than Residue"

Dr. Theodor Leininger, ***Project Director***
Emile Gardiner, ***Research Scientist***
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Abstract: Since the early 1990s, a trend in the Lower Mississippi Alluvial Valley has been to plant trees on cleared land that is marginally productive for agricultural purposes. Much of this effort has been encouraged by Federal programs such as the Conservation Reserve Program and the Wetland Reserve Program. For example, as of 2003, more than 3,600 ha of cottonwood and oak interplantings had been established in Arkansas, Louisiana, and Mississippi. Landowner objectives for establishing plantings, and for potential uses of the resulting woody crop, are varied and include pulp production, sawtimber production, production of sequestered carbon for a hoped-for eventual market in carbon credits, as well as creation of wildlife habitat, revenue from hunting leases, and restoration of

bottomland hardwood forests. The common thread in these objectives is to realize an economic return for the investment. As markets in bio-products emerge, most notably in biofuels and bio-energy, landowners should be quick to embrace opportunities to supply the market. This presentation will highlight production systems, methods, and yields in bottomland hardwoods that would be conducive to the needs of emerging bio-products industries.

DR. THEODOR LEININGER is Project Leader of the Center for Bottomland Hardwoods Research, USDA Forest Service, which is headquartered in Stoneville, Mississippi. Part of his research, as leader of a multi-disciplinary research work unit, includes developing accounting and monitoring guidelines for carbon sequestration in the Lower Mississippi Alluvial Valley and exploring new opportunities to use the biomass produced through afforestation efforts in the LMAV.

EMILE GARDINER is a Research Forester with the USDA Forest Service, stationed at the Center for Bottomland Hardwoods Research in Stoneville, Mississippi. His research program is focused on problems involving the ecophysiology and silviculture of bottomland hardwood tree regeneration. A significant portion of this research is conducted under the context of forest restoration on former agricultural fields in the Lower Mississippi Alluvial Valley.

"Grazing No-Till Corn with Steers in an Agro-Forestry Environment: Advantages for Land Owners, Wildlife and Timber Producers"

Boyd, M.E., G.B. Triplett, J.C. Jones, D.L Grebner, P.H. Steele, D. Manning, and M. Bell

Abstract: This project combines forestry, forest products, wildlife, agronomy and animal production in a system that contributes to or enhances each component. This agro-forestry system utilizes no-till corn harvested by steers as a companion crop to trees. The cropped area is fertilized with ½ the N and all of the P and K prior to planting. Glyphosate tolerant corn, 32,000 seeds/acre, is planted in early April. The planted area is sprayed preemergence with paraquat to dessicate vegetation, which stops the loss of soil moisture. The corn is sprayed with glyphosate at the V5 stage. The remaining N is applied when the corn reaches the V8 stage. Heavy weight steers are turned into the corn prior to senescence, allowing the steers to adapt their rumens to the high starch intakes they will soon be experiencing. The steers harvest most of the corn during a 2-3 month period, dropping from 5-10 % of the grain. The dropped corn attracts wildlife. Research to date has shown Mourning dove are highly attracted along with deer, turkeys, quail, song birds and raptors. Only a small fraction of the nutrients that are applied to the field leave, mainly in the form of animal gain. The remaining nutrients are available to the trees. An increased growth rate of the trees is anticipated. Unwanted woody vegetation is controlled by herbicides used during planting.

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DR. MICHAEL BOYD has been at Mississippi State University since 1981. He is currently a Professor in Animal and Dairy Science. His current field of research is in grazing management and alternative grazing systems. Dr Boyd teaches Animal Breeding, Livestock management and Advanced Animal Breeding, at both the undergraduate and graduate level.

TRACK 2: Bio-Fuels *Chair: Sumesh Arora*

"Technology Advances in Biobased Fuels"

John Jechura, ***Senior Chemical Engineer***

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Abstract: In 2001 consumption of biodiesel (diesel from soybeans and other oil feedstocks) reached 20 million gallons and in 2003, ethanol production from starch topped 2.8 billion gallons. Both biobased fuels have had a long road to the limited percentage they have now in the fuel pool. Ethanol is roughly 2% of the gasoline pool and biodiesel is less than 0.5% of the diesel pool, and both are primarily used as additives. But new governmental and corporate policies are indicating that this is not just the beginning of biobased fuels but also biobased chemicals and materials. The demand for green but sustainable and profitable biobased products must lead to new feedstocks that are cheaper and more abundant, and the technologies to utilize them efficiently and economically. This paper discusses some of the recent advances in biochemical and thermochemical technology to convert biomass, specifically lignocellulosic biomass (i.e. non-starch biomass), to ethanol. This is a portion of the work being done under the Office of the Biomass Program (OBP) in the US Department of Energy and also in the private sector.

JOHN JECHURA is a Sr. Chemical Engineer with the National Bioenergy Center at the National Renewable Energy Laboratory. John is the technical lead of the Process Engineering team in the Integration, Analysis, & Planning Group. His primary background is as a process modeler & applied thermodynamicist. He has performed techno-economic studies of the biomass to ethanol conversion process using ASPEN PLUS. John came to NREL after spending 20 years in the oil industry with Marathon Oil Company. Most of his work there was related to physical property measurement & modeling for process & reservoir applications. Outside of NREL, John is an Adjunct Professor in the Chemical Engineering Department at the Colorado School of Mines

"Federal Policies and Programs Driving the Development of Biofuels"

Bill Holmbeg, ***New Uses Council***
(Representing **Doug Durante,** ***CFDC)***

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Abstract: The US Ethanol and Biofuels Industry is experiencing a phenomenal period of expansion. What is driving this growth and what is the role of incentives at the federal level? Are there lessons that can be learned for the rest of the biomass industry? This presentation will cover these and related topics, keying on the authors 20+ years in Washington working on ethanol.

Mr. WILLIAM HOLMBERG: Enlisted Marine, Naval Academy graduate, medically retired as a Lt. Colonel after 19 years commissioned service. Well decorated. Commanded platoons, companies, a Marine Barracks and a Battalion Landing Team – 1,600 Marines; Russian linguist and Soviet specialist with assignments behind the Iron Curtin during Cold War; Aide to two Chiefs of Naval Operations; and, a tour on the Joint Chiefs of Staff. Advanced degrees in Personnel Administration, Russian language, Soviet Affairs and Advance Integrated Amphibious Operations.

Government service at EPA (1971-73 and 74-78), Federal Energy Office/Administration and the Department of Energy (73-74 and 78-83). Government and Regional Operations, Pesticides, renewable energy and ethanol were highlights. Retired as member of Senior Executive Service. Picked up the renewable energy mantle in 1974.

In the private sector managed associations and several small businesses with a focus on ethanol, biodiesel, sustainable agriculture and environmental enhancement. Helped pioneer the ethanol and biodiesel industries, and the biorefinery concept covering industrial crops as well as soil and water quality; biofuels; biopower; bio-based products: and the cleanup component – meeting air and water quality standards, recycling, composting and anaerobic digestion of organic wastes. Has dedicated 30 years to these concepts.

"Overview of Biogas Production Facilities: An Engineering Assessment"

Mark Zappi, Todd French, and Tracy Benson: MSU
Katherine Taconi, Department of Chemical Engineering
University of Alabama-Huntsville

Dr. Mark Zappi,
Distinguished Professor
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Abstract: Biogas is a gas produced from the anaerobic decomposition of organic materials by methanogenic organisms. Its typical composition is primarily made up of methane and carbon dioxide. With increasing natural gas prices, production techniques of biogas may offer an option for reducing power production costs and even potentially offering a profitable secondary income to various entities including municipalities, industries, and farmersNumerous waste products and conversion systems appear applicable from both an economic and technical viewpoint. This presentation will highlight an assessment of production potential for biogas within the State of Mississippi. Of particular note will be the overview of equipment and production potential for industries, landfills, farming operations, and municipal wastewater plants.

Dr. MARK ZAPPI holds the Texas Olefins Professorship of Chemical Engineering at The Dave C. Swalm School of Chemical Engineering of Mississippi State University. He has a BS in Civil Engineering from The University of Louisiana and a MS and PhD in Chemical Engineering from Mississippi State University. Dr. Zappi serves as the Director of the Mississippi University Research Consortium for the Utilization of Biomass which is a DOE EPSCoR and state supported consortium composed of researchers from Mississippi State University, Jackson State University, University of Mississippi, and University of Southern Mississippi. This Consortium focuses research toward the production of fuels and chemicals from both waste and cultured biomass products. Dr. Zappi=s research areas include development of bioprocesses for the production of commodity and specialty chemicals, including ethanol, acetic acid, biodiesel, fatty acids, proteins, and biogas. He is also actively involved in the development of new bio-based products, such as cellulose-based adsorbents for treatment of polluted waste streams. Dr. Zappi holds two patents relating to bioprocessing and has three additional patents pending in the same subject area. He is also currently working with several private companies on the commercialization of bio-based products and processes.

"Bioenergy from Agricultural Residues and Animal Wastes"

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Assistant Professor

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Abstract: The major agricultural crops in Louisiana include sugarcane, rice, soybean, cotton, corn, hay, sorghum, and wheat. These crops are grown on about 3,500,000 acres of land. These crops produce large quantities of agricultural residues such as bagasse, corn stover, and rice husks. Currently, most of these agricultural residues in Louisiana are directly burnt on the field or burnt for steam generation with very little heat extraction efficiency. Louisiana also has a significant number of livestock and poultry producers, who are seeking treatment (or disposal) alternatives for the generated wastes.

The first stage of this research focuses on separation of solids from the waste stream (liquid waste stream) using low-maintenance screen filters. The next phase involves drying the agricultural residue or animal waste to the required moisture content using non-conventional, low-cost energy sources (such as mechanical dewatering, solar stills, and reuse of waste heat). Biomass with about 20% moisture content is fed to in-house-built, down-draft gasifiers. The synthetic gas produced from gasifiers can be used for heat generation or can be further cleaned for use in engines coupled with electrical generators. With respect to animal wastes, two other revenue generation options are also being explored under this research. Preliminary research indicated that the solar drying process lowers the coliform numbers drastically, thereby, opening new doors for production of organic fertilizer pellets from solar-still dried animal manure. Methane production from temperature controlled, insulated, anaerobic digesters is also being investigated.

Dr. CHANDRA THEEGALA joined the Biological and Agricultural Engineering Department in Fall 2003. Dr. Chandra Theegala holds a Ph.D. in Civil and Environmental Engineering from Louisiana State University. His research interests include: agricultural bi-products/waste treatment and management, point and non-point source water pollution prevention and treatment, wastewater treatment (agriculture and aquaculture), biosensors, bioenergy and alternative energy. He is also the founder and group coordinator of the "Renewable Energy, Byproduct Utilization and Biosensors (REBUB)" research group in the Biological and Agricultural Engineering Department. In the renewable/bioenergy area, he is actively working on projects involving gasification

of biomass, methane production and ethanol production. By the end of Fall 2005 he plans to have a fully functional, in-house developed, demonstration unit for producing bioenergy from agricultural residues and wastes (such as bagasse, crop residues, animal wastes, etc). Dr. Theegala is also actively involved in utilization of geothermal, solar energy, and evaporative cooling for low cost heating/cooling applications (such as greenhouse and dairy facilities). Last year, he initiated a new research aimed at developing a biothreat alarms system for detecting chemical and biological contaminants in water supply lines. Dr. Theegala is currently working on producing, solar-still dried, bacteria-free, fertilizer pellets from agricultural waste for use as organic/agriculture fertilizers.

"Opportunities for Bio-fuels in U.S. Southeastern Region"

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Abstract: This talk about Corn to ethanol and soybeans to biodiesel as primary biofuels for will also mention other potential feedstocks for ethanol/biodiesel (yellow grease, etc.). Factors to be considered when locating a biofuel facility: transportation issues (highway/rail), feedstock, etc. will be discussed. Map of potential markets for biofuels: major metropolitan statistical areas will be shown. ETHANOL SECTION: Overview of corn to ethanol industry with data on regional ethanol consumption (100% ethanol, and potential 10% blend with gasoline). Corn to Ethanol Model; how much ethanol is produced per bushel of corn and a summary of corn production levels will be presented as will a maps of existing/proposed ethanol plants in U.S. and Southeast Region with corn production levels. Potential areas for siting ethanol plants will be pointed out and ethanol incentives will be highlighted. BIODIESEL SECTION: An overview of a soybean to biodiesel model with summary of soybean production levels will be presented. Maps of existing/proposed biodiesel manufacturing plants in U.S. and Southeast Region with soybean production levels will be presented and potential areas for siting biodiesel plants will be pointed out. Federal regulations; users of biodiesel (federal agencies, etc.); emissions regulations; Renewable Fuel Standard; U.S. Farm Bill Biodiesel tax credits; Mississippi house bill 928 will also be discussed.

Gerald Sherfy has 13 years of professional research experience. Mr. Sherfy served for four years as a travel professional in the Marine Corps. While in the Service, he lived in Japan for two years before being transferred to Tennessee's Naval Air Station in Millington. He has worked as a loan analyst performing professional research analysis for multi-million dollar projects, and also worked for several years in the field of agricultural real estate appraising. He now works as a Project Manager at FBA, specializing in biomass-related projects.
Mr. Sherfy was born in Ohio, raised in Oregon, and made Memphis, Tennessee his home in 1991. He received his Bachelors of Science Degree in Physics from the University of Memphis, where he is currently enrolled in the Executive Masters in Business Administration Degree program.

"Earth Biofuels: The story of Mississippi's Fuel"

Tommy Johnson
Operating Manage/Board Member
Earth BioFuel, Inc.
Byram, Mississippi

Abstract: This presentation will be a historical account of the beginning of biodiesel production in Meridian and the company Biodiesel Fuels of Mississippi, and takes the audience through the short history to date. From there, I will discuss where we are today, including the opening the first biodiesel blend filling station in the Metro Jackson area and where we are going in the future.

Tommy Johnson received his Bachelors Business Administration from the University of Texas 1988. He is currently the Secretary and Treasurer of Earth Biofuels, Inc. He is also a Stockholder and Board member of the corporation and serves as the Operating Manager. Earth Biofuels is a member of the National Biodiesel Board as well as the Mississippi Biomass Council. Tommy is married and has three boys and lives in Brandon, Mississippi.

"Ethanol Fermentation of Sugars Present in Acid Hydrolyzates of a Wood Biomass"

Huey-Min Hwang[1], Maria Begonia[1], Yi Zhang[1], Jennifer Ntoni[1], Ken Lee[2] and Jun Gao[1]
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Abstract: An alternative energy source could be found in ethanol produced from microbial fermentation of sugars present in the acid stream derived from agricultural biomass treated with acid hydrolysis. The fermenting microbes must be tolerant of acidity and ethanol and able to ferment various hexose and pentose sugars. After acid hydrolysis treatment, the product (acid hydrolyzate) often contains not only sugars needed for ethanol fermentation but also inhibitors (including organic and inorganic chemical species) that could adversely affect microbial growth and fermentation activity. This research focused on using genetic and physiological approaches to achieve the goal of moving ethanologen development. Acid hydrolyzates used in this study were obtained from the engineer group of the University of Southern Mississippi and pseudo hydrolyzate solutions produced in a JSU lab under less drastic conditions. In this research we are seeking microbes which can utilize a wider range of sugar substrates, especially under acidic condition. We purchased certain strains from ATCC and selected others from acidic environmental samples. Their ability to ferment sugars under acidic conditions was tested. Identification of inhibitors/contaminants in the hydrolyzates and determination of their effect on growth and fermenting ability of the test microbes are being conducted. Ion exchange was used to treat the hydrolyzates to bring pH up for ethanol fermentation. This research was funded by (1) DE-FG02-00ER45830 through DOE/EPSCoR program and (2) NIH-MBRS S06GM08047 to JSU.

Keywords: hydrolyzate, fermentation, ethanol, biomass

Dr. Huey-Min Hwang is a tenured Professor in the Biology Department at Jackson State University and has been at JSU more than 15 years. Dr. Hwang obtained his PhD in microbiology at the University of Georgia in Athens, Georgia and conducted his postdoctoral associate studies there as well. He obtained his Bachelors of Science in biology from the National Taiwan Normal University, Taiwan. Dr. Hwang was awarded the Jackson State University Outstanding Faculty Honoree in 2002 at the Higher Education Appreciation Day Working for Academic Excellence (HEADWAE) Program. He has been serving as a member of the Environmental Toxicology Task Force of the Institutes of Higher Learning of Mississippi State since June 1996. He is also serving as a guest member of the editorial board of the Environmental Chemistry section of the journal Chemosphere and as an external reviewer for the journal "Environmental Toxicology and Chemistry" and "Bulletin of Environmental Contamination & Toxicology. He has coauthored over 40 publications in peer reviewed journals. He is a member of several professional organizations including the American Society for Microbiology and American Association for the Advancement of Science.

"Converting Animal Manure into Activated Carbons for Metals Remediation"

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Abstract: The United States has a strong agricultural foundation that leaves behind large quantities of both plant and animal wastes. Animal waste continues to represent a significantly large and problematic portion of the U.S. agricultural waste generated yearly. Georgia, Alabama and Mississippi together contribute about to 1/3 of the nations supply of broilers generating in excess of 3 million tons of manure. Nutrient buildup due to excessive manure application onto soils, can lead to non-point source pollution runoff into rivers and streams. One of the best ways to manage this disposal problem and to use animal waste to its full potential is to transform it, from an environmental hazard to an environmental solution.

Our research group with the Commodity Utilization Research Unit at ARS' Southern Regional Research Center in New Orleans, Louisiana, is looking into converting various animal manures with focus on poultry manure into a material that can be used to help keep the environment clean. Our research project, unique to ARS and to our best knowledge, with unprecedented art, involves manufacturing activated carbons from animal waste, with a strong focus on poultry manure. Development of these value-added products can give animal waste producers profitable solutions for their disposal problem and make value out of the waste by producing superior, less costly adsorbents that will compete successfully with currently available activated carbon products. Four different types of animal manures (broiler, turkey, swine and dairy) have been converted into granular activated carbons, via pyrolyzation and activation of a pelletized sample of manure. The resulting carbons were characterized in terms of their physical properties (yield, surface area, attrition, bulk density) and adsorptive properties for four metal ions (Cu^{2+}, Cd^{2+} Ni^{2+} and Zn^{2+}) from single metal solutions as well as in competition. Carbons made from coal, coconut shell and wood and produced under the same conditions were used as reference. Yield and surface area of the manure-based carbons were lower and attrition higher than the reference carbons, yet the carbons produced from animal manure adsorbed up to 6 times the amount of Cu^{2+}, Cd^{2+} and Zn^{2+} adsorbed by the reference carbons.

The low cost and high availability of large quantities of animal manures generated at concentrated animal facilities throughout the United States make them an attractive feedstock for carbon production. This novel approach to the utilization of animal manure can create new markets for animal manures, a new inexpensive source for activated carbons, and a cleaner environment.

DR. ISABEL LIMA got her Masters and Ph.D. in Food Engineering from the Agricultural Engineering Department of the University of California-Davis, in 92 and 96 respectively. Dr Isabel Lima has been working for ARS, USDA, in the Southern Regional Research Center, New Orleans, Louisiana since 1997. More recently, she joined the Commodity Utilization Research Unit as a Research Chemist and has been involved with high value-added applications, such as converting animal manures, with emphasis on poultry litter and swine manures as well as other agricultural residuals to granular activated carbons for environmental remediation.

"Poultry House Distributed Generation Using Recycled Vegetable Oils"

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Abstract: The objective of this project is to demonstrate that vegetable oils and used restaurant greases and can be recycled and utilized to reduce poultry production costs. This is done by using the oils and greases as an engine fuel for a specially-built, commercially-available engine generator unit (genset). In this manner, fuel costs can be reduced over 30% compared to making Biodiesel from the recycled greases. The project sponsored by Alabama Department of Economic and Community Affairs (ADECA), and the test is being conducted at a poultry farm in southeast Alabama. Two enabling technologies allow this fuel to be used effectively: (1). The ability to burn the raw grease product in a specially-modified diesel engine, and (2) The ability to connect the engine generator (genset) directly into the existing electrical grid.

Results from laboratory testing and field operation from this ongoing project are presented. Engine modifications and fielding issues are discussed. Economic factors and other benefits for the customer, electric utility, and society are outlined.

SHANNON VINYARD is president of Vinyard Technology Company, Inc. a consulting, technology, and manufacturing company in Hartford, AL. Established in 1998, this company focuses on engines, alternative fuels and waste-to-energy systems. Current projects include fuels from waste engine fluids, biomass energy projects, biodiesel and waste cooking oils, disposal of medical wastes, and manufacturing of waste-fueled generator systems. Mr. Vinyard has over 27 years direct experience in engine research and alternative fuels.

He was formerly President, CEO, and cofounder of Vinyard Engine Systems, Inc. (1993-1998) in San Antonio, Texas. Previously he was employed by Southwest Research Institute in San Antonio (1984-1993), serving as Director of Engine Research from 1988-1993.

Mr. Vinyard served in the U.S. Army (1980-1984), last serving as a Captain and Assistant Manager of the Propulsion Systems Division, U.S. Army Tank Automotive Command, Warren, MI. He received his BS and MS in Agricultural Engineering at Auburn University, with thesis emphasis on engines and alternative fuels.

Professional activities include the Society of Automotive Engineers (SAE), and the American Society of Agricultural Engineers (ASAE). In SAE, Shannon was past chairman of the Diesel Engine Committee, Power Plant Activity chairman, and chairman of the Horning Award committee that annually chooses the best engine and fuels technical paper. Mr. Vinyard is also an Affiliate Assistant Professor in the Biosystems Engineering Department at Auburn University.

"New Uses for the Glycerol Byproduct from Biodiesel Production"

W. Todd French, Mark E. Zappi, Rafael Hernandez, Juliana Kyle, &Ryan Tappi
Dave C. Swalm School of Chemical Engineering
Mississippi State University

Abstract: Due to the world's decreasing supply of fossil fuels, alternative fuel sources must be sought out. Biodiesel fuel is steadily becoming a more feasible alternative to petroleum. As production of biodiesel fuel increases, byproducts of the process become more abundant, which could eventually lead to the formation of gluts of major byproducts, such as glycerol. Glycerol is a non-toxic compound with many uses; however, if a surplus exists in the future, more uses for the extra glycerol need to be found. Also, for biodiesel production processes that incorporate animal wastes, the glycerol byproduct could be considered a health risk (due to its origin), and thus would not be desirable for use in many of its current applications in foods, cosmetics, pharmaceuticals, etc. These limitations again illustrate the need for new, more profitable uses to be discovered.
The goal of this project is to find an add-on process for the biodiesel production process that will convert the glycerol byproduct to more valuable substances, focusing at present on 1,3-propanediol and lactic acid. Research using bacteria that are known to ferment glycerol into these compounds has been performed in order to establish a benchmark for comparison against other types of bacteria. The three benchmark cultures used so far are *Clostridium acetobutylicum*, *C. beijerinckii*, and *C. pasteurianium*. These cultures have shown production levels up to approximately 550 ppm 1,3-propanediol and approximately 200 ppm lactic acid after growing on a medium of 0.2% glycerol. After growing on this same medium, a culture recently isolated by MSU produced approximately 200 ppm 1,3-propanediol and another produced approximately 800 ppm lactic acid. Optimization of fermentation conditions would likely increase the current production levels. Also, novel cultures producing larger amounts of valuable

products will be sought after, the goal being to find the most efficient and least expensive glycerol-fermenting microorganisms for use in an add-on process to biodiesel production. By making more useful and valuable products from the excess glycerol, biodiesel fuel will become even more affordable and profitable.

Dr. Todd French is an Assistant Research Professor of Microbiology in the Dave C. Swalm School of Chemical Engineering. He is currently serving as the Associate Director of the Mississippi Biomass Consortium and the President of Mississippi State University Chapter of Sigma Xi. Dr. French has over 15 years of experience in the areas of fermentation, bioprocessing, bioremediation, and microbially enhanced oil recovery technologies. His current research activities include the production of ethanol and acetic acid from synthesis gas, biodiesel production from alternative feedstocks, fermentation of glycerol, and microbially enhanced oil recovery.

"Biological Treatment of Lignin to Improve Biomass Conversion to Ethanol and Biopolymers"

Naresh Budhavaram[1*], Aarti Gidh[1], Clint Williford[1] and Alfred Mikell[2]

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Abstract: Biomass can be used to produce ethanol an alternative to petroleum. The cellulose and hemicellulose in biomass can be converted to ethanol by enzymatic saccharification and fermentation. However, biomass also contains lignin that associates with cellulose and hemicellulose and forms a barrier to enzymatic attack. Termites, beetles and other arthropods can digest decaying wood and other lignocellulosic plant litter. Lignin-degrading filamentous bacteria have been isolated from the termite gut. Bacterial lignin degradation has been reported to be more specific than that with fungal systems, an advantage, leading to many industrial applications like vanillin, adhesives, binder for laminated or composite wood products, etc. The purpose of our work is to find biological agents that can disengage and depolymerize lignin, improving enzymatic saccharification. The benefits of success include reduced costs for ethanol production, and a revenue stream from lignin byproducts.

We have screened inoculum sources for lignin depolymerization. Sources were cultures from dissection of guts of various insects like termites, beetles etc. that are known to digest wood. Other sources included cow rumen/dung, deer dung, and soils high in lignin content. Detailed analysis with Near Infrared Spectroscopy (NIR) and Atomic Force Microscopy (AFM) along with HPLC (UV detector) were conducted for the sources showing potential for lignin degradation. Future plans include applying the promising cultures that have shown lignin depolymerization to pretreated corn stover. We will look for increased ethanol yield as a sign of reduced lignin inhibition, and thus enhanced saccharification and fermentation of cellulose.

"VALUE ADDED COMPOUNDS FROM ENERGY CROPS"

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Dr. David Bransby
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Abstract Technologies are available to convert ligno-cellulosic biomass to bio-ethanol. One of the most promising of these is the gasification-fermentation process, but the relatively low value of ethanol, and subsidies for oil, make it difficult for bio-ethanol to compete with gasoline as a transportation fuel. Extraction of high value products in a biorefinery prior to processing biomass for energy could alter this situation. Studies at Auburn University have demonstrated that mimosa (*Albizia julibrissin*) offers considerable potential as an energy crop, providing high yields of biomass from annual harvests with very low inputs. The objective of this study was to examine the antioxidant content of mimosa foliage, and to demonstrate the potential value of such products using results obtained from milk thistle. Laboratory tests indicated that mimosa foliage is high in two antioxidants, hyperoside and quercitrin, and that these compounds can be extracted with water. Additional tests indicated that extracts from milk thistle prevent the oxidation of low density lipids (LDL) which are beneficial to human health. It is anticipated that the antioxidants from mimosa could have a similar beneficial effect, and this will be examined in the next phase of research.

DAVID BRANSBY is Professor of Energy Crops and Bioenergy in the College of Agriculture at Auburn University. He has 18 years of experience in this field. His early research focused mainly on optimizing production from switchgrass and other energy crops. More recently he has expanded this effort to address both technical and policy issues that are obstacles to commercialization of bioenergy, with special emphasis on co-firing biomass with coal to produce electricity.

"Development of an Innovative Water treatment Process using Biobased Adsorbents"

Mark Edward Zappi, Ph.D., P.E.

Mark Zappi, Doug Tolar, Rafael Hernandez and Eugene Columbus (2)

Dave C. Swalm School of Chemical Engineering and (2) Department of Agricultural and Biological Engineering,
Mississippi State University

Abstract: A novel process is being developed for treatment of contaminated water and air streams. The process involves adsorption of contaminants onto crushed kenaf fibers. Kenaf, a plant that is related to okra, is an agricultural crop that has recently been found to have many uses including animal litter, paper manufacturing, and composite material construction. The cost of processed kenaf is approximately 1% of the cost of commercial activated carbon. The fibers of the kenaf plant are resistant to water logging and are structurally stable when exposed to overburden loads allowing tight, yet sturdy packing.
Kenaf fibers will be packed into a column where contaminated water will be passed through the column using up-flow hydraulics to provide intimate contact between contaminated water and the kenaf fibers. The contaminants adsorb onto the sorptive sites on the kenaf and the column operated until all of the kenaf fibers within the column are completely spent (i.e. all sorption sites filled). This approach is very similar to that used with activated carbon adsorbers; however, once the kenaf becomes spent, then the fibers will be removed and placed into a compost bed. The composting will be used to reduce the volume of the kenaf plant mass and degrade and/or concentrate the adsorbed contaminants via biotreatment.

Dr. MARK ZAPPI holds the Texas Olefins Professorship of Chemical Engineering at The Dave C. Swalm School of Chemical Engineering of Mississippi State University. He has a BS in Civil Engineering from The University of Louisiana and a MS and PhD in Chemical Engineering from Mississippi State University. Dr. Zappi serves as the Director of the Mississippi University Research Consortium for the Utilization of Biomass which is a DOE EPSCoR and state supported consortium composed of researchers from Mississippi State University, Jackson State University, University of Mississippi, and University of Southern Mississippi. This Consortium focuses research toward the production of fuels and chemicals from both waste and cultured biomass products.

Dr. Zappi's research areas include development of bioprocesses for the production of commodity and specialty chemicals, including ethanol, acetic acid, biodiesel, fatty acids, proteins, and biogas. He is also actively involved in the development of new bio-based products, such as cellulose-based adsorbents for treatment of polluted waste streams. Dr. Zappi holds two patents relating to bioprocessing and has three additional patents pending in the same subject area. He is also currently working with several private companies on the commercialization of bio-based products and processes.

LUNCH KEYNOTE SPEAKER

Introduction by *Dr. Lester Spell*
Commissioner, Mississippi Department of Agriculture and Commerce

"R&D Trends for BioProducts"

Abstract: Research policy is the best indicator for what is coming in bioproducts arena, and this presentation will cover some national and international trends in bioproduct research. Not surprisingly, some of the best work is being done in Mississippi!

Dr. Robert Fireovid, *National Program Leader*
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DR. ROBERT FIREOVID joined the National Program Staff at the USDA last November and focuses on bioproducts and bioenergy. He came from the Dept. of Commerce's National Institute of Standards and Technology (NIST) where he spent ten years as a program manager in the Advanced Technology Program (ATP). While in ATP, Robert focused on high-risk/high-payback R&D at companies within the chemical, materials, agricultural and industrial biotechnology industries. While in ATP, Robert worked with companies Cargill-Dow, Genencor, Metabolix, Seminis, Metabolix, Maxygen/Verdia, Maxygen/Codexis and CropTech for the development of bio-based products. Robert has been involved in biobased research for over 30 years, starting with his Ph.D. work on ethanol fermentation of cellulosic sugars. His career has included work on "bioproducts" such as pencillin fermentation at Wyeth Labs, the production of acrylates from lactic acid at Corn Products and fermentation-derived food additives at Hercules. In addition to a Ph.D. in Chemical Engineering, Robert also has an MBA from Northwestern University and has been a business manager at both Black & Decker and GE Plastics.

TRACK 4: Polymers

Chair: Dr. Robert Lochhead
University of Southern Mississippi

"Fish Collagen"

Peter Bernegger
We Gel, LLC 1-662-494-2006
935 Hwy 50 West
West Point, MS 39773
www.we-gel.com

CPI, LLC 1-662-494-5025
www.citrusproducts.org

Abstract: Our goal is to utilize all fish waste by turning it into value added products. Approximately 50% of a fish is wasted including the head, skin, bones, and viscera. If the subcomponents can be properly broken down into their base structures, such as protein or oil, then markets in the human sector can be developed for such items. We wish to take it one step further by processing these items into value added products.

Gelatin is the first step and we have recently achieved the daily production of this product. Gelatin is an amphoteric protein derived from thermal extraction of the collagen in the fish heads, bones, and skins. In our system design there is no waste thus no EPA issues. Also, gelatin can be produced in less than 5 hours so new economies of scale have allowed production times of at least 72 hours and even up to 140 hours. Considerable amounts of hazard waste and BOD's is a big problem for them. The other components have markets too including the bone which has excellent organic based calcium. The oil can be mixed with bio-diesel. The blood and remaining material evaporated into blood meal perfect for the landscape/garden market. Value added products we're focusing on include using the gelatin to manufacture edible films, production of capsules and cosmetic creams.
B. Solar Panels-our objective was to research and develop a solar panel which would increase the output of usable watts during cloudy days and also while the sun was not at its peak position. After 5 years of work the results to date look astonishing with measured results achieving double the output of any other panel on the market.
C. Sorice-is a hybrid plant which has a higher level of starch than any other grain including corn. The level reaches 86% starch and the plant can grow without water. The yield per acre however triples when there is water. The climate and warm temperatures of Mississippi are perfect growing conditions for this crop.
PETER BERNEGGER's career began early on in the agricultural arena specifically with hogs, cattle and cash crop. Shortly thereafter moving into food processing beginning with the Sara Lee Company. Positions ranged from production floor up to consumer end marketing. Then for 15 years he specialized in food production equipment and line designs. This included work on Surimi, processed meats, wheat protein, gelatin, fiber, edible films and hydrocolloids. Peter currently owns and operates a fish gelatin plant in Mississippi and a dietary fiber plant in Florida.

"Production and Use of Thermal Polyaspartic Acid"

Larry P. Koskan
Global Green Products, LLC

Abstract: Millions of pounds of anionic polymers are used each year in many industrial applications. Polyacrylic acid (PAC) is one important class of such polymers. In many uses, the polymers ultimately end up in a waste treatment facility. The ideal disposal for these polymers is via biodegradation by microorganisms because the degraded end products are innocuous. The disposal of PAC is problematic, however, because it is not biodegradable. An economically viable, effective, and biodegradable alternative is thermal polyaspartate (TPA).

LARRY P. KOSKAN, the President and founding Member of Global Green Products LLC since its inception in 2004, leads a company specializing in the marketing and sales of environmentally friendly and biodegradable chemical products. Prior to this recent experience, Mr. Koskan founded Donlar Corporation in 1990 and served as a director, President and Chief Executive Officer, and as Chairman of the Board of Donlar since 1992. In 2000, he orchestrated the merger between Donlar and Biomune Systems to create the new Illinois public company, Donlar Corporation. Donlar Corporation was awarded the Presidential Green Chemistry Challenge Award in 1996.

Prior to founding Donlar, Mr. Koskan held several research and development positions during a 23-year career with Nalco Chemical Company. While at Nalco, he served as Vice President of Research for Nalco's Water and Waste Treatment Division.

Mr. Koskan holds a B.S. in Education in Chemistry from the University of Kansas and an M.S. in Organic Chemistry from Loyola University of Chicago and is the inventor or co-inventor of 27 U.S. patents and is the author or co-author of 18 publications. He has served on the Presidential Green Chemistry Challenge Award selection panel for four years and is serving on the CEI committee of the American Chemical Society (ACS).

"THE IDENTIFICATION OF VALUE AND MARKETS FOR NANOSTRUCTURED® CHEMICALS"

Dr. Joseph D. Lichtenhan

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Abstract: POSS® nanotechnology emerged from the U.S. Air Force Research Laboratory where it was developed for the purpose of controlling the chain motion and expanding physical property envelopes of existing polymeric and metallic materials. Nanostructured® Chemicals can be incorporated into materials via three different methods: compounding, polymerization/grafting, and as surface modifiers. When incorporated, a variety of different physical properties are enhanced through variation of the POSS® cage structure, R group, and loading level. Technical strategies and business models behind the current adoption of POSS® products in optical polymers, medical prosthetics, and electronic resins are described.[1]

[1] Nanostructured and POSS are registered trade marks of Hybrid Plastics Inc as listed under 2,610,806 and 2,548,048 respectively.

Joseph D. Lichtenhan, Ph.D. Co-founder of Hybrid Plastics™ and serves as President, and Chief Executive Officer. Hybrid Plastic operates a chemistry and sales support facility in Fountain Valley, CA while polymer support and development, bulk production, and corporate headquarters are located in Hattiesburg, Mississippi USA. Dr. Lichtenhan is a pioneer and world authority in the field of Nanostructured® Chemicals. His insights into their applications launched the company and its four lines of POSS® nanobuilding blo products. Prior to starting Hybrid Plastics, he served for seven years as a Technical and Business Area Director for the Polymeric Component Applications Program at the Air Force Research Laboratory. He received his BS from Kansas State University and a Ph. from the University of California at Irvine. His entrepreneurial activities started at the age twelve and he has actively participated in number of sole-proprietorships. He currently serves on the Advisory Board for the Advanced Technology Program at the US Depart of Commerce's National Institute of Standards and Technology

"Secondary Structural Changes During Adhesive Processing of Soy Protein Isolate via ATR-IR"

J. N. Shera, J.W. Rawlins*, and S. F. Thames

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Abstract: In recent years, wood composites have grown in popularity due to limited lumber resources. Current industrial composite manufacturing methods employ formaldehyde-based resins such as urea-formaldehyde (UF) as the adhesive. Formaldehyde emissions from such materials are a health concern, as formaldehyde is listed as a known carcinogen by the World Health Organization. The Thames-Rawlins Research Group has demonstrated that soybean protein-based adhesives can be used to manufacture wood composites. The adhesives are made almost entirely from natural products and are completely formaldehyde-free. Composites fabricated with soybean protein-based adhesives demonstrate physical properties comparable to commercial particleboards manufactured with UF resin.In order to understand the interactions within these adhesives, a soybean protein study has been conducted using attenuated total reflectance infrared spectroscopy (ATR-IR). Soy protein isolate (SPI) was adjusted to varying pH levels, ranging from 7.1 to 11.5. In the amide I regions (1590 cm^{-1} to 1720 cm^{-1}) of the treated SPI, ATR-IR spectra were deconvoluted to reveal peaks that can be attributed to protein secondary structure. As the pH of the SPI mixtures increased, peaks that can be attributed to β-sheets (1635 cm^{-1}) and β-turns (1670 cm^{-1}) were significantly less prominent. Peaks consistent with random coils (1650 cm^{-1}) and interactions between β-sheets of different protein chains remained (1620 cm^{-1} and 1695 cm^{-1}). The shift of the protein secondary structure with increasing alkalinity will be also investigated.

Jeanne N. Shera is a graduate student in the Thames-Rawlins Research at the University of Southern Mississippi. Her hometown is Poynette, Wisconsin. She received her B. A. in chemistry from Ripon College in 1999. In 2002, she received her M. S. in polymer science and engineering from the University of Southern Mississippi. Jeanne is currently pursuing a Ph. D. in polymer science and engineering.

"The High Throughput Investigation of Polyphenolic Couplers in Biodegradable Packaging Materials"

Stephen Ray Jones, Virginia Smith, and Robert Y. Lochhead*, Ph.D.

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Abstract: Our goal is to select develop stimuli-responsive interfacial coupling materials for nanocomposites that will enhance substrate mechanical properties during use but cause triggered disintegration when exposed to the appropriate aqueous environment. The study could potentially provide the scientific underpinning for the development of an interfacially interacting nanocomposite alloy capable of enhanced biodegradation in the aqueous environment. nanoparticles to polycaprolactone.
The investigative approach is to create a coupler from the hydrogen-bonded coacervate formed between a polyphenolic compound and polyvinylpyrrolidone, and to use this to exfoliate and couple montmorillonite To achieve this, solubility parameter mapping of candidate polymeric couplers, polycaprolactone and target polyphenolic compounds was undertaken. This was used as a screening process in predicting incompatibilities and eliminating unpromising materials that were soluble in the same materials as the polycaprolactone and the polyvinylpyrrolidone. Solubility diagrams coupled with simple techniques like high throughput FT-IR spectroscopy and polarized light microscopy provide a powerful tool for the evaluation of compatibility between formulation components. We were able to quickly evaluate over 110 food-contact-approved phenolic compounds, select the two promising candidates and eliminate all of the rest by evaluating their propensity for compatibility and hydrogen bonding.

Dr ROBERT LOCHHEAD'S industrial career spanned 25 years, comprising 4 years with the Nobel Division of I.C.I , 10 years with Unilever Research and 11 years with the Specialty Polymer and Chemicals Division of BF Goodrich.

After this career as an industrial scientist and research manager, Dr Lochhead joined the University of Southern Mississippi as an Associate Professor in 1990. He became chair of the Department of Polymer Science in 1993. By 1996, the department was ranked third in the nation and during the years from 1994 $2billion in capital has been invested in the Mississippi Polymer Industry, creating 42 new companies and 10,000 new jobs.

In 2001, Dr. Lochhead became Dean of the College of Science and Technology. In 2003 he re-joined the School of Polymers as a Professor of Polymer Science and is currently serving as interim director of the school and Director of The Institute to Formulation Science.

Dr. Lochhead is the author of 252 scientific papers and 14 U.S. Patents. Since 1995, he has graduated 8 PhDs. Six of these graduates won best paper awards at National Meetings.

Lochhead's current research is focused on the development of biodegradable nanocomposites, polymer-surfactant interaction, stimuli-responsive polymer systems and the elucidation of the physical principles of formulation with special emphasis on the development and use of high throughout experimentation.

"The TCP Waste & Energy Solution"

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Abstract: Billions of tons of agricultural, industrial and municipal waste are produced each year in the United States. Changing World Technologies, Inc. (CWT) has developed the Thermal Conversion Process (TCP) which converts organic waste residuals and low value materials into marketable high quality clean fuels and specialty chemicals. The TCP provides a solution to many health, environmental and economic issues which result from waste disposal, animal disease, food contamination and natural disasters.

Agricultural waste represents more than 50% of the waste generated each year in the United States. Changing World Technologies, through its agricultural joint venture with ConAgra Foods, Inc. (Renewable Environmental Solutions, LLC), has completed its first demonstration commercial agricultural facility in Carthage, Missouri. This plant is converting a variety of materials from the nearby Butterball turkey processing plant into safe, useful and saleable products. This highly energy-efficient process is able to cost effectively produce a high-grade petroleum product, which replaces oil that would have been extracted from underground reserves, thereby lessening global warming. Construction of TCP facilities will also create high- value rural jobs in the U.S.

The TCP has been successfully tested on numerous other waste streams such as mixed plastics, shredder residue, rubber and sewage sludge. In each case, waste streams are converted into saleable energy products and specialty chemicals, which do not damage our air, land or water resources. Existing infrastructures at refineries, blenders and energy companies will be used to further process, distribute and consume these end products.

The TCP fuel meets the stationary (D396) and diesel (D975) fuel standards and is a good resource for the bio-power industry. Boilers, reciprocating engines and gas turbines can utilize this fuel in combined cycle, steam turbine, combined heat and power, and peak shaving cycle arrangements to supply the "green power" market.

BRIAN APPEL is Chairman and Chief Executive Officer of Changing World Technologies, Inc. (CWT), a company responsible for successfully bringing emerging, environment-friendly technologies to the international marketplace. Mr. Appel founded Changing World Technologies in 1997, and in 1999 started up CWT's research and development facility in Philadelphia, Pennsylvania, where CWT's waste-to-energy process, the Thermal Conversion Process, was tested and developed.

In 2000, Changing World Technologies signed a joint venture agreement with food giant, ConAgra Foods, Inc., called Renewable Environmental Solutions, LLC, for the purpose of building plants to process ConAgra's agricultural waste. Their first commercial plant is currently operating in Carthage, Missouri, adjacent to a ConAgra Foods Butterball Turkey processing facility.

In December 2003, under Mr. Appel's leadership, Changing World Technologies was named to *Scientific American's 50* list of people or companies recognized for their singular accomplishments contributing to the advancement of technology in the realms of science, engineering, commerce and public policy. Changing World Technologies was recognized in the category of Energy, for devising a method of turning solid waste into oil.

Mr. Appel serves on the board of directors of Renewable Environmental Solutions, LLC, as well as the board of New Uses Council, a non-profit organization dedicated to the development of bio-based industries and renewable products. He is also a member of the Energy Future Coalition, an organization that seeks to bring about change in U.S. policy relating to the production and use of energy.

"Potential for Ash Value to Make or Break a Poultry Litter Energy Project"

Dr. Bert Bock, *President*

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Abstract: The ash remaining after combustion or gasification of poultry litter contains high concentrations of valuable nutrients, most notably phosphorus and potassium. Because of these nutrients, poultry litter ash has potential value for use in fertilizers and mineral feed supplements. However, the ash value and net return from ash to a poultry litter energy plant are highly dependent on (1) the way the poultry litter feedstock is managed; (2) energy conversion factors; and (3) end-use considerations that affect bio-availability of nutrients in the ash, costs of any further ash processing, and ash transportation costs. Depending on these factors, the net revenue from poultry litter ash can potentially range from zero, or even negative, to an equivalent of about $2.00/1000 lb process steam produced or about 2¢/kWh of electricity produced. Given these ranges, the net revenue from poultry litter ash is an important consideration regarding the economics of poultry litter energy projects and potentially can make or break these projects.

DR. BERT BOCK is President of B.R. Bock Consulting, Inc. He recently formed B.R. Bock Consulting, Inc. after completing 25 years of service at the Tennessee Valley Authority where he worked for 15 years in TVA's national agricultural programs and for 10 years in the bioenergy and waste-to-energy fields. B.R. Bock Consulting, Inc. provides technical support, feasibility studies, project development, technology transfer, and educational programs in the areas of bioenergy, waste-to-energy, and nutrient management and specializes in developing interdisciplinary teams as well as providing individual services. Dr. Bock holds a Ph.D. degree in soil science from the University of Nebraska and B.S. and M.S. degrees in Agronomy from Kansas State University. He started his professional career as Assistant Professor of Soil Fertility at Auburn University. His most recent position at TVA was Principal Scientist with responsibilities in assessment and development of biomass energy systems, strategy development for waste-to-energy systems, and assessment of options for sequestering carbon as a means of reducing greenhouse gas emissions. In this position he organized many externally and internally funded projects and gained extensive experience in assembling interdisciplinary teams to successfully address complex waste, energy, and nutrient problems. The goal of B.R. Bock Consulting, Inc. is to build on this experience to provide win-win waste, energy, and nutrient solutions relative to economics and the environment.

"Landfill Gas Energy – An Untapped Resource in Mississippi"

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Abstract: In order to become more energy efficient and environmentally friendly, Mississippi has begun to place more emphasis on developing alternate energy sources. There is one potential source of alternate energy, that is often overlooked, the solid waste landfill. This alternate energy source is generated from methane gas that is produced from the decaying solid waste disposed the landfill. In order to promote the use of this untapped resource, the State of Mississippi has joined in a partnership with the U.S. EPA to develop a state Landfill Methane Outreach Program (LMOP).

Methane is a potent heat-trapping gas and landfills are the largest man-made sources for generating methane. An estimated 89,700 tons of methane are being emitted per year into the atmosphere from landfills in Mississippi. By not using this landfill gas, Mississippi is wasting enough energy to generate about 40 Megawatts of electricity – enough to power over 29,000 homes. MDEQ have identified several landfills throughout the state that have potential to support an economically viable landfill gas energy project. Through the Landfill Methane Outreach Program (LMOP), MDEQ's goal is to protect the environment and public health by reducing methane emissions from the landfills in our state, through the development of landfill gas-to-energy projects. An additional benefit that the LMOP program offers is the economic development opportunities in areas located near landfills within the state

PRADIP BHOWAL works as an Environmental Administrator with the Mississippi Department of Environmental Quality (MDEQ) where he manages a number of programs on solid waste management. Pradip has been employed with the MDEQ for 14 plus years.

Pradip is the State Coordinator for the Landfill Methane Outreach Program (LMOP) that the MDEQ administers in partnership with the US EPA. Under his leadership, the MDEQ developed an LMOP program that helped Mississippi earn recognition as the LMOP State Partner of the Year 2004. He also manages the Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund

Program that focuses on correcting problems associated with old closed landfills in Mississippi. In addition, Pradip is involved with solid waste planning issues, developing regulations and guidance. He is responsible for collection and publication of annual solid waste disposal reports. Finally, he serves as the State Biosolids Coordinator, for which he directs sludge management and disposal issues in Mississippi.

Prior to migrating to the United States of America, Pradip worked for the Calcutta Metropolitan Development Authority for almost 12 years. He was involved in extensive engineering work for different projects under the International Development Association – program worth $87.0 million of the WORLD BANK. He was also involved in the development of different engineering projects related to solid waste management, water supply, and river pollution control. Pradip obtained his Bachelor of Science Degree in Mechanical Engineering from Jadavpur University in Calcutta, India. Also, Pradip received his Master of Science Degree in Environmental Engineering from the University of Mississippi.

"The Impact of SO_x and NO_x Credits and Other Incentives on the Economics of Co-firing Biomass with Coal"

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Abstract: Co-firing biomass with coal to produce electricity offers multiple benefits, including reduction of emissions such as CO_2, NO_x, SO_x and mercury, and generation of new markets for agriculture. On an energy basis, the cost of biomass is typically about double that of coal. Utilities frequently offer this price discrepancy as a major disincentive for co-firing biomass with coal to produce electricity. However, economic analysis shows that credits for CO_2, NO_x and SO_x reductions from co-firing biomass with coal, along with other incentives, should more than offset the higher cost of biomass if co-firing systems are properly designed.

One of the often-overlooked facts is that biomass co-firing with coal and other fossil fuels at levels above 10% on a heat input basis would reduce the overall emissions of NOx and SOx well in excess of the percentage of the biomass offsets. Reports from Europe dating back to the 1970's have reported overall reductions in SOx from biomass co-fired fossil fueled boilers of as much as 30%. Tests conducted by EPRI have shown NOx reductions from properly tuned biomass co-fired coal boilers of 30% and higher. These results are born out by reported data from operating co-fired facilities in the European Community.

The means and methods required to achieve the enhanced emissions reductions will be explored, and the net operating economic benefits derived from properly designed and executed biomass coal co-firing will be presented.

GARY ELLIOTT's primary responsibilities are derived from serving as President of International Applied Engineering, Inc. (IAE) headquartered in Atlanta, Georgia. IAE is a multi-discipline engineering consulting company, which works primarily in the power generation field. The company prides itself on finding the optimum environmentally sound solution to energy problems. As such, the company is a leader in the application of renewable energy technologies.

In addition to his duties with IAE, Gary serves on the Board of Directors of the United States Export Council for Renewable Energy (US/ECRE), as Chairman of the National Wood Energy Association (NWEA), on the Advisory Board of the Southeast Regional Biomass Program (SERBEP), as past Chairman of the Power Boiler Subcommittee of the Technical Association of the Pulp and Paper Industry (TAPPI), and as a contributing member of other national renewable energy forums and organizations.

Gary is a recognized expert in power generation applications and has pioneered biomass power technology improvements and technology transfers in the United States and abroad. He has first hand experience in adapting and retrofitting conventional fossil fueled power generating facilities to co-fire biomass fuels. He also has participated in designing new co-fired and biomass fired power generating plants over a wide range of applications.

"Biorefinery Approach to a Poultry Litter Anaerobic Digester"

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Abstract: Conversion of animal manure into useful products such as methane and fertilizers using anaerobic digestion is a well established technique in theory and practice. A few farms around the country are now successfully capturing methane gas from their digesters to generate electricity or provide heat for local operations. However, most of these projects are located on swine or dairy operations and there are no anaerobic digesters operating on poultry farms, specifically broiler operations. Commercial poultry production in Mississippi is the largest agricultural enterprise with recent sales in excess of $2.2 billion. Data suggest that if all of the poultry litter in Mississippi was converted to gas, there would be more than enough energy generated to cover all the heating and electricity needs of all poultry houses in the state.

The goal of this project is to take a biorefinery approach for installing the first methane generation and capture system at a broiler chicken farm in the country. The current high cost of energy for heating and cooling the poultry houses is placing enormous pressures on the farmers. Another major challenge the poultry industry is facing today is the disposal of poultry litter. Health safety and environmental concerns are leading to new, stricter, regulations on land application of poultry litter. With the pending environmental regulations and an immediate need to lower energy costs, the on-farm anaerobic digester system offers a unique solution. The biorefinery concept will yield several value added products form poultry litter such as concentrated liquid fertilizers, composted plant bedding materials, and animal feed protein, in addition to producing useful electricity and heat. Excess electricity will be sold back to the grid. This will possibly be the first anaerobic "biorefinery" in the country utilizing poultry litter as "feedstock" and yielding a broad range of products mentioned earlier.

The implementation of this project will produce jobs, greatly offset fossil fuel based energy consumption, reduce waste and odors associated with poultry production, and create additional markets for farmers and industries from bio-based products. It will reduce the poultry producer's energy cost significantly and will convert the poultry farmer's problematic waste into an asset while increasing environmental compliance. Outreach efforts for helping disseminate the information about this poultry litter biorefinery have been partially funded by a grant from the U.S. Department of Energy under the grant DE-PS26-04NT42068-10.

SUMESH ARORA is the President of S3N Consulting, LLC and works with private businesses, non-profit organizations and state and federal agencies to provide project management, technology assessment, and grant writing and administering services. Currently, he contracts with the Mississippi Technology Alliance and is responsible for evaluating renewable energy projects that may bridge the gap between available resources and potential markets. He currently serves as the Vice President for the Mississippi Biomass Council and is an Executive Board member of the Southern Alliance for the Utilization of Biomass Resources. He is also a member of the National Resource Conservation and Development Council's Energy Committee and is charged with evaluating various biomass based energy technologies. He is a frequent speaker at various workshops and conferences held statewide and published several articles about biomass and renewable energy. He is currently involved with two anaerobic digester projects as well as solar energy projects in the state of Mississippi.

His prior experience includes working as an engineer for the Mississippi Development Authority's Energy Division. Sumesh was responsible for managing the statewide Biodiesel Feasibility study in 2004 for the Biomass Council and also helped implement the first school-bus biodiesel demonstration project in the state. Before that Sumesh was employed in the R&D Division at Mississippi Chemical Corporation in Yazoo City for 12 years.

Sumesh is currently enrolled in the International Development PhD program at the University of Southern Mississippi. He holds a Master's in Materials Engineering and a Bachelor's in Electrical Engineering from the University of Central Florida, Orlando. He has many years of experience in materials analysis and characterization and corrosion prevention.

"Bioenergy from Biomass Gasification"

Dr. Mark Bricka[(1)], Mr. Lin Wei[(2)], Mr. James Wooten[(2)], Dr. Alex Thomasson[(3)] and Mr. Eugene Columbus[(2)]

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Abstract: Currently researchers at Mississippi State University (MSU) are actively involved with gasification research of alternative fuels. One of the major studies, funded by the US Department of Agriculture, is benign conducted in conjunction with Oklahoma State University (OSU).

As part of this research effort MSU purchased a prototype downdraft gasifier system produced by Community Power Corporation (CPC) of Littleton,

Colorado. MSU research involves the modification of this unit for gasifying alternative feeds as well as conducting mass balances inventories during the gasification process. This paper present preliminary result of the results of using wood and switchgrass as a feed-source for the gasifier. Gas flow rate and grate temperature were varied over a range of 35-55 Nm3/h, and 750-950^{o}C, respectively. Producer gas quality, tar, particulate, as well as ash and char generation were measured. While the results of the switchgrass runs are preliminary this paper will present a comparison of the switchgrass results to the hardwood results

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Dr. R. MARK BRICKA is an Associate Professor at the Dave C. Swalm School of Chemical Engineering at Mississippi State University since Jan 2001. Previously he worked as Research Environmental Engineer and a research chemical engineer for the U. S. Army Corps of Engineers, U.S. Army Engineer Waterways Experiment Station (WES), Environmental Laboratory (EL), Environmental Engineering Division (EED) in Vicksburg, Mississippi since 1983. Before that Mark worked for PPG Industries in Lake Charles, Louisiana as a process chemical engineer. Dr. Bricka obtained his PhD in the field of Environmental Engineering from Purdue University. His dissertation topic was: "Evaluation of the Use of Exothermic Solidification/Stabilization Binding Agents to Enhance the Removal of Volatile Organic Compounds from Contaminated Soil." His master's in chemical engineering is from Mississippi State University and BS in chemical engineering is from University of Alabama. Mark also attended Memphis State University for two years. Dr. Bricka is a member of several professional organizations including the American Chemical Society (ACS) and the American Institute of Chemical Engineers (AIChE). He is certified as a professional engineer in the states of Alabama and Mississippi.

Mr. Bricka's current area of research focuses on alternative energy sources and the physical and chemical treatment of inorganic contaminated media. His current research program includes a wide scope of topics ranging from the development of gasification and pyrolysis to innovative techniques for the treatment of soil at small arms.

TRACK 6: Other Products

Chair: Phillip Badger
General BioEnergy/Southern States Energy Board

"A Status Report on Federal Government Promotion of Biobased Products"

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Abstract: This presentation will describe implementation of Section 9002 in the 2002 Farm Bill, FB4P, the Federal Biobased Products Preferred Procurement Program. Specifically, the final rule for guidelines, the proposed rule for designating items and the proposed rule for labeling will be summarized.

ROGER K. CONWAY is a native of Virginia and received his B.A. degree in Economics at The George Washington University, his M.A. in Economics at George Mason University, and his Ph. D. in Economics at The George Washington University.

He joined the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) in 1978 as an Agricultural Economist specializing in commodity modeling.

In 1985, Roger spent a year with the Bureau of Economic Analysis, U.S. Department of Commerce, as an Econometrician before returning to ERS to become Section Leader of the Productivity and Public Policy Section in the Resources and Technology Division. In that capacity, Roger led successful program initiatives to redesign the current USDA productivity indices, introduce important recent advantages in agricultural production economics into the staff analysis and policy making process, and evaluate sustainable agricultural production practices. For his efforts with ERS, Roger has received four ERS Administrator Special Merit Awards.

Roger has shown a variety of research interests duly indicated by the breadth of topics covered by his numerous publications and professional presentations. Topics have included global warming, international trade, commodity policy, agricultural investment an macroeconomic policy among others. Roger has published well over 20 refereed journal articles in such journals as the American Journal of Agricultural Economics, Journal of Business and Economic Statistics, and Econometric Reviews.

"BIODRYER IMPROVES PERFORMANCE AND ECONOMICS OF BIOMASS ENERGY PROJECTS"

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Abstract: The usable energy in biomass typically ranges from about 6500 to 8500 Btu/lb on a dry basis. However, most biomass fuel is generally not "dry". On a wet (green) basis, biomass typically has moisture content of from 40% to 50%, which reduces the energy value to about 4000–4500 Btu/lb.

Higher moisture content (60%-90%) biomass resources such as pulp sludge, biosolids (sewage sludge) and peat with heating values of less than 3500 Btu/lb (<8133 kJ/kg) are of little value to a suspension-fired or grate-fired plant, since it would require a net energy input in order to sustain combustion.

Therefore, in order to improve the actual calorific value to 6000 to 8000 Btu/lb for biomass energy projects and to create a more viable energy resource from biomass feedstock with high moisture content, it is necessary to dry or dewater the biomass to reduce its moisture content to 10%-20% for direct combustion, cofiring, gasification or calcination based energy projects.

In the past, biomass fuels have been either dried by thermal means (i.e. evaporation) or dewatered by mechanical means (i.e. pressure). Unfortunately, these past practices have been energy intensive or limited in their ability to remove moisture from the biomass. For example, while rotary and flash dryers can reduce biomass moisture levels to the necessary 10%-20%, they still require 25-40 kWh/bdt of power and 1500-2200 Btu/lb (3486 - 5112 kJ/kg) of thermal energy for evaporation purposes in the form of natural gas, oil or steam. In addition, the O&M costs, air permitting and emissions associated with these thermal dryers (i.e. combustion based process) can impact the project siting, performance and economics.

In contrast to the above methodologies for reducing the moisture content of biomass, a biological dryer (i.e. Biodryer) uses naturally occurring microorganisms in the biomass mix, which consume oxygen and produce heat (7450 Btu/lb dry organic matter) during aerobic decomposition process. Bio-Dryers can thus effectively reduce biomass moisture content to the required 10%-20% without the need of fossil fuels and minimal electricity use (fans, pumps).

A biological dryer is very similar to an invessel composting system, but the system has been modified and upgraded to produce either a fuel grade "product" (10%-20% MC, low carbon loss, etc) or compost (40% moisture content, etc) to meet current market conditions. Therefore, biological dryers can offer many economical, siting and performance based improvements over traditional drying technologies for biomass based energy projects

RUSSELL BLADES is an Energy Engineer with over 20 years experience in providing technical solutions and senior management to various Energy (Ontario Hydro, Mississauga Hydro, Enron, Alstom, Wright) Municipal (Hamiliton Wentworth, Halton) and E&C (AMEC, Hill, BASSAI) companies throughout North America. Russ Blades holds several energy related patents, has published various energy related articles and has chaired or sat on numerous engineering or energy committees (ASHRAE, Energy Roadmap - Canada, WEF-Bioenergy, etc). Russ is currently Vice President of Wright Tech Systems Inc; a leading manufacturer of invessel technology designed to convert organic waste streams into either biomass fuel or compost.

"Boiler Combustion Improvement and NO_x Reduction Technology"
Bill Buckley and Daniel Palomino

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Abstract: This informative presentation address issues surrounding the competitive economics mandate optimization of boiler combustion efficiency and maximization of boiler component life. Also, the Environmental regulations mandate compliance with increasingly rigid emissions requirements for Nitrogen Oxides (NOx) via the State Implementation Plan (SIP) call rule will be discussed. Synterprise would like to share NOx reduction and combustion improvement benefits this technology has provided at a number of reference installations.

Issues:

- Competitive economics mandate optimization of boiler combustion efficiency and maximization of boiler component life.
- Environmental regulations mandate compliance with increasingly rigid emissions requirements for Nitrogen Oxides (NOx) via the State Implementation Plan (SIP) call rule.

The **Ecotube System** consists of two or more retractable lance tubes, located in the boiler furnace above the primary burner zone, for the introduction of high-pressure air as well as nitrogen reagent (e.g. ammonia or urea) for supplemental NOx reductions. It has had over 250,000 hours of successful operation and is ideally suited for biomass (waste to energy) plants and coal fired boilers producing up to 200KW. Its cost is less than ½ of SCRs. Its flexibility allows it to be used with or without low NOx burners, SNCR, etc. or in conjunction with other SCR technologies.
The primary objective of the **Ecotube System** is to provide high-velocity air to improve the mixing of over fire air with partially burned gases leaving the lower furnace of boilers. **The Ecotube System's** operating location and lance delivery methodology allows it to address both NOx reduction and combustion optimization issues at the point of origin. It delivers high-velocity air to improve the mixing of the over-fired air with partially burned gases leaving the lower furnace of biomass and waste-fired boilers. To avail the technology of the SNCR-reduction process, the lance tubes can also be used to introduce a mix of air and a nitrogen-reducing chemical such as ammonia or urea for added NOx reduction. The improved mixing alone not only reduces CO and VOC, but also lowers NOx emissions without the use of any chemical reagent. This staged combustion radically improves mixing of combustion products, reduces erosion and corrosion: increasing equipment life cycles.

Synterprise would like to share some of the NOx reduction and combustion improvement benefits this technology has provided at a number of reference installations. These benefits include:

- NOx Reduction 60-80% or even more, dependent upon site conditions & equipment
- Reduced and stable CO levels and other VOCs (10-80%)
- Reduced Loss on Ignition producing less carbon and ash (5-20%)
- Reduced fly ash resulting in reduced disposal costs and lowered downstream maintenance (5-30%)
- Radically improved turbulence and mixing of combustion gases
- Reductions in gas velocity; reduced gas phase corrosion & reduced molten salt corrosion (10-30%)

Reduced metal and gas temperature spikes, and reduced high velocity laminar flows (10-50%)
Bill Buckley is Vice President of O&M Services at Synterprise Global Consulting, specialists in combustion improvement, work management, reliability and outage services. He comes to Synterprise from Mirant Corporation, having spent over 25 in power generation including management positions at New York State Electric and Gas and AES. During his tenure, he has been a technical support manager, operations and maintenance manager, and plant manager for fossil fuel power stations. He brings a strong strategic operational background in technology management, work management, operations, corporate change, and improvement initiatives

"Introduction and Application of Innovative Mobile C&D Waste Recycling System"

Abstract: According to EPA documents, over 125 million tons per year of mixed construction waste and demolition debris (C&D waste) were estimated to be generated in the US in 1997. Most of these materials are generated at major new development jobsites, renovations and/or large demolition projects. For the most part, this C&D waste material is accumulated in roll-off boxes and large dump trucks. The C&D industry is therefore not using 30 gallon or 96 gallon containers, nor does it typically have the benefit of residential recycling-type public relations programs to educate the public of the benefits of recycling. Rather, the C&D materials typically get commingled at jobsites as fast as generated, and hauled to transfer stations or landfills. Most of the C&D volumes are very large, due to low density hauling and the lack of hydraulic compaction principles.

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This presentation will describe the initial operation and findings of a new patented trailer-mounted sorting system that brings the basic attributes of a commingled recycling MRF into the C&D field. The patent holders have built a full scale mobile demonstration unit, mostly from used equipment, and offer this system as the field "pilot unit" for prospective clients to test the concept. The presentation will describe the design principles of the mobile C&D screening/sorting system, manufacturing process, capacity of the finished product and the field applications completed to-date. The major conclusions of the paper will include capacity and cost estimates for the innovative system, and the author's opinion of the locations and types of C&D recycling opportunities that would be the "best applications" for the system.

"Extraction of Valuable Products from Rice Bran Using Non-Traditional Techniques"

Abstract: Every year, about 40 million metric tons of rice bran is disposed of because of its tendency to become rancid. Rice bran contains nutritional components, such as proteins, fiber, antioxidants, and oil (18-22% by weight). Some of these components can be extracted and used to produce nutraceuticals, specialty chemicals, and/or fuels. The focus of this paper is the extraction of valuable bio-based products from rice bran via nontraditional extraction techniques. Extraction of rice bran oil was performed using liquid propane, and supercritical carbon dioxide (SC-CO_2) with or without co-solvents. The effect of pressure and temperature on efficiency was investigated for both extraction techniques. To provide a basis for extraction efficiency, accelerated solvent extraction (ASE) with hexane was performed at 60 °C and 1500 psig. The effectiveness of each extraction method was based on % yield of oil, pounds of oil extracted per pound of extraction fluid, chemical composition of the extract, and separability of residual proteins from rice bran raffinate. An economic analysis was conducted to determine the cost effectiveness of the evaluated technologies.

Dr. Rafael Hernandez, *Assistant Professor of Chemical Engineering*
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RAFAEL HERNANDEZ, Ph.D. is an Assistant Professor for the Dave C. Swalm School of Chemical Engineering at Mississippi State University. His educational background include B.S. Chemical Engineering, University of Puerto Rico, Mayaguez, 1993; M.S. Chemical Engineering, University of Puerto Rico, Mayaguez, 1996; Ph.D. Chemical Engineering, Mississippi State

University, 2002

Dr. Hernandez's research interests include generation of commodity and/or specialty products from biomass. He is currently working on the production of biodiesel using the *in-situ* transesterification process and the transformation of vegetable oils and animal fats into building blocks for the production of polymers and lubricants.

"A Review of the Pulverizing Air Dryer for Biomass" : WITHDRAWN

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Abstract: The history of technology in the environmental industry has often been simply transferring a " problem " from one carrier medium (air, water or solids) to another medium, with a consequent net expenditure of energy (and costs) with no net gain to the immediate affected area. Producing methane gas from anaerobic digesters only removes 15 % of the carbon mass while leaving behind a carbon mass that is more difficult to handle than the original "waste."

Producing ethanol from grain requires the production of up to one pound of VOC emissions for each gallon of ethanol produced - VOC's that must be combusted with a Thermal Oxidizer.Similar or related problems are found in attempts to use municipal sludge, paper mill wastes, coal fines, agricultural manure etc as feedstocks.

"Small Farm Distributed Power Opportunities"

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Abstract: : Not Available

SHANNON VINYARD is president of Vinyard Technology Company, Inc. a consulting, technology, and manufacturing company in Hartford, AL. Established in 1998, this company focuses on engines, alternative fuels and waste-to-energy systems. Current projects include fuels from waste engine fluids, biomass energy projects, biodiesel and waste cooking oils, disposal of medical wastes, and manufacturing of waste-fueled generator systems. Mr. Vinyard has over 27 years direct experience in engine research and alternative fuels.

He was formerly President, CEO, and cofounder of Vinyard Engine Systems, Inc. (1993-1998) in San Antonio, Texas. Previously he was employed by Southwest Research Institute in San Antonio (1984-1993), serving as Director of Engine Research from 1988-1993.

Mr. Vinyard served in the U.S. Army (1980-1984), last serving as a Captain and Assistant Manager of the Propulsion Systems Division, U.S. Army Tank Automotive Command, Warren, MI. He received his BS and MS in Agricultural Engineering at Auburn University, with thesis emphasis on engines and alternative fuels.

Professional activities include the Society of Automotive Engineers (SAE), and the American Society of Agricultural Engineers (ASAE). In SAE, Shannon was past chairman of the Diesel Engine Committee, Power Plant Activity chairman, and chairman of the Horning Award committee that annually chooses the best engine and fuels technical paper. Mr. Vinyard is also an Affiliate Assistant Professor in the Biosystems Engineering Department at Auburn University.

STUDENT POSTER PRESENTATIONS

(LISTED IN NO PARTICULAR ORDER)

Cash prizes will be awarded to student posters finishing in the First, Second and Third place)

First Place: $500
Second Place: $250
Third Place: $100

(Posters will be judged by the number of votes received by the attendees at the Conference)

Biomass Gasification: Removal/Conversion/Destruction of Tars from Synthetic Gas
Prashanth R.Buchireddy and Dr. R. Mark Bricka, Mississippi State University

Soybean Based Four-Stroke Engine Lubricants
Prashanth Karra, Mississippi State University

Production of Biodiesel from Lipids Extracted from the Chinese Tallow Tree
Scott Crymble, Mississippi State University

Value Added Products from Shrimp Processing Waste
Emily Easterling, Mississippi State University

Hydrogen Extracted From Biomass Fueling Fuel Cells
James I. Harris, Jared E. Williams, Jeffery W. Taylor, Alcorn State University

Ethanol Fermentation of Saccharomyces Cerevisiae Utilizing Sugars Present in Acid Hydrolyzate
Jennifer Ntoni, Jackson State University

Stripping and Recovery of Ethanol in Fermentation Broth
Ernest Rufus, Mississippi State University

Wood Composites: Evaluation of Shelf Stability, Crosslinker Model Study, and Soil Degradation Properties
Jeanne Shera, University of Southern Mississippi

Technologies of Converting Biomass to Synthetic Gas
Lin Wei, Mississippi State University

Extraction of Rice Bran Oil for the Production of Value-Added Chemicals and Nutraceuticals
Jaricus Whitlock, Mississippi State University

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Mission: MTA is a non-profit organization with the mission to champion science and technology-based economic development for the State of Mississippi. Browse through our website to see how MTA can help you and how we are helping to grow and strengthen Mississippi's technology culture.

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Description: Synterprise optimizes asset utilization and integrates technology and human performance with world-class business process consulting. Our focus is: outage management, CMMS services, reliability management, and delivering the latest NOx reduction and combustion improvement technologies.

United States Department of Agriculture (USDA)- Rural Development

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