

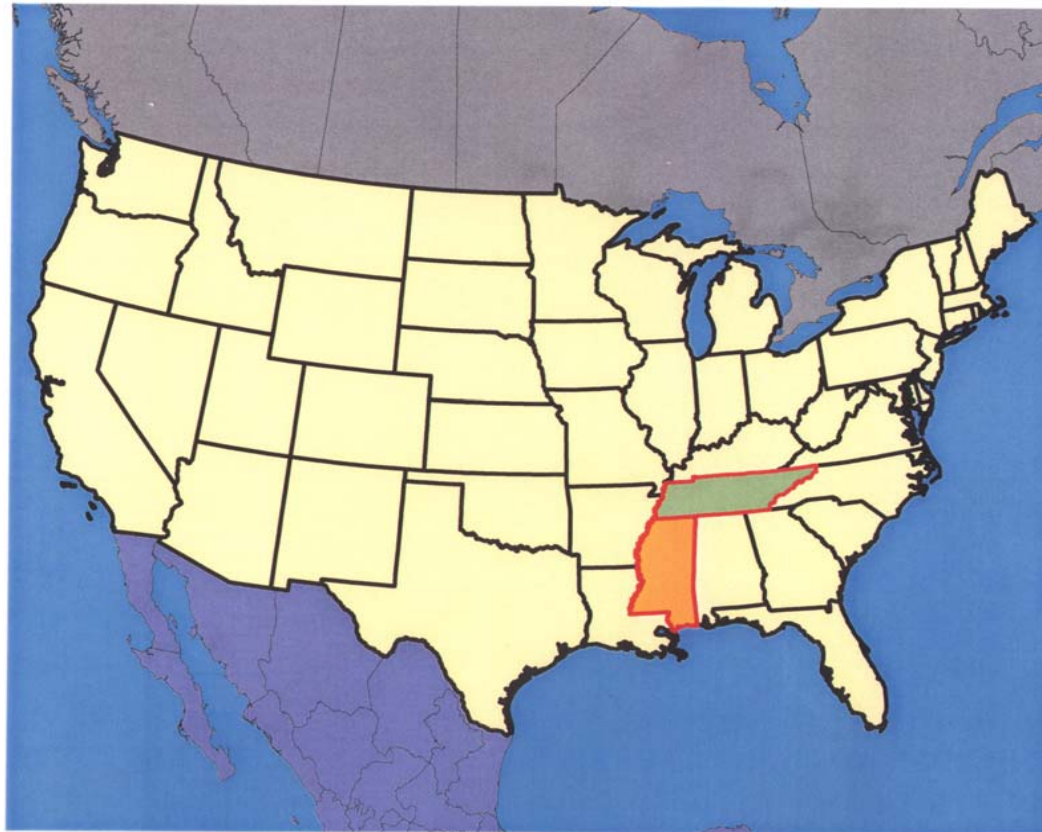


Project Overview

Objective: Feasibility study of siting a renewable energy, biomass-based installation on tribal lands.

Resources: Poultry Litter & Wood Waste

United States



-  State of Mississippi
-  State of Tennessee
-  Other U.S. States
-  Canada
-  Mexico
-  Ocean

900 0 900 1800 Miles

Project Participants

Mississippi Band of Choctaw Indians: Workforce & Cultural Assessment -- Mr. John Hendrix

Mississippi Alternative Energy Enterprise: Project Management -- Mr. Charles “Bubba” Weir

MSU -- DIAL: Technology Analysis -- Dr. John Plodinec

MSU -- Food & Fiber Center: Resource Availability & Analysis -- Dr. Steve Murray

Applied Geo Technologies: Mapping & Geospatial Data -- Mr. James Young

MSU -- Dep’t of Electrical & Computer Engineering: Load Analysis -- Dr. Noel Schulz

Objectives

- ◆ Creation of technology-based jobs for tribal members
- ◆ Generate revenues for Tribal Government operations
- ◆ Diversify the Tribal economy
- ◆ Provide an environmental benefit by reducing poultry litter that is “dumped”
- ◆ Increase self-sufficiency of the MBCI for energy production

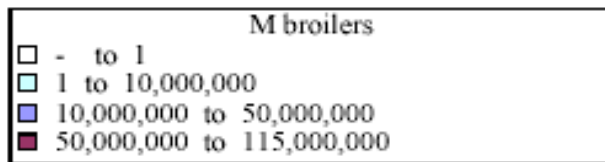
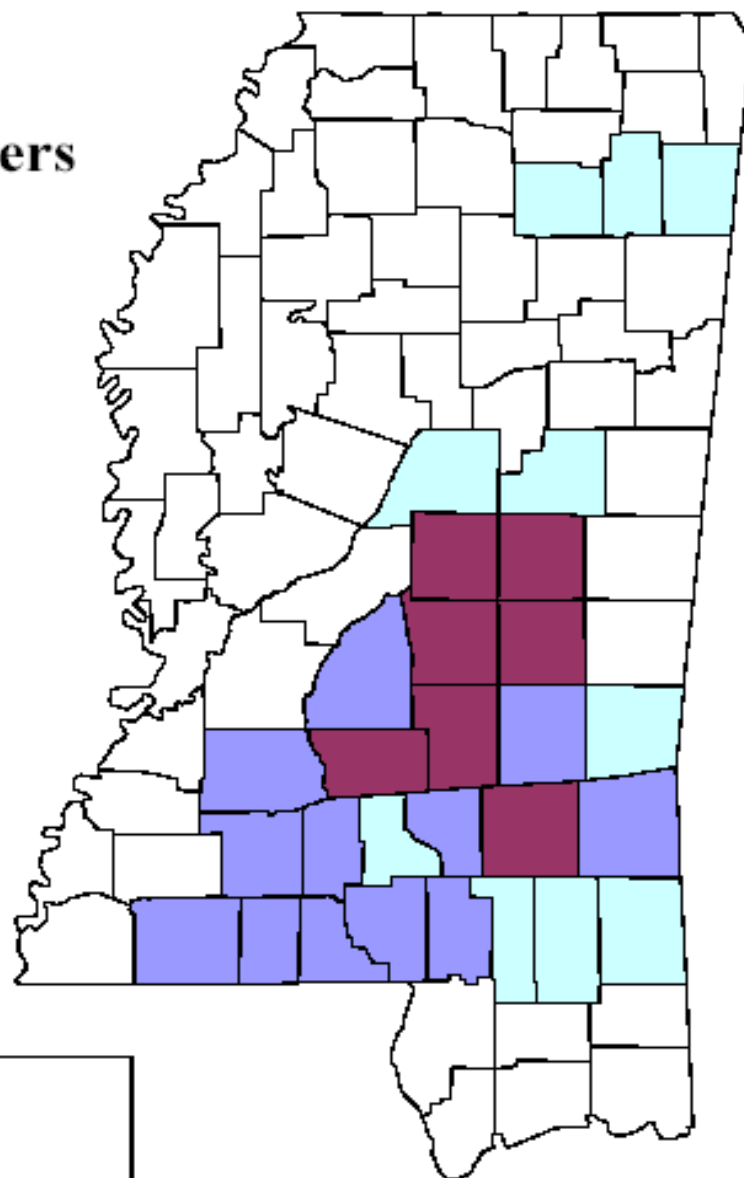
Tasks

- ◆ Resource availability assessment (Dr. Murray)
- ◆ Power utilization assessment (Dr. Schulz)
- ◆ Technology review (Dr. Plodinec)
- ◆ System design(s) (Dr. Plodinec)
- ◆ Manpower development assessment (Mr. Hendrix)
- ◆ Economic assessment (Dr. Murray)
- ◆ MBCI compatibility assessment (Mr. Hendrix)

Types of Available Biomass near the Choctaw Reservation

- ◆ Chicken litter
 - a mixture of wood shavings (bedding) and manure from chicken barns
- ◆ Wood waste
 - manufacturing residue,
 - logging residue

Mississippi Broilers Produced-2002



Modern Chicken House



Poultry Litter Storage Barn



Chicken Litter

- ◆ Composed of chicken manure and pine shavings
- ◆ The bedding placed in broiler grow-out barns
- ◆ Energy content is 5000-7000 BTU/lb.
- ◆ Disposal is a potential environmental issue because of its phosphorus content

Poultry Litter as Fuel

- ◆ Large-scale litter fired power generation such as Fibro Watt-uses 300,000 tons of litter and 150,000 tons of wood waste
- ◆ 40 Megawatt facility costs about \$100 million
- ◆ Cost of generating electricity is about 8 cents per Kwh
- ◆ Retail price of electricity in reservation area is about 5.5 cents per Kwh

Fibro Watt



Biomass-Small Scale

- ◆ Study done by Miss. State Univ. Dept. of Electrical Engineering looked at using biomass to fuel a 100Kw power plant
- ◆ Used project life cycle analysis
- ◆ Concluded that over the life of the project, costs in excess of revenue were \$3.2 million

Market Situation for Poultry Litter

- ◆ Litter is used to fertilize pastures in reservation area (nitrogen).
- ◆ Its value is about \$10-\$18 per ton.
- ◆ New CAFO rules in effect in December 2002 had little effect on litter use in Mississippi.



Bio-Oil from Litter

- ◆ Production is technically feasible
- ◆ No commercial process or equipment is available yet.

Conclusion about Litter

- ◆ Too expensive as a fuel
- ◆ Existing method of disposing by spreading on pasture as fertilizer will continue
- ◆ Next best use is as fertilizer for pine trees and as a row crop fertilizer.

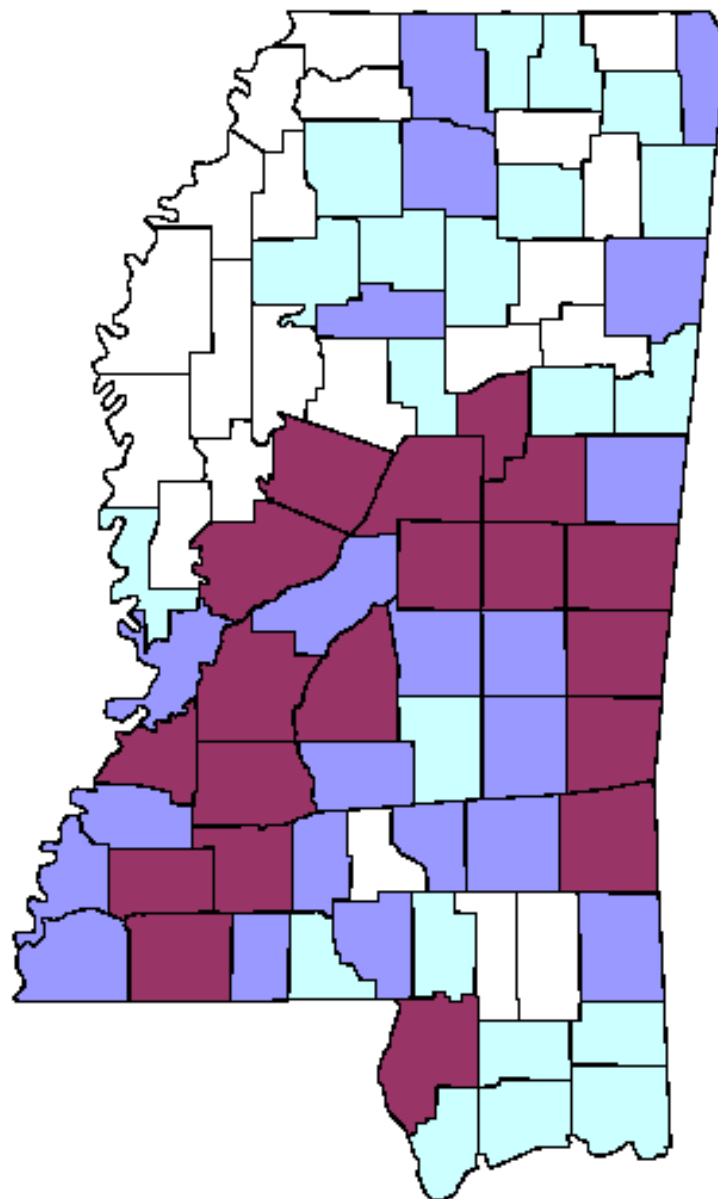


Wood Waste Sources



- ◆ Logging residue
- ◆ Manufacturing residue
- ◆ Thinnings from pine plantations

Logging Residue



M tons	
□	77 to 2,047
□	2,047 to 2,942
□	2,942 to 4,226
■	4,226 to 8,112

Recently Logged Tract



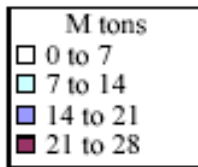
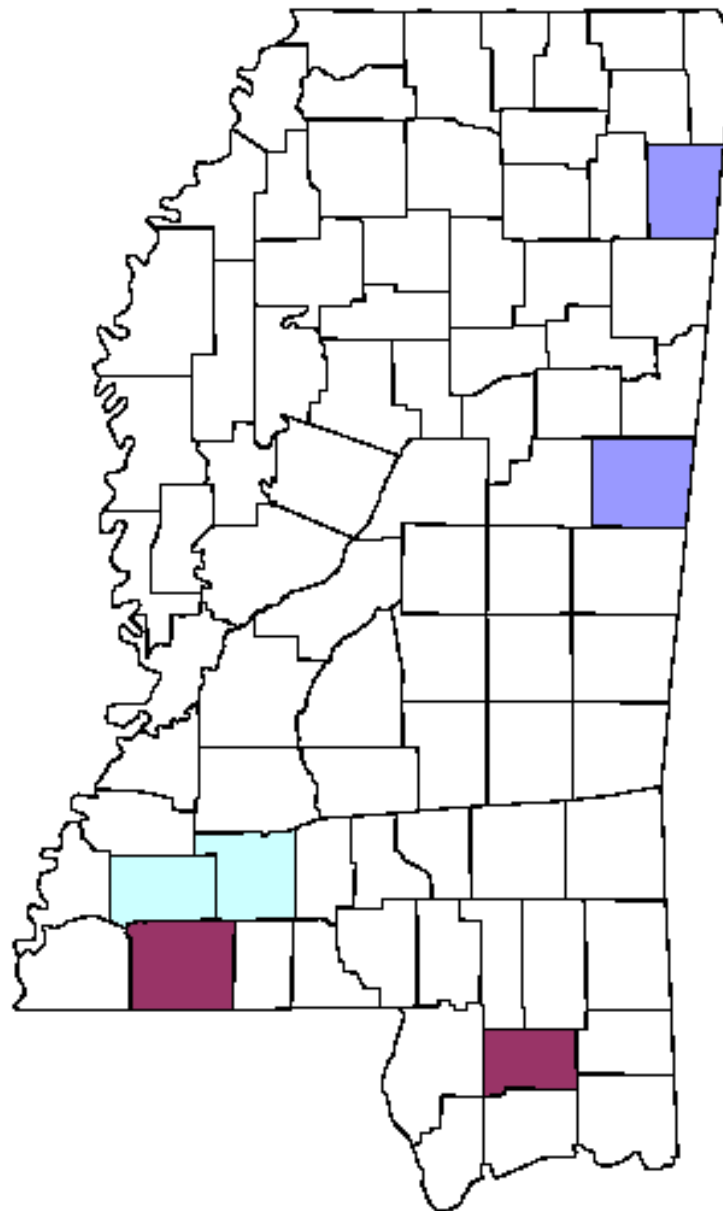
Logging Residue



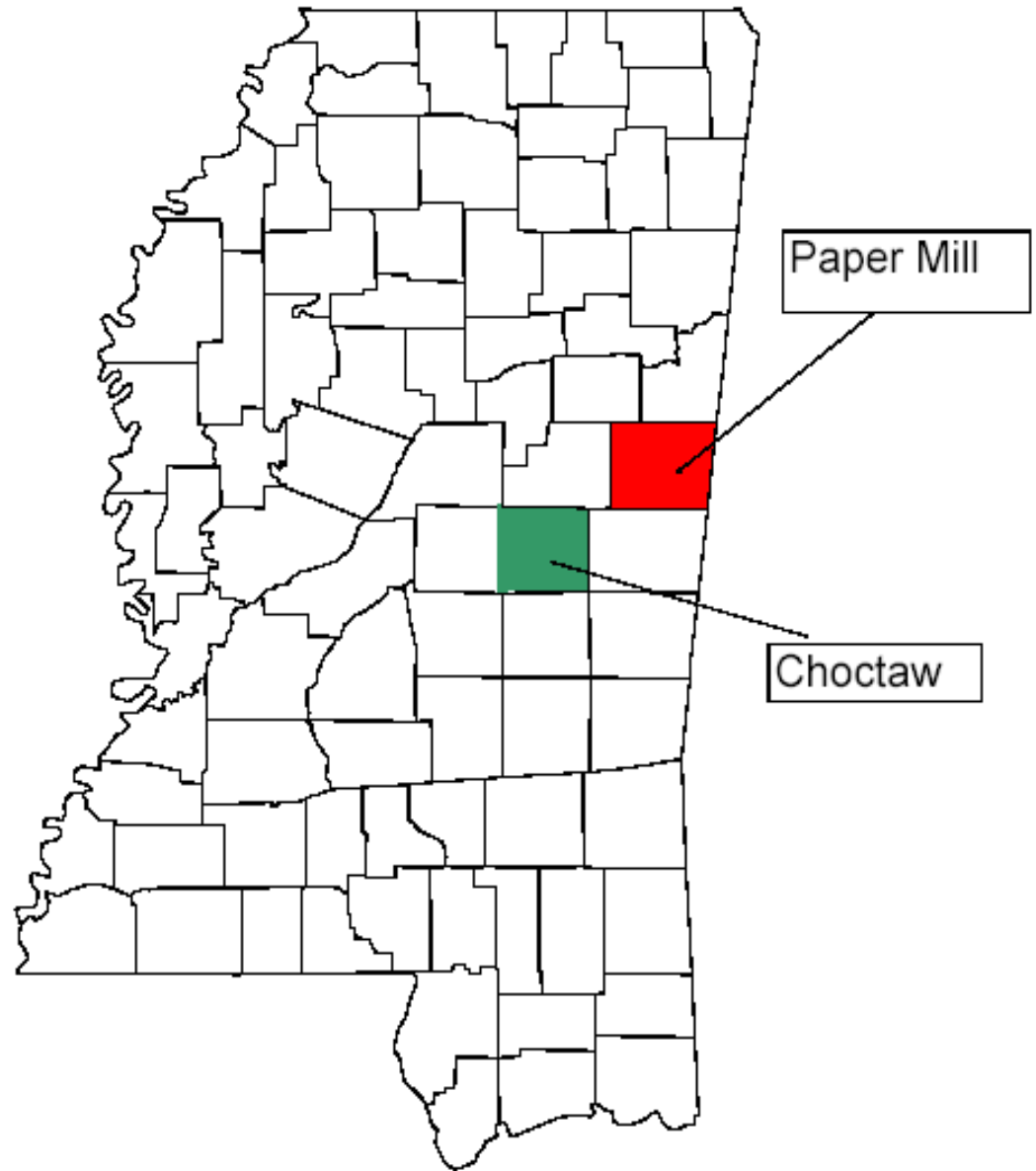
Manufacturing Residue



Unused Manufacturing Residue



Wood Waste Users



Market for Wood Waste

- ◆ Weyerhaeuser paper mill about 60 miles from the reservation uses wood waste to fire its boilers. Value is \$25 per ton.
- ◆ Some bark is used to supply landscapers.
- ◆ Some waste is used for mulch.
- ◆ Cost of recovering logging residue is about \$40 per ton.

Conclusions about Wood Waste

- ◆ Disposal of wood waste in the reservation area is not a problem.
- ◆ Wood waste is a valuable commodity which responds to local market conditions
- ◆ At current market conditions using wood waste for power generation is not economic.

Other Wood Waste Uses

- ◆ Manufacture of wood-plastic composite lumber
- ◆ Found to be a highly competitive industry with several dominant firms
- ◆ Technically very feasible but difficult to establish marketing organization



Technology Assessment

Mississippi State University
Diagnostics & Instrumentation Lab (DIAL)
Dr. M.J. Plodinec, Director



Approach

- ◆ Identify applicable technologies
- ◆ Screen, to determine most promising
- ◆ Develop detail for in-depth evaluation
- ◆ Evaluate and recommend

Identification and screening

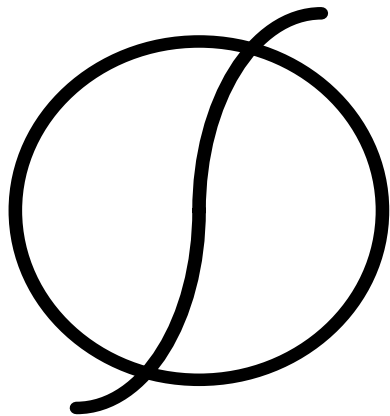
◆ Criteria

- Ready (or almost ready) for application
- Possibility of profitability

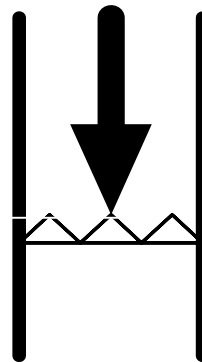
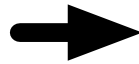
◆ Results

- CPC gasifier and WTT biorefinery selected for detailed evaluation
- Bio-oil production still at bench-scale
- Large-scale power production not economic

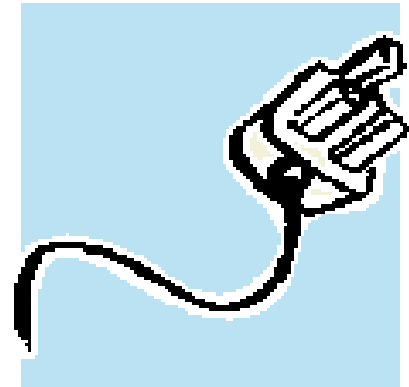
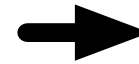
CPC gasifier



**Mix and dry poultry litter
and wood waste**

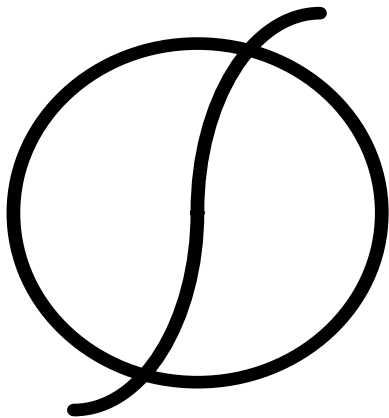


Gasify mixture

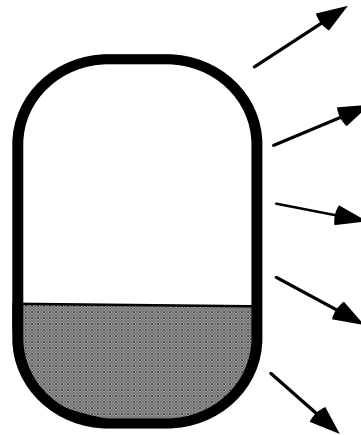
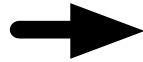


Generate electricity

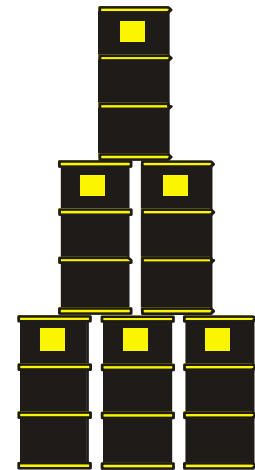
WTT bio-refinery



**Mix, heat, and extrude
poultry litter and wood
waste**



**Fractionate resulting
"bio-crude" oil**



**Produce value-added
products**

Assessment of CPC gasifier

◆ Pro's:

- Portability
- Ease of operation, maintenance
- Fuel flexibility

◆ Con's

- Cost / kW; grid power much cheaper for larger installations
- No manufacturing or support base

Conclusion: can't be economically justified, for now

Assessment of WTT bio-refinery

◆ Pro's:

- Fuel flexibility
- Variety of products, some with high value
- Potentially high ROI

◆ Con's

- Only pilot plant scale
- Products not yet made from this mix
- Risks of market entrance

Conclusion: technically attractive, but market factors require further data

Future Plans

- ◆ Energy Efficiency Program within Tribal Facilities
- ◆ Solar evaluation at Water Park & Wellness Center
- ◆ Evaluate local “capacitor” option during heavy loading
- ◆ Evaluate distributed generation in residential areas