Three Rivers Planning and Development District

February 2007

Northeast Mississippi

Eight County Economic Development Study

Prepared by

Center for Economic Development and Resource Stewardship

In collaboration
with

Tennessee Valley Authority
and
Economic Development Organizations
of

Calhoun County, Mississippi
Chickasaw County, Mississippi
Itawamba County, Mississippi
Lafayette County, Mississippi
Lee County, Mississippi
Monroe, Mississippi
Pontotoc, Mississippi
Union County, Mississippi

Grant Funding Provided
by
Economic Development Administration

This document was accomplished by staff of Three Rivers Planning and Development District, Inc. through an investment by the U.S. Economic Development Administration, 04-86-05657. The statements, findings, conclusions, recommendations, and other data in this report are solely those of Three Rivers Planning and Development District, Inc. and do not necessarily reflect the views of the Economic Development Administration.

Contents

Contents Continued

Three Rivers Planning and Development District

Eight County Economic Development Study

Introduction

This report presents an economic development study of the eight-county region of the Three Rivers Planning and Development District's (TRPDD) service area. Various area and site maps, along with site layout and site concept plans are provided in this report. The eight counties within this northeast Mississippi study area are:

- **Calhoun**
- **Chickasaw**
- **Itawamba**
- **Lafayette**
- **Lee**
- **Monroe**
- **Pontotoc**
- **Union**

Principal organizations involved in this study include TRPDD, Economic Development Administration (EDA), Tennessee Valley Authority (TVA), county economic development organizations, and the Center for Economic Development And Resource Stewardship (CEDARS). CEDARS was selected as the lead consultant after a review and evaluation of proposals for qualified organizations by TRPDD. Primary funding for the study was provided through a grant from the EDA. TVA Economic Development provided “in-kind” technical services from its headquarters and field staff. Data and technical input along with cash contributions were provided by the participating county economic development organizations.

The scope of work includes several parts, which together are intended to provide a framework, strategy, and implementation materials to benefit future economic development opportunities for the eight-county region. The strategy and framework will be assessed and developed on a regional, sub regional, and county level basis considering existing industry types and clusters; and future industry clusters emerging in the region as a result of the natural resource assets and potential public and private sector funding opportunities. The implementation materials will include marketing summaries for specific industrial park sites within each county linked to and through the individual county websites to the regional sites managed by TRPDD and the State of Mississippi. These will then be linked to nationally recognized websites like TVA Economic Development. The study along with hard copies and electronic files of marketing summary sheets will be provided to the counties. These summary sheets are provided in Appendix C along with information related to technical needs required to make changes in these products.

Regional Overview

The natural and developed assets of the eight-county region are significant and provide for a broad array of potential economic development strategies. Developed assets include ports and other facilities located along the Tennessee Tombigbee Waterway (Tenn-Tom). Four major highways link the communities together as well as to the larger regional interstates in Mississippi that connect to the Southeast Industrial Corridor. Multiple rail companies including Norfolk Southern, Mississippi Central, Skuna Valley, Kansas City Southern, and the Burlington Northern Santa Fe Railroads generally connect the area to the South and North accessing the coastal and the internal heartland regions of the United States. Low cost reliable electric power is generated and transmitted to distributors who serve the public in this TVA power service region. Natural gas is readily available through major distributors such as Mississippi Valley Gas and Atmos Energy. County water and sewer systems have available capacities either in place or readily available for additions and expansions.

Generally, the topography of the region is flat or gently rolling hills, which is conducive to medium and large-scale site development at very reasonable costs. Relatively low land costs and local tax structures are also attractive incentives for locating in the region. In addition, the natural resources, including water supply, is more than adequate for most industrial uses and provides abundant outdoor recreational opportunities that enhance quality of life for industrial prospects. Forestry and agricultural resources along with waste biomass from existing industries are significant and provide great opportunity for “feedstock” sources needed for the national urgency to increase bioenergy production. And, a trained and eager workforce is available within the region but may also be supplemented from adjacent areas.

However, as is the case nationally, there are limitations and threats to maintaining the current economic mix due to potential losses associated with global competition. Furniture and apparel manufacturing are prime examples of industry and jobs in the eight-county area, which are under extreme stress from international competition and face the likelihood of potential catastrophic losses within the next several years. But, through the existing local, regional, and state leadership from the public and private sectors and the major successes the area has had for many decades, the TRPDD region can continue to retain and attract new industry to benefit the communities of northeast Mississippi.

The objective of this study is to provide the strategy, framework, and implementation materials that can be used to assist the collaborative efforts of regional leaders to achieve their sustainable economic development goals.

Regional Strategy

There is a wide variance among the eight counties in the structure, funding and goals of their various economic development programs. Generally, the TRPDD area can be divided into northern and southern sub regions based on the number and types of existing industries, opportunities for growth and the degree of implementation of previously evaluated and defined marketing strategies.

For example, Pontotoc, Union and Lee Counties have formed an alliance and proceeded with the pursuit of an automobile assembly plant to be located at the Wellspring site in Union County. McCallum Sweeney, site consultants under the TVA Megasite Certification Program, certified the site as "development ready". If successful, this strategy will become a prominent driver for industrial development in Pontotoc, Union, Lee, Itawamba and Lafayette Counties for tier 1, 2, and 3 level suppliers located in the area. While Chickasaw, Monroe and Calhoun Counties would also benefit and recruit suppliers from an automobile assembly plant at the Wellspring site, they have the opportunity to proceed with other focused economic development strategies that may likewise benefit the northern counties in the TRPDD region. This strategy involves pursuit of major emerging opportunities in the alternative energy markets.

The American Energy Security (AES) Study estimates that if oil peaks in 2010, and aggressive domestic alternative fuels production programs are not implemented, over the period 2010 to 2020 the U.S. economy will lose about: $4.6 trillion in Gross Domestic Product, 40 million job years of employment, and $1.3 trillion in federal, state and local government tax revenues. The economic, national security and environmental advantages of establishing a thriving domestic alternative liquid fuels industry vastly outweigh the development costs. In contrast, doing nothing subjects America to energy supply disruptions and to potentially sever economic consequences and national security risks.

Tremendous opportunities now exist to develop multi-source energy complexes that co produce liquid fuels, natural gas substitutes, hydrogen, electric power, process heat, agricultural fertilizer and petrochemical feedstock. Some are calling these future facilities "Alternative Energy Eco Parks". These parks will be integrated combinations of alternative energy production units. The combinations vary but some are as follows:

- Coal-to-liquids/gas/electricity/hydrogen/chemicals/steam
- Biomass-to-liquids/gas/electricity/fertilizers/hydrogen/chemicals/steam
- Shale-to-liquids/gas/electricity/chemicals/steam

Wind, solar and hydro modules are also possible but may be very specific to known higher net yield areas of the country.

The opportunities for a wide range of alternative energy production facilities are substantial for the region. These potential facilities would more fully and efficiently utilize local natural and waste resources, process heat, infrastructure, product blends, manpower, technology, land and capital. The resulting synergies can significantly improve resource utilization and efficiencies, thereby lowering production costs and market advantages. The environmental benefits along with decreasing dependency on petroleum imports would help northeast Mississippi retain its quality of life standards for future generations.

Both the automotive and bioenergy economic development strategies will be discussed in the following sections with emphasis on the priority considerations for industry clusters in determining sites for development and expansion. The strengths and weaknesses of the existing and proposed industrial sites within each county are evaluated as to their potential to contribute to the success of this dual economic development strategy. The following table provides a "broad bushed" ranking for the 20 primary sites reviewed in the TRPDD region. Ranking is based on proximity to the Wellspring Megasite, transportation infrastructure, existing industries and proximity to potential suppliers and overall local and regional drivers likely to attract specific industries. Bioenergy rankings are further supported by Steil (2004) based on analysis of potential biodiesel production for Mississippi counties as presented later in this report (figures 10 and 11) and other feedstock and transportation factors.

It is important to understand that the site rankings are presented for consideration of a potential clustering framework that might help county economic development leaders and organizations in marketing strategies. The ranking is not intended to hamper opportunities for industrial recruitment to any given site. The number and quality of sites, the lack of environmental constraints related to overall air and water resources (i.e., unlike some other regions in the U.S.), transportation network, quality of life, incentive packages and market driven opportunities could "land" a myriad of different manufacturing and supplier related industries to any site in the region. For instance, the location and availability of low-cost process heat could drive the ultimate decision for a new chemical plant in Itawamba or Monroe Counties or an extrusion plant in Lee or Union Counties.

Table 1. Location and Gross Ranking for Automotive and Bioenergy Sites

Location by County	Industrial Park Name	Ranking for Automotive	Ranking for Bioenergy	Transportation and Supplier Proximity
PUL-Union	Wellspring	High-High	NA	Certified Megasite
Union	Glenfield	Med-High	Low-Med	I-22/Megasite
Union	New Albany West	High-Med	Low-Med	I-22/Megasite
Union	Cobb	Med-High	Low-Med	I-22/Megasite
Union	I-22 Business & IP	High	Low-Med	I-22/Megasite
Union	Wallerville-Burlington	High	Med	I-22/Megasite
Lee	Harry Martin	High	Low-Med	I-22/US 45/Megasite
Itawamba	Port Itawamba	High-Med	High	Tenn-Tom/I-22/Rail
Monroe	Amory Port	Med-High	High	Tenn-Tom/US 45/Rail
Monroe	Aberdeen-BASF	Med-High	High	Tenn-Tom/US 45/Rail
Monroe	Stovall	Med-High	High	Tenn-Tom/US 45/Rail
Chickasaw	Northeast MS Automotive Park	Med-High	High-Med	US 45/Rail/Megasite
Chickasaw	Houston	Med-High	High-Med	Megasite & feedstock
Calhoun	Calhoun City	Med	High-Med	Resource feedstock
Calhoun	Bruce 1	Med	High-Med	Resource feedstock
Calhoun	Bruce 2	Med	High-Med	Megasite & feedstock
Lafayette	Lafayette County	Med-High	Low-Med	I-55
Lafayette	Metts	Med-High	Low-Med	I-55
Pontotoc	Three Rivers P&DD	High-Med	Low-Med	I-22/Megasite
Pontotoc	Pontotoc County	High-Med	Low-Med	I-22/Megasite

Automotive Economic Development Opportunities

The TRPDD region is strategically located within the "new southern automotive corridor" to attract an automotive manufacturing facility. Such plants are locating in the South because of non-union environment, plentiful and hard working labor force, and low freight costs due to competition among carriers, transportation infrastructures and proximity to the established auto supply chain. Quality of life opportunities plus commitment of local, regional, and state political organizations are also important considerations.

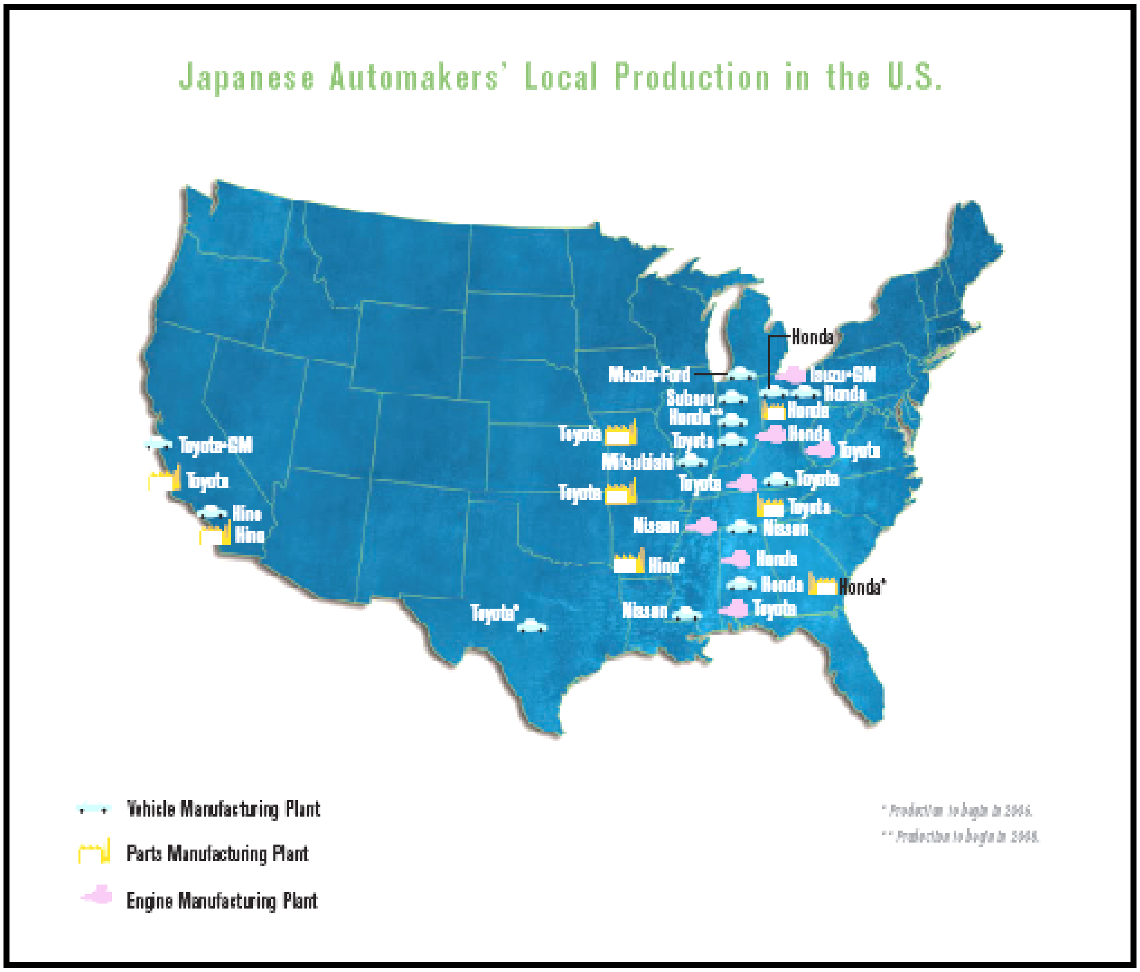


Figure 1. Japanese Automakers' Local Production in U.S. - Japanese Automakers in America: New Plants, New Jobs, New Vehicles (JAMA, September 2006)

According to the Japan Automobile Manufacturing Association, Japan will invest over 28 billion in U.S. auto and auto parts manufacturing plants. The Japanese are anticipated to have 28 manufacturing facilities located in the United States by the end of this decade. That suggests at least 3-5 companies are actively reviewing candidate locations.

For potential new prospects in northeast Mississippi, it is also important to note that once a major automaker (Figure 2. Nissan Plant in Canton, MS) has located in your state the potential to attract either another automaker or significant Tier 1 and Tier 2 suppliers dramatically increase. In Tupelo, TKA Fabco already employs 200 people making body panels for the existing Nissan Plant in Canton, Mississippi.

Figure 2. Aerial View of Nissan Plant in Canton, Mississippi

The Mississippi Development Authority (MDA) and many other state officials along with private sector partners collaborated to make over 1,000 acres of rural land available and ready for the 2.5 million-square foot Nissan assembly plant in a record 5-month period (November 2000 to April 1, 2001). And, this was without having a “development ready” site prior to TVA’s Megasite Certification Program.

Mississippi has proven that it can provide all the necessary incentives and selection criteria to attract automakers. However, having one or more automakers existing in your state certainly doesn’t guarantee that you will land the next one. According to an analysis, *The Location Decision of Automotive Suppliers in Tennessee and the Southeast* (Matthew, 1999), a survey of automotive suppliers reaffirmed existing research on location determinants. “Access to markets, labor availability and quality, and right-to-work laws all play crucial roles in determining business location, expansion and retention in Tennessee”. Although this report deals primarily with Tennessee, the critical attributes are basically the same for Mississippi and any other state or region. The survey also suggests concerns about skills, quality of public education, continuing education and technical training. In addition, there are still some concerns about the perception of quality control issues but those seem to be subsiding over the last several years. Many of these criteria relate to Quality of Life factors as shown in Figure 3 below.

In general, the Southeast has made great strides over the past few decades in improving factors under state control and at the community level. Northeast Mississippi and the TRPDD region is a good example. Local governments, organizations and their federal and private sector partners have made tremendous progress with all significant selection criteria.

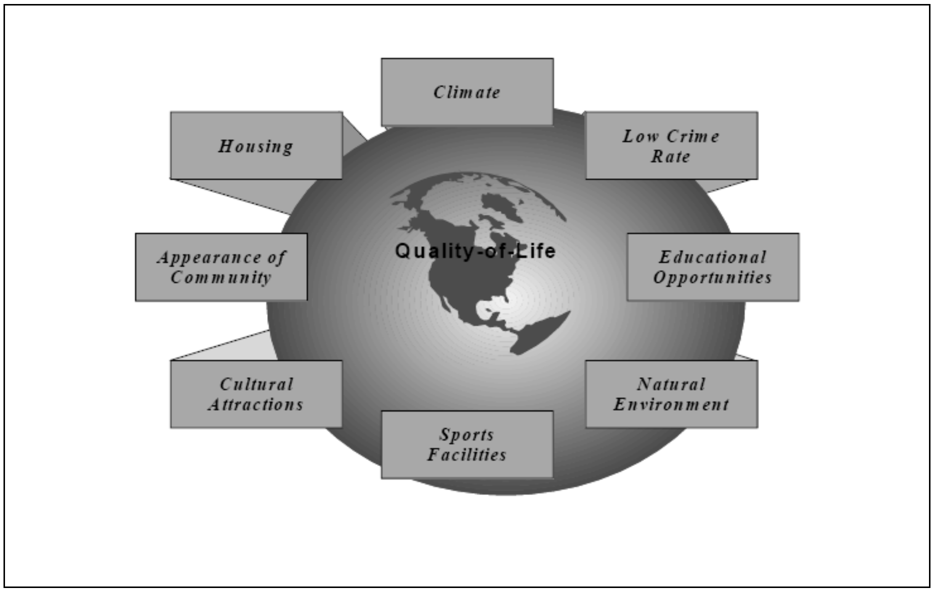


Figure 3. Quality of Life, *The Location Decision of Automotive Suppliers in Tennessee and the Southeast* (Matthew, 1999)

In northeast Mississippi the transportation network is good and provides easy access from its primary communities to Tupelo. The region includes the State's two major universities with the University of Mississippi in Oxford and Mississippi State University in Starkville.

The area around the Wellspring Project offers an attractive combination of small town living with easily accessible urban and suburban attractions. In Tupelo, there are a variety of organized activities, cultural events (including a resident ballet and symphony orchestra) and sporting events. There are four seasons, but with the winter months considerably milder than in the north, outdoor activities are possible year round. These offerings are supplemented by cultural, academic, and sporting events at the nearby universities, and the presence of Memphis offers the excitement of urban activities including professional sports, and world-renowned musical events and the ever-increasing enchantments of the Tunica area.

The public school systems in Pontotoc, Union and Lee counties are recognized as being among the top school systems in the State of Mississippi. Over ninety-eight percent (98%) of school age children attend the public schools in the area.

Tupelo is the regional shopping hub with a major mall and out parcels in the surrounding area providing over 1.5 million square feet of retail space. The area is served by two large health care systems, North Mississippi Health Services and Baptist Memorial Health Services. North Mississippi Health Services, with a 650-bed hospital in Tupelo, is the largest rural hospital in the nation and is the hub of a 22-county health care system with 430+ physicians. Baptist Memorial also has a 200-bed Baptist Memorial Hospital-North located in Oxford and another facility in New Albany.

The relatively low cost of living is an attraction for transferees. The ACCRA Cost of Living index for the 3rd quarter of 2004 indicates an area index of 86.3 (compared to the U.S. average of 100). Particularly important is the low cost-of-housing index, which makes the initial capital needs for a move to Tupelo much more feasible for a potential resident.

The remainder of this section will evaluate the region's capacity to attract an automobile manufacturing facility based on established criteria used in the site selection process. An effort will be made to measure this capacity against these criteria to square the potential for success with the time, energy and costs of the effort plus the importance of success given the need to diversify. The following factors will be considered:

- Site Information
- Transportation Infrastructure
- Utilities
- Environmental Issues
- Demographic & Socioeconomic Attributes
- Geographic Positioning

Site Information – Wellspring Megasite

As previously discussed, in order to respond to the present opportunity to locate an automotive manufacturing facility in the region, Pontotoc, Union, and Lee Counties formed the PUL Alliance. The intent of this alliance was to pool their collective resources to enable a rural location to compete for a large-scale automotive assembly or components, manufacturing plant. This Alliance became the first in Mississippi to use multi-government jurisdiction authority under enabling State of Mississippi legislation to pursue projects classified as major economic investment of $150 million and creation of 1,000 jobs.

The PUL Alliance chose in 2004 to participate in the TVA Megasite Certification Program. This program utilized the expertise of an automobile industry expert, McCallum Sweeney Consulting, to perform an independent and extensive site evaluation of candidate sites submitted by TVA Communities. To participate in this program the PUL obtained options on a large tract of land (Wellspring Site) located along US 78 (future I-22) approximately 10 miles west of Tupelo in Union County, Mississippi. Due to the diligence of the communities involved, the site received certification as "development ready" meeting all minimum criteria for selection of a site by an automotive manufacturer.

The Wellspring Project is composed of 1,700 acres with a 1,200-acre core site located near the Blue Springs interchange on Interstate 22 (US 78) about 76 miles southeast of the Memphis International Airport. It has an ideal rectangular configuration and preliminary site plans indicate that a 6 million square foot building parcel can be accommodated with room to double for future expansion. Although the site has considerable topographic variance, engineering plans indicate a balance of cut and fill can be accomplished. Geotechnical studies indicate that soil-bearing capacities are acceptable for an automotive assembly plant.

Transportation Infrastructure

Interstate access to the site will be outstanding. US 78, which has been recently designated as I-22, is adjacent to and parallels the site's frontage road. The existing Blue Springs interchange is situated near the property's midpoint and another interchange is located at Sherman, about 4 miles southeast. A new interchange about halfway between these two accesses has been proposed, allowing excellent separation of the site's car and truck traffic. The project engineer partnered with the Mississippi Department of Transportation (MDOT) on the design and layout of the transportation improvements for the site, and has approved them.

The Burlington Northern Santa Fe Railroad has agreed on the alignment and extension of a proposed spur off their mainline, which is situated northeast of the site. Also, as a second option, the Mississippi Tennessee Railroad has agreed to extend rail service to the site. This short line railroad provides direct access to the Burlington Northern Santa Fe, Norfolk Southern, and Kansas City Southern railroads. A preliminary engineering report showing details, a layout, cost estimates and construction times has been prepared.

The geographic positioning of the Wellspring Project is expected to provide freight cost advantages. For inbound components and materials, the site is in a region containing a host of existing automotive plant suppliers, as well as ample opportunities for new suppliers to locate nearby (table 2.) For outbound shipments, the site location is south of the center of population for the entire U.S. The availability of alternate shipping modes will help maintain competitive freight costs, and export/import shipments can be routed through relatively close ports of entry.

Utilities

Electrical service will be provided through dual feed electrical service with 161kV voltage lines looped from the site to the Tennessee Valley Authority’s Union 500 kV substation approximately a mile and half from the site. The site’s service provider is the Tennessee Valley Authority. TVA is the nation’s largest public utility company offering the most reliable, safe and affordable electricity in the United States.

Natural gas will be delivered at 9 billion cubic feet per day at 200 pounds per square inch. Both the Columbia Gulf Transmission Line and Tennessee Gas Transmission line will be tapped and serve the site giving the locating company choice in their natural gas transmission service.

The site offers two sources of water service to be selected by the company. Surface water from the Northeast Mississippi Regional Water Supply District can be provided to the site at a capacity of 5 million gallons per day at 60 pounds per square inch. Well water can also be provided on-site at a capacity of 2 million gallons per day at 60 pounds per square inch.

Wastewater service will be provided to the site with a capacity of 4 million gallons per day. The Mississippi Department of Environmental Quality has already provided preliminary approvals of wastewater discharge.

The company will have choices in selecting a local service provider that will offer direct service to a public/private wholesale 10-bit fiber broadband backbone system.

Environmental Issues

The ability to manage the various environmental issues is an important consideration for any proposed industrial site. Mitigation costs can be significant and time lines can be disruptive to the generally fast track schedules. Consultants evaluating these potential issues on the site have conducted numerous studies. The conclusions are as follows:

Air Quality
The Wellspring Project is located in an Environmental Protection Agency (EPA) ozone attainment area.

Wetlands
Based on site studies three small areas were identified as wetlands including: wooded wetlands of 25.5 acres, intermittent streams of 16,362 feet and manmade ponds of 7.8 acres. These areas could be mitigated onsite using the Prior Converted (PC) crop field that lies along the northern boundary of the PUL site. This area is considered suitable for restoration of riparian wetlands, bottomland hardwoods wetlands, seep wetlands and linear intermittent streams.

Threatened and Endangered Species
Based on a site survey for threatened and endangered species on the PUL. No threatened, endangered or imperiled species were encountered or found to be utilizing the site.

Cultural Resources Survey
A cultural resources survey on the PUL site indicated that no standing structures or archaeological sites were found to be considered eligible for the National Register of Historic Places and should be considered cleared of significant cultural resources.

Phase I, Environmental Assessment
A phase I environmental site assessment on the PUL site was preformed by a consultant. Three recognized environmental conditions were revealed during the assessment including: surface staining near a diesel fuel dispenser and two 500-gallon above-ground storage tanks, used tires, and bags of household garbage. These conditions can be easily corrected and removed from site and does not warrant further environmental assessments.

Demographic and Socioeconomic Attributes

Workforce

The area's labor force is heavily oriented towards manufacturing and the quality of the workforce is considered excellent. Diverse skill sets are available and labor-management relations are superior.

Within a 50-mile radius of the site, the population for 2007 is projected to surpass 440,000 with a civilian labor force exceeding 200,000. There are no other auto assembly/manufacturing facilities within this 50-mile radius, and this recruiting area does not overlap with a similar circle around the Canton, MS Nissan plant.

Labor costs in the area are relatively low, and offer a manufacturer a minimal labor-cost relative to other national locations. BLS (U.S. Bureau of Labor Statistics) figures indicate the average weekly manufacturing wages in the three Counties forming the Wellspring Project range from 60% to 72% of the U.S. average figure.

Labor Market

The area's labor force is heavily oriented towards manufacturing and the quality of the workforce is considered excellent with continuous support from the state university systems. Diverse skill sets are available and labor-management relations are superior.

Education/Training

The Wellspring Project has access to a number of highly respected academic institutions. The University of Mississippi has a major presence in the region, with its main campus in Oxford, and a satellite campus in Tupelo. Mississippi State University, with its Center for Advanced Vehicular Systems located in Starkville is also within a one-hour drive time from the Wellspring Project. Two community colleges and two additional universities are within approximately an hour’s drive of the Wellspring Project.

The Center for Advanced Vehicular Systems was established in 2001 at Mississippi State University to embrace the interaction of the state with the automotive manufacturing community. The Center has a research and development partnership with the Nissan Research Center in Japan because of Nissan’s manufacturing investment in Mississippi, but will have projects with other automotive and vehicular manufacturing companies.

The Community Development Foundation, the Pontotoc Chamber of Commerce and the Union County Development Association are aggressive in their approach to workforce development. A comprehensive training and education needs survey is conducted every 2 years, leading to programs designed to recruit and retain skilled workers. An active Workforce Advisory Committee of business, industry, education and governmental representatives meet on a regular basis. Mississippi provides excellent training programs for new and existing industries through the community college system. Northeast Community College and Itawamba Community College that will serve the site, lead the state in these programs.

The public school systems in Pontotoc, Union and Lee counties are recognized among the top school systems in the State of Mississippi. More than ninety-eight percent (98%) of school age children attend public schools in the area.

Pontotoc Union Lee (PUL) Alliance

Pontotoc Union Lee (PUL) Alliance is the State of Mississippi's first regional economic development alliance. State law gives the PUL Alliance the ability to collectively use multi-governmental jurisdictions' authority, and technical and financial resources to recruit a major economic development project. The PUL Alliance's effort has been named the Wellspring Project.

Business Climate and Community Cooperation

The formation of the regional PUL Alliance is a strong indicator of the pro-business attitude in the area. A high degree of cooperation is expected in working to meet an individual company's needs, and all the governmental entities involved are committed to the success of a mega-site project.

Incentives

The ability of the State of Mississippi to deliver a significant incentive package was proven in the recent Nissan project in Canton, MS. Local entities are committed to participate in granting incentives to the full extent of their financial capabilities and as appropriate for the specific project.

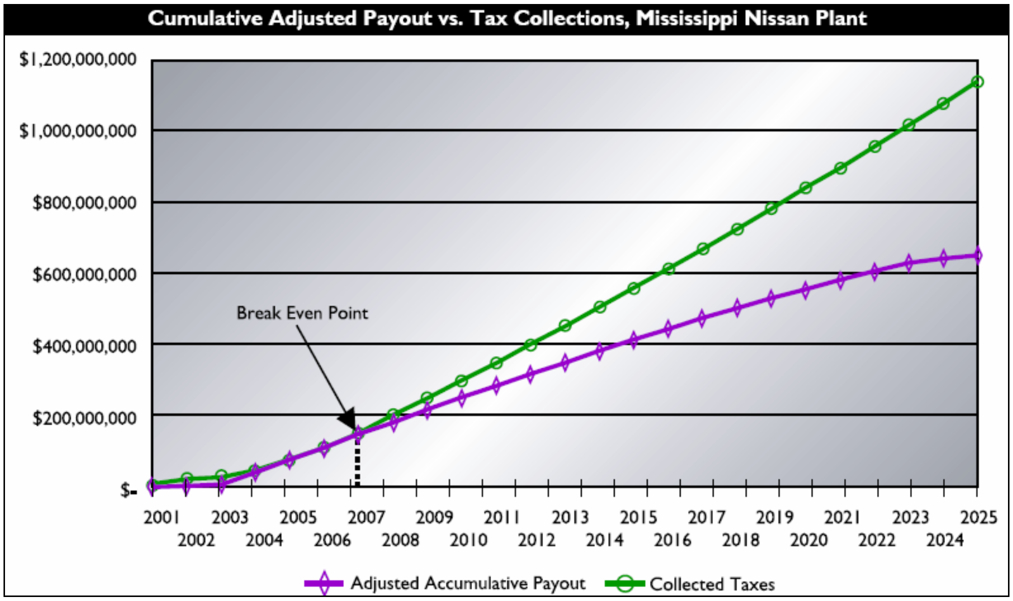


Fig. 4. (Source: MDA) Cumulative Adjusted Payout vs. Tax Collections, Nissan Plant

Although automotive plant incentive packages have been debated from a long-term cost to benefit prospective based on allocations for direct, indirect and local impacts, Figure 4 above shows a break-even point of about 6-7 years. Debates aside, regardless of whether the break-even point is 6-10 years or even more it appears that the overall benefits of an automotive plant are expected to eventually outweigh subsidized costs to the state and its local communities.

Based on Toyota's most recent plant openings in San Antonio, Texas the following economic impacts can generally be expected if an automotive manufacturing facility were to locate at the Wellspring Site.

• $1.28 billion spent by Toyota to build and equip the Texas plant
• 2,000 workers when full production is reached this spring
• $300 million spent by 21 suppliers on new facilities on the Toyota site.
• 2,100 people to be employed by on-site suppliers when full production begins
• 4.5 other jobs created in the area's economy for every Toyota job created.
• $430 million/year payrolls for Toyota, its suppliers and spin-off jobs tied to the plant

SOURCE: Toyota Motor Co., Center for Automotive Research

Geographic Positioning

The Wellspring Project is located in the midst of the geographic area that has attracted the clustering of U.S. automotive assembly and manufacturing plants over the past decade. This region has all the logistical advantages, operating characteristics and support services that have made this sector of the United States attractive to the industry.

Truck shipments from the site can reach almost all points east of the Rocky Mountains within three days drive time. Large numbers of 1st and 2nd tier automotive supplier firms are already established within less than one-half day's drive from the site, and other suppliers often are eager to relocate to this area, to obtain/retain business. The proximate Memphis area can supplement local vendor offerings when unusual services are required.

Supplier Park Sites

Significant tier 1, 2, and 3 supplier infrastructure is in place in the region. This was considered a benefit for the Wellspring Site in its completion for selection as an automobile manufacturer expansion site. However, the regions ability to provide Supplier Park sites within a 15 to 60-mile radius is also of utmost importance particularly to Japanese manufacturers who utilize the "just in time" approach to inventory management.

This study has been conducted during a time when Japanese manufactures are engaged in reviewing alternative sites in the Southeast. The scope of work and project schedule has been flexed to provide timely and beneficial information to the economic development community representing the Wellspring Site in the competition. The following table 2 provides a listing of the industrial park sites within this radius. As indicated, many of those potential supplier park sites are within the TRPDD study area. Credit should be given to the proponents and funding supporters of this study since the information developed is considered to be critical to the successful marketing of the Wellspring Site.

Table 2. Supplier Park Sites – TRPDD Region – Distance from Wellspring Megasite

County	Site Location	Map Site Number	Site Acres	Distance from Wellspring
Lee	Harry A. Martin Industrial Complex	7	503	Less than 15
Pontotoc	Pontotoc County Industrial Park	20	153	Less than 15
Pontotoc	TRPDD Industrial Park	19	378	Less than 15
Union	New Albany West Industrial Park	3	206	Less than 15
Union	Glendfield Industrial Park	2	192	Less than 15
Union	Cobb Industrial Park	4	150	Less than 15
Union	I-22 Business and Industrial Park	5	1100	Less than 15
Union	Wallerville - Burlington Northern	6	177	Less than 15
Itawamba	Port Itawamba Industrial Park	8	68	Less than 45
Chickasaw	Northeast Mississippi Automotive Park	12	363	Less than 45
Chickasaw	Houston Industrial Park	13	367	Less than 45
Calhoun	Bruce Industrial Park 1	15	193	Less than 45
Calhoun	Bruce Industrial Park 2	16	184	Less than 45
Calhoun	Calhoun City Industrial Park	14	62	Less than 45
Monroe	Amory Port Industrial Park	9	270	Less than 45
Lafayette	Lafayette County Industrial Park	17	450	Less than 45
Lafayette	Metts Industrial Park	18	300	Less than 45
Monroe	Stovall Industrial Park	11	1200	Less than 60
Monroe	Port of Aberdeen/BASF	10	350	Less than 60

As shown in the referenced table, there are about 2,850 acres of available industrial park sites within 15 miles of the site, about 5,120 acres within 45 miles and about 6,700 within 60 miles of the Wellspring site that fall within the TRPDD region.

Many of these sites include large tracts with rail, highway, and port facilities. Concept plans and site descriptions for the regional industrial park sites are provided in subsequent sections of this study. Also, many of the sites are “development ready” and some include well-maintained vacant buildings that could be retrofitted for new industrial uses.

Conclusions

Based on the review and analysis of the TRPDD region with the Wellspring Megasite helping to drive potential recruiting -- the opportunities available, natural and developed assets of the region, and overwhelming support of public and private organizations, we conclude the potential for success in attracting an automobile manufacturer more than justifies the investment of time and money to date.

More specifically, the Wellsprings site and region is:

- Strategically located in the Southeast automotive corridor
- Certified development ready
- Supported by all necessary utility and transportation infrastructure
- Fully compliant for environmental regulation/permit requirement needs
- Well supported by specifically defined and positioned supplier park sites
- Work force ready with highly skilled and available manufacturing experience
- Continuing education, research and development from nearby universities

Thus, all objective factors associated with the site selection process are in place. This should allow the region to compete on an equal or perhaps better basis with other sites in the Southeast. In addition, competent economic development organizations continue to work at marketing the region, which provides confidence to address the intangible subjective factors that ultimately drive final selections.

Bioenergy Economic Development Opportunities

The TRPDD area, along with adjacent counties has the forest, agricultural, and waste biomass feedstock to attract and support a significant increase in development and use of bioenergy and related products. The biomass feedstock together with an excellent highway network and barging options on the Tennessee Tombigbee Waterway and Mississippi River provide the region with great opportunities in this emerging industry. The following sections provide a review of potential markets, economics, and strategies for attracting these industries to the region.

Overview of Bioenergy

Bioenergy is energy derived from biomass. Biomass is any organic material available on a renewable or recurring basis and includes forest and agricultural products referred to as "feedstocks". These include crops and crop residues, products, and by-products; trees and wood products, by-products, and residues; animal products, wastes and by-products; and other organic wastes.

There are four types of biomass feedstocks:

- *Sugar* – such as sugarcane, sugar beets, sweet sorghum, fruits, candies, and beverage wastes. Sugars in these feedstocks can be fermented to ethanol or used as a platform to produce other products.
- *Starch* – such as cereal grains, white potatoes, sweet potatoes, and kudzu tubers. Starch can be easily broken down to sugars and fermented to ethanol.
- *Oil seeds and fats* – such as soybeans and cottonseeds; and used cooking oil and rendered animal fats used to make biodiesel.
- *Cellulosic* - woody and grassy products, by-products, and wastes and crop residues remaining from sugar, starch, and oil crops. Currently, the primary form of bioenergy from cellulosic biomass is heat for industrial processes, producing electricity, and home and district heating. However, emerging technologies can convert cellulosic biomass to liquid fuels and other value-added products.

Bioenergy is a growth industry in the United States due to the recent convergence of several driving forces. Fossil fuel prices, especially crude oil (Figure 5) and natural gas (Figure 6), have increased dramatically since 2003 and are projected to remain high for the foreseeable future. These higher prices make bioenergy more competitive with fossil fuels. United States dependency on foreign sources in light of global unrest is creating a strong national interest to be less reliant on fuel imports. Less reliance on foreign sources is important from both security and economic perspectives.

In addition, environmental concerns associated with fossil fuels are increasing public support for alternative energy options. Atmospheric emissions, including greenhouse gases, are generally lower from bioenergy and there is less environmental concern with extraction, transport, and refining. Bioenergy is produced locally from biomass feedstocks that are often underutilized and therefore can boost local economies much more than use of fossil fuels. Low-cost bioenergy can be used as a tool for retaining and recruiting energy-intensive industries looking for lower-priced and less volatile process energy. Because of these very important economic, security, and environmental drivers, the Energy Policy Act of 2005 (EPACT, 2005) provided numerous incentives for development and use of bioenergy.

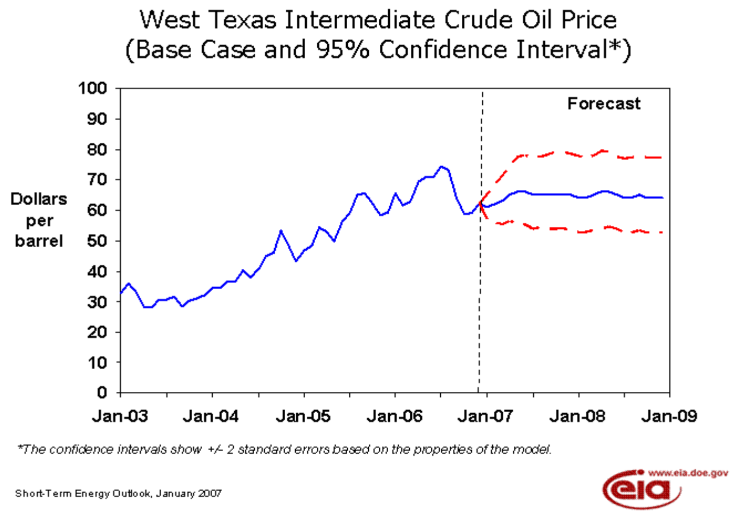


Figure 5. U.S. Oil Price Trend, EIA (2007).

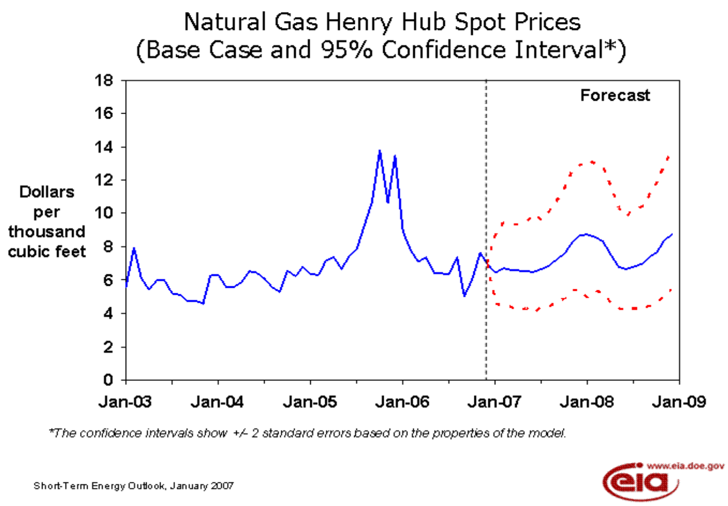


Figure 6. U.S. Natural Gas Price Trend, EIA (2007).

The TRPDD region is well positioned for bioenergy-based economic development. As shown in this report, northeast Mississippi has abundant supplies of competitively priced biomass feedstocks. The transportation infrastructure and proximity to southeastern bioenergy markets also provide competitive advantages for production of bioenergy. The TRPDD region has three ports (Port of Itawamba, Port of Amory, and City of Aberdeen Port) on the Tennessee-Tombigbee Waterway, active rail access in all eight counties, and good access to major highways, especially in the eastern portion of the region (Figure 7).

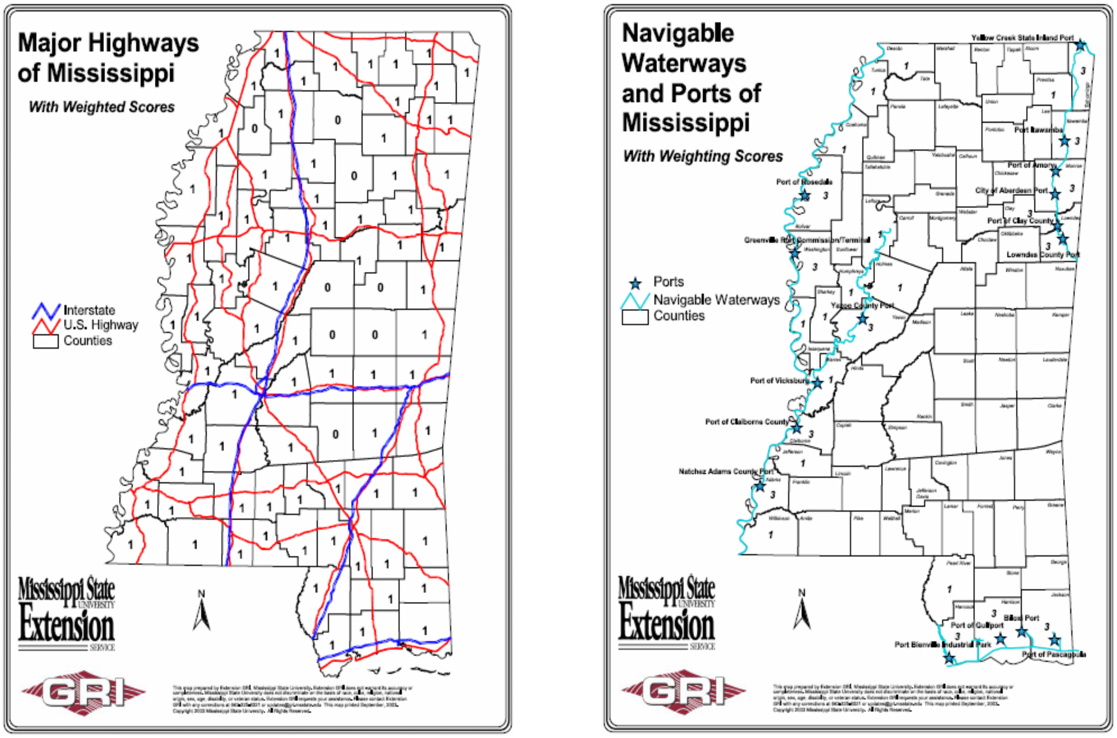


Figure 7. Mississippi Highway and Water Transportation Infrastructure, Steil (2004).

Bioenergy projects and technologies currently underway have laid significant groundwork and can benefit from a regional approach to bioenergy-based economic development. In addition, the State has been proactive in positioning itself to capitalize on its bioenergy potential through its universities, Mississippi Strategic Biomass Initiative, economic development organizations, Tennessee Valley Authority, and Appalachian Regional Commission.

Bioenergy offers inherent opportunities for multi-tier economic development with energy conversion facilities serving as hubs. In some cases, bioenergy conversion facilities will be biorefineries with multiple value-added products of higher value such plastics and pharmaceuticals. To minimize transportation costs, feedstock generally comes from local first tier suppliers, which provides more benefit to local economies along with transportation of outputs. Second tier equipment suppliers and transporters also provide significant benefits.

Corn Ethanol - Destination Plant Concept

U.S. ethanol demand has more than doubled since 2002 and is projected to increase at a similar pace through 2015 (Figure 8). Most of the ethanol supplied during this growth period is projected to be from corn.

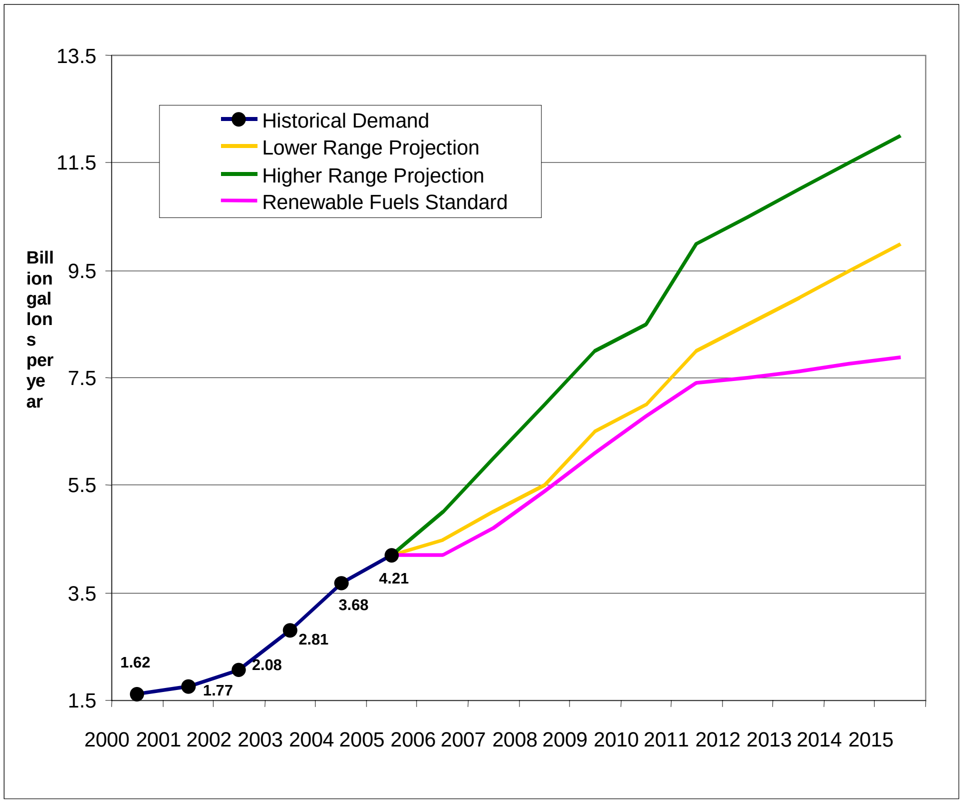


Figure 8. United States Fuel Ethanol Demand Projections (Miles and Bock, 2006).

Most corn ethanol plants to date have been located in or on the fringes of the Corn Belt but a strong case can be made for destination plants in the Southeast. Destination corn ethanol plants are located close to markets for ethanol and the co-products (distillers grains and carbon dioxide). They use as much local corn as possible but most supplies come from the Midwest. For a destination plant to be competitive with Midwest ethanol plants, the higher netback (sales price minus transportation and marketing costs) for ethanol, co-products and other advantages like lower costs for process heat must offset higher corn costs. An example of this type of destination plant is a 100-million gallon/year ethanol plant being built at Camilla, GA (FUE, 2006). The economic tradeoffs ($/bu of corn) for the Camilla plant vs. a Nebraska plant are presented in Table 3. The Camilla plant is projecting a $0.03/bu advantage without using biomass process energy and a $0.22/bu advantage using biomass instead of natural gas energy. A second example is a proposed corn ethanol destination plant at Decatur, AL on the Tennessee River (Table 4). The Decatur plant is projecting a $0.30/bu advantage without using biomass process energy and a $0.54/bu advantage using poultry litter for process energy instead of natural gas.

Table 3. Economic Tradeoffs for an Ethanol Plant at Camilla, GA vs. a Nebraska Plant[1/]	
Advantage or disadvantage vs. Nebraska	$/bu corn
Corn price disadvantage	-0.31
Ethanol advantage	0.14
Distillers grain advantage	0.11
Carbon dioxide advantage	0.09
Net advantage	**0.03**
Biomass process energy advantage	0.19
Net advantage	**0.22**
[1/]First United Ethanol (2006)	

Table 4. Economic Tradeoffs for an Ethanol Plant at Decatur, AL vs. Pekin, IL[1/]	
Advantage or disadvantage vs. Pekin, IL	$/bu corn
Corn price disadvantage	-0.06
Ethanol advantage	0.20
Distillers grain advantage	0.06
Carbon dioxide advantage	0.10
Net advantage	**0.30**
Biomass process energy advantage	0.24
Net advantage	**0.54**
[1/]Miles and Bock (2006)	

The two destination plant examples discussed above illustrate that, with proper citing, destination plants can compete with Midwest plants. The tradeoffs for the Decatur, AL plant should be similar to what would be expected for a northwest Mississippi plant. One exception is that corn transportation costs will be somewhat higher via barge on the Tennessee-Tombigbee Waterway due to barge towing sizes. There are potential options for offsetting or more than offsetting the higher barge rates for corn on the Tennessee-Tombigbee. One potential option is to backhaul corn in wood chip barges hauling from the Tennessee-Tombigbee Waterway to the Ohio River. Another option discussed later is to use biomass process energy instead of natural gas for cost savings of about $0.20/bu corn as indicated in Tables 3 and 4.

Another option with potential for northeast Mississippi is incorporating corn fractionation as part of the ethanol process as a means of enhancing co-product revenues, Best et al. (2005). Fractionation involves separating the starch, germ, and bran portions of the corn kernel, using the starch to produce ethanol, and selling germ and bran portions in higher-value markets. Fractionation may be a good fit for a northeast Mississippi location because of a nearby Memphis market for the germ, including food grade corn oil extracted from the germ. There is also potential for adding a biorefinery component for producing additional value-added products such as plastics and pharmaceuticals, perhaps in conjunction with one or more existing chemical industries in the region.

A third option for the region might be substituting sweet potatoes for part of the corn as a starch source. This has potential for reducing feedstock costs and further enhancing the local rural economy by using a local feedstock source. Evaluations by Mississippi State University indicate potential for locally produced sweet potatoes, primarily in Calhoun County, to provide starch as a supplemental feedstock for a local ethanol plant (Burdine, 2006).

In 2002, Mississippi House Bill 1130 was passed that provides cash payment to Mississippi producers of ethanol using in-state feedstocks. The cash payment is $0.20/gallon of ethanol for up to 30 million gallons/year ($6 million/year) at an individual ethanol plant for a period of 10 years. The statewide cash payment is capped at $36 million/year. In 2003, Mississippi House Bill 928 was passed "to provide that the Commissioner of Agriculture may make certain cash payments to producers of ethanol, anhydrous alcohol, bio-diesel, and wet alcohol that is produced in Mississippi from non-Mississippi originated products if Mississippi originated products are not available." House Bill 928 authorized the Commissioner to adopt rules for who is eligible for payments. A detailed set of rules for eligibility and documentation requirements has been established. This allows Mississippi corn producers to benefit from local ethanol plant demand while also providing the ethanol plant flexibility if sufficient supply is unavailable in state. The Commissioner is to request appropriations to pay producers for the first 180 million gallons of ethanol if they have been approved for the State of Mississippi Ethanol Producers Payment Program.

The Renewable Fuels Standard (RFS) enacted in the Energy Policy Act of 2005 (EPACT, 2005) provides another potential economic advantage (in addition to lower process heat costs) of providing process heat from waste materials such as wood wastes. The RFS requires that each refiner or importer either use a given percentage of ethanol in their overall system or purchase credits to compensate for any deficit that occurs. When 90% or more of the on-site fossil energy normally used to produce corn/ethanol is displaced by energy from wastes, the ethanol receives 2.5 gallons RFS credit per gallon produced. Corn/ethanol produced using fossil fuels for process energy receives 1.0-gallon RFS credit per gallon of ethanol produced. The 2.5X RFS credit is expected to provide another economic advantage over using fossil fuel for process heat. The rules for the 2.5X RFS credit have not been finalized and it is not clear what the market price of the credits will be. However, it is possible that the market price for RFS credits will be large enough to significantly benefit the economics of a corn ethanol plant using wood wastes or other wastes for process energy in northeast Mississippi.

In conclusion, a destination corn ethanol plant on the Tennessee-Tombigbee Waterway in northeast Mississippi has good potential for being competitive with Midwest ethanol plants, especially if low-cost biomass process energy is used and corn fractionation and biorefinery opportunities are exploited.

Biodiesel

There is also a strong national interest in expanding the biodiesel industry in the U.S. Because of this interest, the Mississippi Biomass Council contracted with Frazier, Barnes, and Associates to assess the feasibility of biodiesel in Mississippi, FBA (2003). The following is a summary of their findings as they apply to the TRPDD region.

Regional potential biodiesel demand projections for Mississippi and the surrounding states of Arkansas, Louisiana, Alabama, and Tennessee were 119,479,240 gallons/year assuming that 2% biodiesel were used in all the diesel consumed in those states. The same projection for Mississippi alone was 15,219,680 gallons/year. There is strong interest in using at least 2% biodiesel as a means of achieving adequate lubricity in diesel products with ultra-low sulfur; ultra-low sulfur diesel is now mandated for heavy-duty highway diesel use. With relatively high petroleum prices, interest will be strong in higher percentage blends of biodiesel. A strong case can be made for local production of at least enough biodiesel to meet in-state demand.

There are two biodiesel commercialization options. One option is integrated production in which a biodiesel plant is co-located at a soybean processing plant as a means of minimizing transportation costs and improving security of soybean oil supplies for making biodiesel. The other option is a stand-alone plant that purchases virgin vegetable oil (e.g., soybean, cottonseed, corn, canola, or sunflower oil) and/or non-virgin oils (e.g., recycled vegetable oils or rendered fats) on the open market for use in making biodiesel at a site other than where the oil is produced. Proforma financial projections for generic 13 million gallon per year plants of each type (integrated and stand-alone) resulted in positive net present values, but the integrated plant had a higher return on investment, cash flow, and internal rate of return.

The distribution of Mississippi soybean production and processing plants (operating and shut down) is presented in Figure 9. The majority of state soybean production is in the Delta Region and consequently, processing plants were located in that region. However, out of four soybean plants only one remains in operation at Marks, Mississippi - two counties west of the TRPDD region. There are also two cottonseed-processing plants in the Delta but it is highly unlikely that any new soybean or cottonseed plant operations will occur in the foreseeable future. The only realistic option for an integrated (ie.multi-feedstocks) biodiesel plant in Mississippi is at the Marks soybean-processing plant. There is opportunity for new stand-alone plants in the TRPDD region.

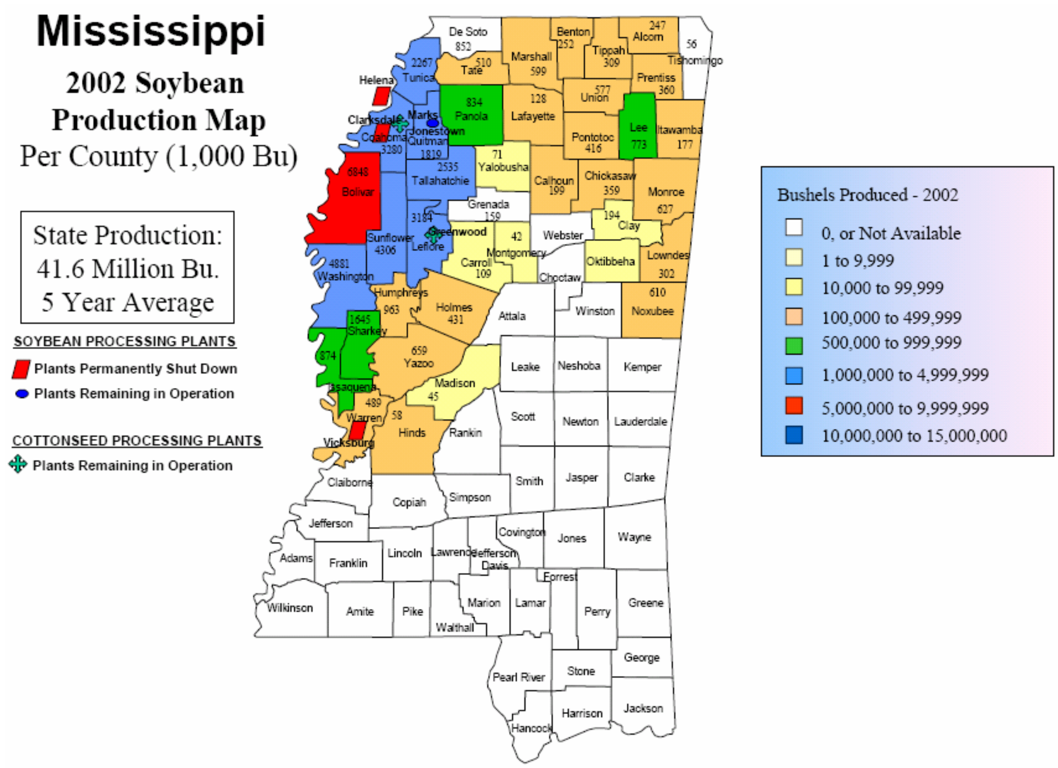
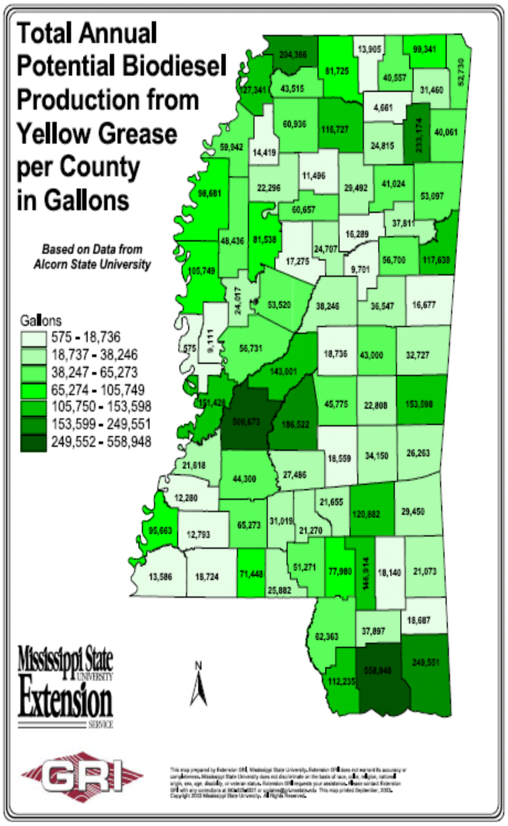


Figure 9. Mississippi Soybean Production and Soybean and Cottonseed Processing Plants, FBA (2003).

The primary oil feedstock options that may provide competitive advantages for a stand-alone plant in the TRPDD region are to purchase oil feedstock from near-by sources, including virgin oil from Marks, Mississippi and local non-virgin oils, or sources supplied via the Tennessee-Tombigbee waterway. Steil (2004) estimated county-level quantities of biodiesel that potentially could be produced from local supplies of yellow grease (Figure 10). Local supplies of yellow grease could serve as a supplemental supply of oil for biodiesel production but not the primary source - assuming an economical plant size of 5 to 15 million gallons biodiesel/year.

That leaves transportation infrastructure as the primary option for a competitive advantage for stand-alone biodiesel production. Steil (2004) rated Itawamba and Monroe counties as “most favorable” with an infrastructure rating of 7 for biodiesel production (Figure 11.) The most favorable infrastructure rating was based on a maximum of 3 points for being on a navigable waterway at a location with a port (Figure 7), a maximum of 2 points for an active railroad, a maximum of 2 points for proximity to a major electricity transmission line, and a maximum of 1 point for proximity to major highways (Figure 7). In addition to reducing oil feedstock transportation costs, good transportation infrastructure is important for minimizing transportation costs for biodiesel, methanol feedstock (about 1 gallon methanol feedstock/10 gallons of biodiesel) and glycerol by-product (about 1 gallon glycerol/10 gallons biodiesel).



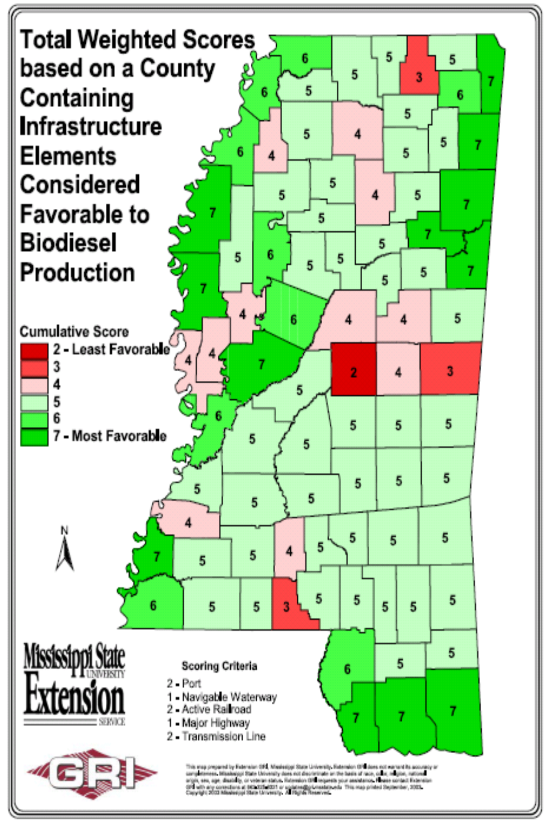


Figure 10. Potential Biodiesel Production from Yellow Grease, Steil (2004)

Figure 11. Infrastructure Ratings Favorable for Biodiesel Production, Steil (2004)

An important consideration of this assessment is the potential and opportunities for producing ethanol from cellulosic biomass (e.g., woody and grassy materials). One of the promising technologies for producing ethanol from cellulosic biomass has the ability to also produce methanol or a dual stream of methanol and ethanol. This technology produces a syngas from cellulosic biomass and converts the syngas to ethanol and/or methanol. A cellulosic ethanol/methanol plant integrated with a biodiesel plant may have merit for serving as a low cost source of methanol feedstock for biodiesel production and should be assessed further.

Another possible advantage of this type of integration is that the glycerol (a by-product) can likely be converted to methanol and recycled back to the biodiesel plant using the cellulosic biomass conversion technology. The glycerol by-product essentially eliminates transportation costs for methanol feedstock. This type of integration should be assessed in more detail as a potential economic development opportunity.

Primarily because of excellent transportation infrastructure, the TRPDD region is well positioned for stand-alone biodiesel production for local and regional markets. Opportunities for integrating a biodiesel plant with a cellulosic biomass/ethanol/methanol plant should be explored further.

Cellulosic Biomass Supplies

As discussed above, northeast Mississippi has significant bioenergy opportunities based on ethanol from starch contained in corn and sweet potatoes and biodiesel from oil contained in soybeans, cottonseeds, and yellow grease. These opportunities exist from logistical and synergistic advantages rather than from feedstock supply competitive advantages. In contrast, northeast Mississippi opportunities for bioenergy from cellulosic biomass are present first and foremost because of abundant supplies of cellulosic biomass.

The TRPDD and adjacent surrounding counties have abundant cellulosic biomass supplies that can potentially be used for bioenergy, given favorable economics. The following sections provide a first approximation of dry tons cellulosic biomass potentially available and pricing for the following types of cellulosic biomass: mill residues, small diameter wood, forest residuals, urban wood wastes, and switchgrass. Opportunities for using the various cellulosic biomass supplies to produce bioenergy will be discussed in later sections.

Mill Residues

Mill residues have historically been the primary woody biomass feedstock used for energy. Garrard and Leightley (2005) surveyed wood waste supplies from mills in northeast Mississippi. The survey area included the 31 counties bordered by Interstate 55 on the west, the Mississippi state line on the east, the Mississippi state line on the north, and Leake and Neshoba counties on the south. The database of companies included sawmills and planing mills, chip mills, and firms producing such products as pallets, furniture, frames, dimension stock, flooring, millwork, doorframes, cabinets, plywood, and particleboard. The survey did not reflect wood wastes expected to be used by the Kingsford charcoal plant that is scheduled to start up soon at Glenn, Mississippi.

A 70% response rate was obtained. The responding firms generate about 2.1 million tons of wood waste/year (Table 5). Of this total, 36.4% is recycled, 60.6% is sold, 0.9% is given away, and 2.1% is disposed of at a cost. Of the wood wastes sold, about 45% was used for energy and 30% was used in the production of paper, particleboard, and other engineered wood products. The remaining wood waste sold was used for various other products such as animal bedding, mulch, and firewood.

Table 5. Wood Waste Tonnage and Disposal Methods in Northeast Mississippi[1/].

Disposal method	tons/year	% of total	% of sold
Sold	1,264,668	60.6	
Bioenergy	569,101		45
Paper, particle bd., engineered wood	379,400		30
Recycled	758,928	36.4	
Given away	18,216	0.9	
Paid for disposal	43,416	2.1	
Total	2,085,228	100.0	75

[1/]Garrard and Leightley, 2005.

Of the wood waste sold, the average transportation distance was 83 miles, the average transportation cost was $9.31/ton, and the average cost recovered by the waste generator was $7.56/ton. The implication is that on average, purchasers of wood waste paid $16.87/ton delivered ($9.31+7.56=16.87). These prices are based on tons at "as-received moisture content". The average moisture content of the wood waste sold was not reported, but some of the wood waste would have been green, implying the price paid per ton on a dry basis was significantly higher than $16.87/ton.

If About 50% of the wood waste were green and 50% dry, the average moisture content would be about 25% and the average selling price per dry ton would be $22.50/dry ton ($16.87/0.75=$22.50). New bioenergy operations likely would have to pay significantly more than $22.50/dry ton to divert the wood wastes to new bioenergy uses. A significant portion of the 1,264,668 tons/year of wood waste sold probably could be diverted at a price of $30-35/dry ton, but the market will determine the ultimate price.

<u>Small Diameter Wood</u>
Stuart and Stewart (2002) estimated the volume of small diameter timber available from private lands in northeast Mississippi to support new undertakings without jeopardizing existing markets. This estimate was based on non-industrial privately owned lands in the following counties: Alcorn, Benton, **Calhoun**, **Chickasaw**, **Itawamba**, **Lafayette**, **Lee**, Marshall, **Monroe**, **Pontotoc**, Prentiss, Tippah, Tishomingo, and **Union.** Although the non-italicized counties are not in the TRPDD region, they potentially could supply wood to bioenergy processing plants in the region. Mill closures, consolidations, and weak paper markets have reduced the demand for small diameter wood produced in these counties. The surplus of small diameter wood in these counties was conservatively estimated at 2 million tons/year (~1 million dry tons/year). Development of new uses would facilitate more thinning operations that are highly beneficial for reducing risk of forest fires, increasing forest growth rates, and improving wildlife habitat as well as increasing income for landowners and creating rural jobs and tax revenues.

Perkins et al. (2005) assessed potential uses of small diameter wood in northern Mississippi based on a literature review and interviews with companies in northern Mississippi. The primary existing markets are oriented strand board (OSB), pulp, and sawmills and these markets are not large enough to consume the existing surplus. Products for which the potential surplus possibly can be used include log homes, log furniture, posts, structural round wood, fencing, handrails, wildlife habitat, softwood and hardwood lumber, pallets and containers, engineered wood products, mulch, specialty products, and bioenergy products. In general, most of the companies interviewed could not currently use small diameter wood for these purposes. Bioenergy is a potentially large market for this surplus, given favorable economics.

Pulpwood prices in the southeastern U.S. range from $19-25/ton (GP, 2006), which corresponds to roughly $38-50/dry ton. Pulpwood stumpage prices for the third quarter of 2006 in the southeastern U.S. averaged $5.38/ ton for hardwood and

$6.21/ton for softwood (Timber Mart—South, 2006a). The average contract price to cut, skid, and load timber from thinning operations in the Southeast (fourth quarter of 2005) was $12.44/ton for the Piedmont and $12.02/ton for the coastal plain (Timber Mart—South, 2005b) with an average hauling rate of $0.11/ton-mile at a minimum of 40 miles (minimum of $4.44/ton). Using round numbers of $6/ton stumpage fee; $12/ton to cut, skid, and load; and $5/ton for hauling gives a delivered cost for pulpwood of $23/ton (~$46/dry ton). The above prices and costs indicate that surplus pulpwood could be delivered to bioenergy processing plants in northeast Mississippi for somewhat less than $50/dry ton. The economic feasibility of using small diameter wood in this price range for bioenergy will be discussed in later sections.

Forest Residuals (Logging Residuals and Cull Wood)
With limited use of fire and mechanical treatments as site preparation tools, dealing with forest harvest residuals prior to regeneration is becoming more expensive and problematic. Bioenergy markets for small stems that are currently non-merchantable and for residues such as limbs and tops could turn what is currently a cost item into a potential revenue stream for forest landowners and reduce the investment required for reforestation.

Because of potential bioenergy markets for forest residuals, Westbrook et al. (2006) assessed the economics of adding a small chipper to a mechanized, tree-length system to also harvest tops, limbs, and understory (diameter at breast height, dbh, 1-4 inch) biomass. The delivered cost of chips from limbs and tops ranged from $12/ton (~$24/dry ton) with a roundwood to chip ratio of 6 to $20/ton (~$40/dry ton) with a roundwood to chip ratio of 14 (Figure 12). The delivered cost of chips from limbs, tops and understory was about $1/ton (~$2/dry ton) more than for chips from limbs and tops only. These cost estimates were engineering costs and didn't reflect return on investment. Adding 20% to the above costs to account for return on investment gives a cost range of $29 to 48/dry ton. These costs indicate that chips from tops, limbs, and understory can be delivered to biomass processing plants at somewhat lower costs per dry ton than the delivered cost of pulpwood. Rummer et al. (2004) estimated the cost of bundling, forwarding, hauling, and chipping forest residuals at between $29 and 34/dry ton. Adding 20% to reflect return on investment gives a cost range of $38 to 47/dry ton, which is comparable to somewhat less than the cost of pulpwood.

In general, the chip system assessed by Westbrook et al. (2006) can be integrated into existing logging systems in the Southeast with fewer changes than can a bundle system. Therefore, a chip system has a higher probability of being commercialized in northeastern Mississippi in the near future, if there are bioenergy markets for the biomass (Rummer, 2007).

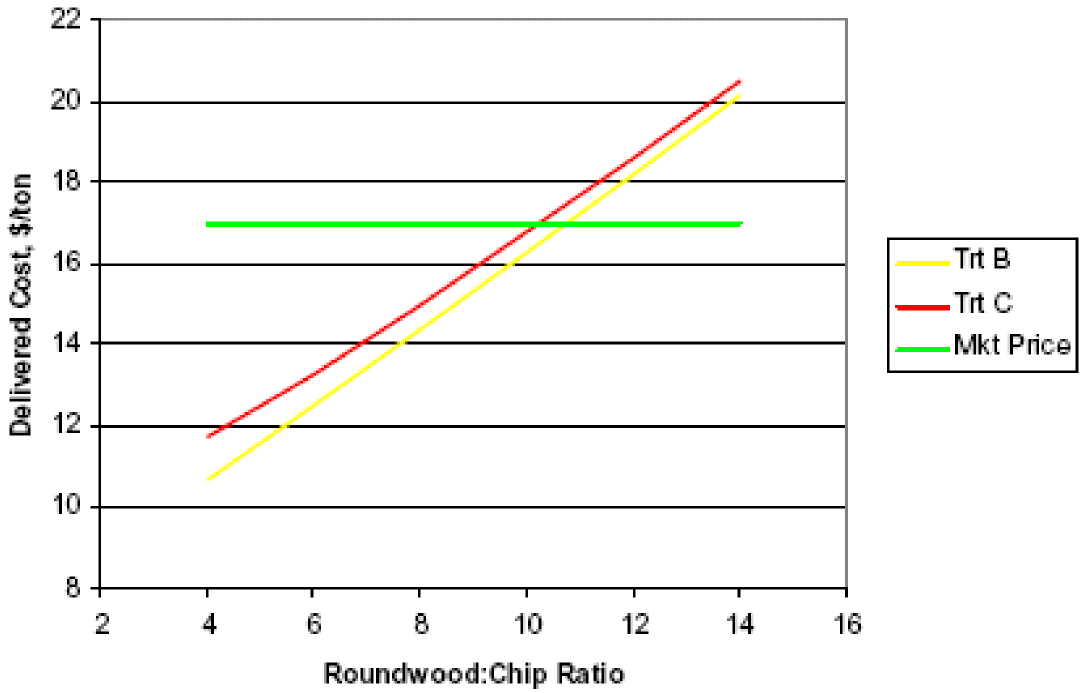


Figure 12. Estimates of Delivered Chip Costs for Treatments B (Limbs and Tops) and C (Limb/Top/Understory) in Relation to Tons Roundwood/Ton Chips Produced, Westbrook et al. (2006).

Supply curves for logging residues for the TRPDD region and perimeter counties are presented in Appendix A Table 1. About 600,000 tons logging residues/year potentially could be supplied for about $45/dry ton or less.

Supply curves for cull wood for the TRPDD region and perimeter counties are presented in Appendix A Table 2. About 450,000 tons of cull wood/year potentially could be supplied for about $45/dry ton or less.

Urban Wood Waste

Urban wood waste supplies in the TRPDD region and perimeter counties are relatively small but could be obtained generally for less than $30/dry ton (Appendix A Table 3). However, some of the urban wood waste such as from construction and demolition waste would require separating woody from non-woody materials and removal of contaminated wood that increases the cost to bioenergy processing plants. Urban wood waste could serve as a supplement fuel for bioenergy processes. About 140,000 tons/year potentially could be supplied from urban wood waste.

Switchgrass

In contrast with existing wood supplies discussed above, very little switchgrass acreage currently exists in northeast Mississippi. However, economic crop models indicate that about 1 million dry tons switchgrass/year potentially could be produced in the TRPDD region for less than $40/dry ton. And, about 1.3 million tons/year potentially could be produced at the same price in the perimeter counties (Appendix

A Table 4), if a bioenergy market developed a demand for the switchgrass. Development of switchgrass supplies for bioenergy may be challenging due to a "chicken or egg" conundrum (i.e., development of switchgrass supplies may be slow until bioenergy processing plants are more certain and development of bioenergy processing plants may be slow until switchgrass supplies are more certain). It should be possible to overcome this conundrum via long-term switchgrass supply contracts. Also, a combination of wood and switchgrass possibly could be used to fill early gaps in switchgrass supplies.

A summary of cellulosic biomass supplies potentially available in addition to mill residues and surplus small diameter wood is presented in Table 6. This summary is based on Appendix Tables 1 to 4. At $40/dry ton, about 1.2 million dry tons of biomass/year from logging residues, cull wood, and urban wood wastes are potentially available for bioenergy applications.

Table 6. Supply Curve for Cellulosic Biomass in Addition to Mill Residues and Small Diameter Wood.[1/]

	price, $/dry ton					
	<$25	<$30	<$35	<$40	<$45	<50
	dry tons logging residues/year					
Logging residues	99,994	227,808	503,932	601,142	601,142	601,142
Cull wood	129,864	295,826	419,546	452,269	482,036	526,075
Urban wood wastes	117,448	142,562	142,562	142,562	142,562	142,562
Subtotal	347,306	666,196	1,066,040	1,195,973	1,225,740	1,269,779
Switchgrass		309,321	2,130,670	2,346,010	2,501,722	2,608,659
Grand total	347,306	975,517	3,196,710	3,541,983	3,727,462	3,878,438

[1/]ASU (2003).

About another 2 million tons/year (~1 million dry tons/year) of surplus small diameter wood and possibly some mill residues could be diverted from current uses totaling at least 2.2 million dry tons of woody biomass. Even if only 50% of this potential could be diverted to bioenergy applications, the impact on economic development could be substantial. Roughly another 2.5 million tons of switchgrass could be available at about $45/ton but this would require substantial acreage conversion, which is generally a longer-term process.

Recruiting Industry with Low-Cost Process Heat

Because of high and very volatile fossil fuel prices, there are potential opportunities to use relatively low-cost biomass energy to attract energy-intensive industries to northeast Mississippi. Using wood wastes to produce process heat and/or electricity on site at wood processing plants has been a common practice for many years. In these cases, the wood wastes are often a zero-cost fuel and can even be a negative-cost fuel.

The economics of this practice generally were favorable even when natural gas and electricity prices were much lower because of no transportation costs for the wood wastes. Now that natural gas prices are much higher (Figure 6), use of cellulosic biomass to displace natural gas is economical in some situations even if the biomass has a significant positive delivered cost. Given high natural gas prices, economics are generally more favorable for providing process heat than electricity from biomass, especially if the electricity is sold to the grid at utility avoided costs, Bock and Broder (2006). The economics of using biomass energy to displace natural gas for supplying process heat are reviewed below.

Henry Hub natural gas prices are projected to average $7.06/MBtu in 2007 and $7.72/MBtu in 2008, EIA (2007), and remain in that range or somewhat lower for the foreseeable future. Mississippi industrial natural gas prices historically have averaged about $1.00/MBtu higher than at the Henry Hub. Therefore, wood used to provide process heat for industrial processes in northeast Mississippi is projected to compete with an average natural gas price of about $8.00/MBtu in 2007 and somewhat higher in 2008. Delivered prices for wood feedstock in northeast Mississippi are projected to range generally from $25 to 50/dry ton. Assuming 17 MBtu/dry ton of wood, these delivered prices for wood range from $1.47 to 2.94/MBtu on a dry basis (Table 7), which is much less than the projected price of natural gas on a Btu basis.

Displacing natural gas with biomass fuel usually involves replacing a natural gas package boiler with a solid fuel boiler suitable for biomass. A solid fuel boiler costs significantly more than a natural gas package boiler. The economic feasibility of displacing natural gas with wood depends on the relative cost of the two fuels on a Btu basis, relative efficiencies at which the two fuels are converted to process heat, and cost of adding and operating a solid fuel boiler.

On a Btu basis, wood is used less efficiently than natural gas, mainly because of the energy required to evaporate moisture in the wood. The moisture content of wood ranges from about 50% for green wood to almost 0% for sawdust from dried wood. Natural gas prices at which the cost of fuel to produce a unit of steam are the same as for wood at given moisture content and price per dry ton are presented in Table 7.

For example, with a wood price of $35/dry ton and a moisture content of 50%, the equivalent natural gas price is $2.73/MBtu. This means if the industrial natural gas price in northeast Mississippi were $8.00/MBtu, the fuel cost savings from wood at 50% moisture would be $5.53/MBtu of natural gas displaced (i.e., $5.27=$8.00-$2.73). In this example, a wood boiler would be profitable if adding and operating a solid fuel wood boiler costs less than $5.27/MBtu of natural gas displaced over the lifetime of the project.

The economics of a biomass boiler for process heat are most favorable for relatively large continuous users of natural gas because of economies of scale and efficient use of equipment. Corn ethanol plants are a good example of this type of application. Corn ethanol plants operate 24/7 and require large amounts of process heat to produce ethanol and dry distillers grains.

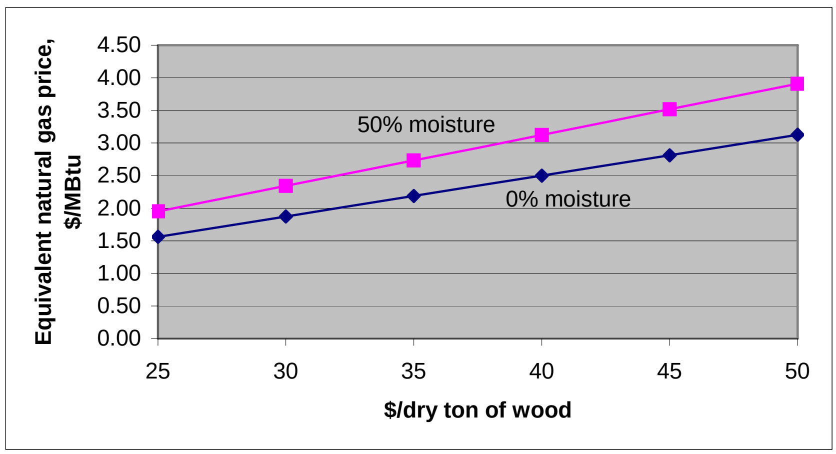
Table 7. Equivalent Natural Gas Prices for Wood at Various Moisture Contents and Prices per Dry Ton.

			$/dry ton of wood					
			25	30	35	40	45	50
			$/MBtu from dry wood[3/]					
Wood fuel			1.47	1.76	2.06	2.35	2.65	2.94
Moisture	Boiler efficiency[1/]	Efficiency relative to natural gas[2/]	Equivalent natural gas price, $/MBtu					
	%							
0	80	94.1	1.56	1.88	2.19	2.50	2.81	3.13
10	78	91.8	1.60	1.92	2.24	2.56	2.88	3.21
20	76	89.4	1.64	1.97	2.30	2.63	2.96	3.29
30	73	85.9	1.71	2.05	2.40	2.74	3.08	3.42
40	69	81.2	1.81	2.17	2.54	2.90	3.26	3.62
50	64	75.3	1.95	2.34	2.73	3.13	3.52	3.91

[1/]SERBEP,1994; boiler efficiency=(Btu steam produced/Btu fuel input)x100.

[2/]Assumes 85% boiler efficiency for natual gas used in a package boiler.

[3/]Assumes 17 MBtu/dry ton of wood.



First-approximation economics are presented in Table 8 for a wood-fired Energy Products of Idaho (EPI) fluidized bed combustion boiler supplying 170,000 lb process steam/hour for a nominal 50 million-gallon/year ethanol plant. These economics are based on a recent assessment of a similar system using poultry litter to supply the same amount of steam to an ethanol plant, Miles and Bock (2006). Capital costs were adjusted down from $27 million to 22 million because wood fuel would not require a scrubber to remove chlorine and the storage and handling system would cost less for wood than for poultry litter. Our estimated capital cost of $22 million is consistent with the published capital cost of adding virtually the same EPI combustion system for use with coal at an ethanol plant at Goldfield, Iowa (Des Moines Register, 2006). Annual operating and maintenance costs were estimated at $1.32 million. Assumptions for the financial analysis were 10-year straight-line depreciation, 50% equity, 10-year loan, and 9% interest.

Table 8. Fuel Cost Savings and Return on Investment for Wood-Fired Boiler vs. Natural Gas.

	$/dry ton of wood					
	25	30	35	40	45	50
	$/MBtu from dry wood[1/]					
	1.47	1.76	2.06	2.35	2.65	2.94
Industrial	Equivalent natural gas price for wood at 50% moisture, $/MBtu [2/]					
natural gas price	1.95	2.34	2.73	3.13	3.52	3.91
$/MBtu	Fuel cost savings, $/MBtu natural gas displaced					
6.00	4.05	3.66	3.27	2.87	2.48	2.09
7.00	5.05	4.66	4.27	3.87	3.48	3.09
8.00	6.05	5.66	5.27	4.87	4.48	4.09
9.00	7.05	6.66	6.27	5.87	5.48	5.09
	10-year average before-tax return on equity investment (ROI), %					
6.00	28.1	21.8	15.4	9.0	2.6	-3.7
7.00	44.3	38.0	31.7	25.2	18.9	12.5
8.00	60.6	54.2	47.9	41.4	35.1	28.8
9.00	76.8	70.5	64.1	57.6	51.3	45.0

[1/]Assumes 17 MBtu/dry ton of wood.

[2/]See Table 7 for calculations.

An investor in a biomass boiler likely would expect a before-tax return on equity investment (ROI) of at least 20%. With a natural gas price of $8.00/MBtu, the projected ROI is 28.8% with a wood price of $50/dry ton and wood moisture content of 50%. This would roughly correspond to using pulpwood, which is in surplus in northeast Mississippi. At $7.00/MBtu for natural gas, the projected ROI is 25.2% with a wood price of $40/dry ton, which roughly corresponds to using forest residuals. At $6.00/MBtu for natural gas the price for wood would have to be about $30/dry ton or less to achieve an ROI of greater than 20%. This example indicates favorable economics for using cellulosic biomass to provide process steam to medium-sized industrial operations in northeast Mississippi, if natural gas prices stay at levels higher than roughly $7.00/MBtu. In addition to lower average costs, less fuel price fluctuation is another import advantage of using biomass-based process heat.

The above example would require about 145,000 dry tons/year of 50% moisture woody biomass. Earlier sections on biomass supplies indicated that even if only 50% of the potential woody biomass supplies were used, northeast Mississippi could supply several industrial projects. And, switchgrass could also provide competitive feedstock over time at natural gas prices of $8.00/MBtu.

Currently, there is an opportunity for providing process heat for a proposed ethanol plant at Amory, MS. Whether or not relatively low-cost process energy from biomass is available could be a major factor in this project moving forward. Other energy-intensive industries are currently looking for lower-cost and more stable energy options for process heat. Cellulosic biomass is likely to become a positive recruiting tool for energy-intensive industry in the near future. This is an excellent opportunity for retaining and recruiting energy-intensive industries. For instance, discussions continue for using cellulosic biomass to heat existing brick kilns in TRPDD perimeter counties to help assure their economic viability.

Wood Pellet Opportunities

Wood pellet production is an industry with significant growth potential in North America. Canada has 23 wood pellet plants producing 1,400,000 tons/year with 50% exported to Europe for power plant use (Swann, 2006). The United States has 60 wood pellet plants producing 900,000 tons/year for the residential "bagged" market. By 2010, Canadian pellet production is projected at 5.5-6 million tons/year and U.S. production at 2.5-3 million tons/year. High fossil energy prices are the primary driver for increases in the United States. Likewise, fossil energy prices combined with numerous financial incentives for renewable energy by European governments is increasing use of bioenergy, including wood pellets. However, unlike the United States, much of the European demand for pellets is for bulk product used for district heating and power plants, which is driven by policies for reducing greenhouse gas emissions.

Typical current prices for wood pellets produced in western Canada are as follows, Swann (2006):

- $100/ton at the millgate in western Canada
- $140-145/ton FOB (Free on Board), Port of Vancouver
- $175/ton CIF (Cost, Insurance, and Freight), Port of Rotterdam
- $185/ton CIF, Denmark-Sweden

European pellet prices are projected to increase over the next few years with the increasing emphasis on use of renewable fuels and reduction of greenhouse gas emissions.

Northeast Mississippi is well positioned to compete with Canada to provide bulk quantities of wood pellets for European markets for two reasons: (1) plentiful supplies of relatively low-cost wood feedstock for producing pellets and (2) low-cost barge transportation of pellets to Mobile on the Tennessee-Tombigbee Waterway for transfer to ships at the Port of Mobile.

The processing cost for producing wood pellets in a 6 ton/hour (~50,000 tons/year) plant is about $35/ton with drying and $25/ton without drying, Figure 13. Pelletizing costs increase sharply for plants less than 6 tons/hour but improve gradually as size increases above 6 tons/hour, Figure 14. The delivered cost for wood feedstock in northeast Mississippi is expected to range generally from $25-50/dry ton. Using a maximum delivered feedstock cost of $50/dry ton and a pelletizing cost of $35/ton gives a total pellet cost at the millgate of $85/ton. Subtracting $85/dry ton from a European pellet price of $175/ton leaves $90/ton for transportation to European ports and profit taking. Lower delivered feedstock cost, which is likely, makes this potential industry even more attractive.

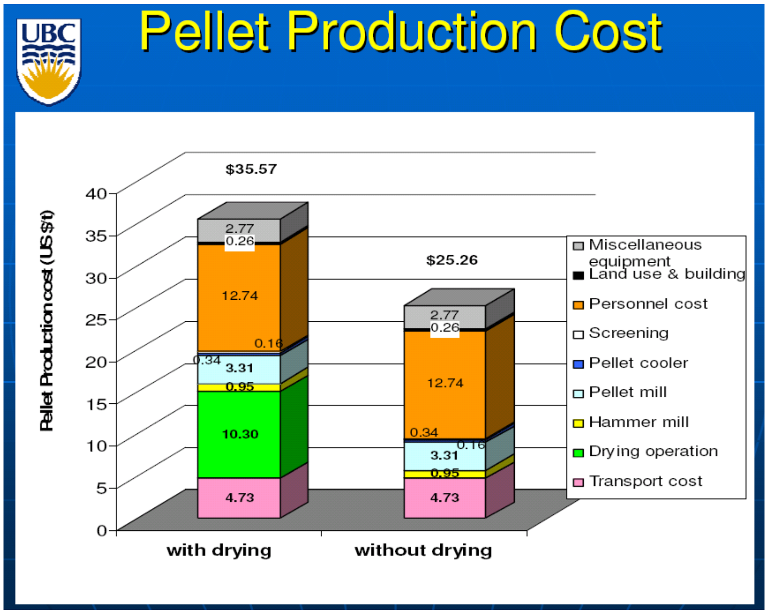


Figure 13. Wood Pelletizing Costs for a 6-Ton/Hour Plant, Mani (2006).

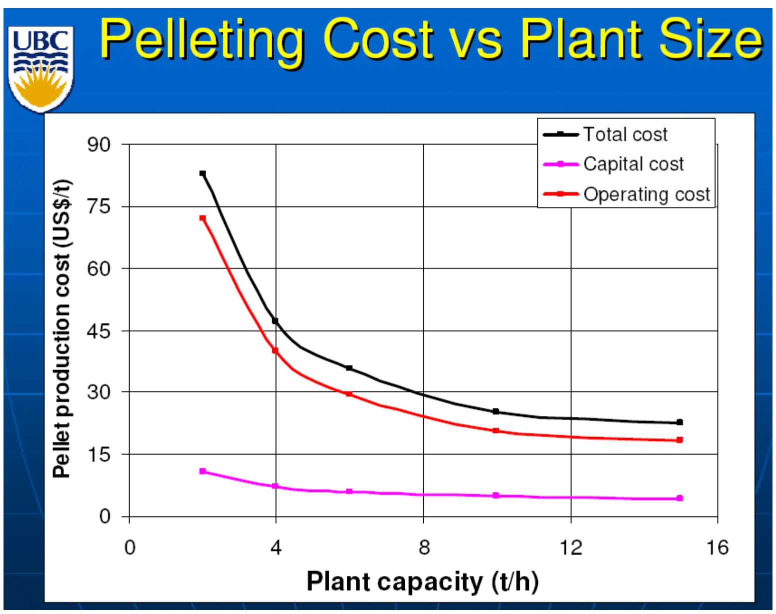


Figure 14. Effects of Plant Size on Wood Pelletizing Costs, Mani (2006).

Wood pellet prices for domestic use in the Southeast range from $119-140/ton, (Pellet Fuels Institute, 2006). This represents a significant regional market for pellets from northeastern Mississippi.

In some cases, European wood pellet markets may require that feedstock for producing pellets come from certified sustainable forestry systems. Currently, the sustainable certification is not accessible to private landowners due to the cost, administrative requirements, and technical requirements (Jarrett, 2006). A pilot program is underway in northeast Mississippi to demonstrate group certification.

This program could be expanded if sustainable certification provides a competitive edge or becomes a requirement for the European market.

The CKS Energy pelletizing plant that is scheduled to start up at Amory, Mississippi in early 2007 is poised to capitalize on the bioenergy opportunities discussed above. There is potential for significant additional economic development in northeast Mississippi based on these opportunities.

Cellulosic Ethanol

Although nearly all the ethanol currently produced in the United States is from corn, several technologies for converting cellulosic biomass to ethanol are near commercial. Northeast Mississippi is well positioned to develop a project to demonstrate one of these technologies on a commercial scale and then be in a competitive position for attracting subsequent cellulosic ethanol projects. There are two platforms for converting cellulosic biomass to ethanol (Figure 15). The sugar platform uses enzymes and chemical treatments to break cellulose down to sugars that in turn can be fermented to ethanol. Syngas, the second platform, gasifies the cellulosic biomass to produce a syngas composed primarily of carbon monoxide and hydrogen that can then be converted to ethanol. The conversion of syngas to ethanol can be achieved chemically using catalysts in a process known as Fischer-Tropsch or it can be converted through a biological process using microorganisms. Both platforms also can be used as a basis for a biorefinery to produce other fuels and chemicals.

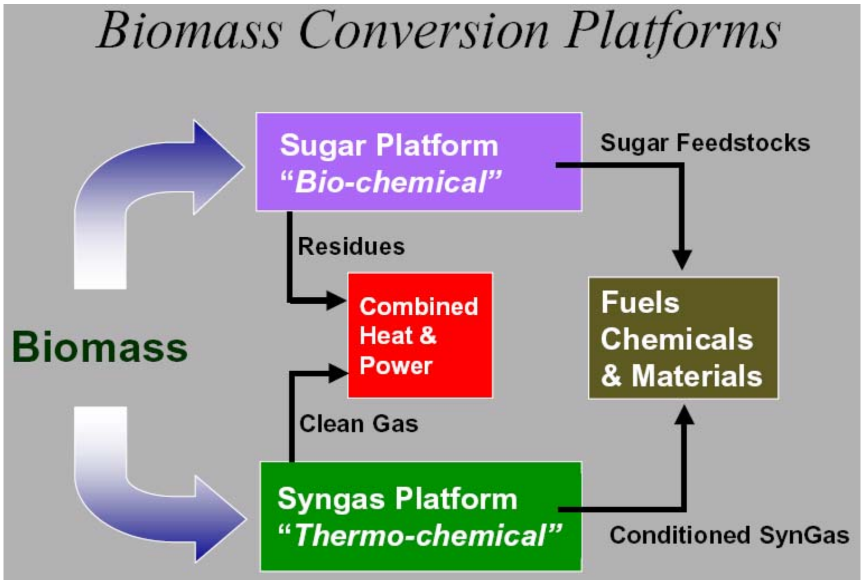


Figure 15. Platforms for Converting Cellulosic Biomass to Fuels and Chemicals, Overend (2004).

With recent increases in crude oil and gasoline prices, cellulosic ethanol appears to be economical from several near-commercial technologies based on pilot-scale demonstrations, but commercial demonstrations of emerging technologies are needed to attract investors.

DOE has programs for supporting commercialization demonstrations of both platforms for producing cellulosic ethanol. In a DOE assessment of dilute acid pretreatment of corn stover followed by enzymatic conversion to sugars and fermentation of sugars to ethanol, the minimum selling price for ethanol to achieve a 20% internal rate of return was $1.35/gallon, assuming 50% equity and $30/dry ton for delivered corn stover, Aden et al. (2002). In a DOE-funded third party assessment of pilot-scale gasification of rice straw followed by Fischer-Tropsch conversion of the syngas to ethanol, the cost of producing ethanol was estimated between $1.09-1.39/gallon, Schuetzle (2006) and TSS Consultants (2005). Pearson Technologies located at Aberdeen, MS provided the gasifier and gas-to-liquids technology used in this project. The third party evaluation indicated a high probability of commercial success for the Pearson Technologies gasifier based on completed evaluations but that the gas-to-liquids technology needs validation on a larger scale.

Much of the DOE program on cellulosic ethanol has been focused on corn stover in the Corn Belt. However, in terms of cellulosic feedstock costs, woody feedstocks in northeast Mississippi should be very competitive with corn stover in the Corn Belt. The delivered cost of corn stover harvested in a separate pass from the corn harvest was estimated as follows: $29/dry ton for baling and staging in temporary storage, $13/dry ton for transportation to the conversion plant, $7/dry ton for added fertilizer costs, and $20/dry ton premium for farmers to accept the risk and added work of collecting residue for a total of $56/dry ton (Aden et al, 2002). Without the farmer premium, the estimated cost of delivered stover is $36/dry ton. Sokhansanj et al. (2002) estimated an average cost of corn stover delivered to intermediate storage at $27/dry ton; this did not include transportation from intermediate storage to the conversion facility or payment to the farmer for the stover. The cost of corn stover delivered to the conversion facility is likely to be at least $35/dry ton, even without any compensation to the farmer for the stover.

Farmers likely will require compensation at least for the added fertilizer costs which Aden et al. (2002) estimated at $7.00/dry ton, resulting in an average delivered cost of corn stover of $42/dry ton. As indicated in the forest residuals section of this report, the estimated delivered cost of forest residuals in northeast Mississippi ranges from $29-48/dry ton for chips. Therefore, northeast Mississippi should be able to compete well with the Corn Belt in terms of cellulosic feedstock costs.

The Energy Policy Act of 2005 includes significant financial incentives to assist with commercial demonstrations of cellulosic ethanol technologies, EPACT (2005). Northeast Mississippi is well positioned for a commercial demonstration of cellulosic ethanol production because of an abundance of competitively priced cellulosic feedstocks, the Tennessee-Tombigbee Waterway for low-cost transportation of ethanol, and strong institutional involvement in commercialization of biomass technologies. Another possible plus is that a local cellulosic ethanol technology (i.e., Pearson Technologies at Aberdeen, MS) is poised for commercialization. A cellulosic ethanol demonstration project is being proposed by Potlatch at its Cypress Bend, AR facilities on the Mississippi River with the help of federal financial incentives (Ethanol Producer Magazine, 2006). The proposed first phase involves gasification of 1500 tons/day of cellulosic biomass and conversion of the syngas to ethanol via Fischer-Tropsch. Northeast Mississippi is well positioned to develop a similar demonstration to help move the region into a competitive position for subsequent cellulosic ethanol and biorefinery projects.

Conclusions

The TRPDD region and northeast Mississippi are well positioned for bioenergy-based economic development because of abundant supplies of competitively priced biomass feedstocks and excellent transportation infrastructure—including the Tennessee-Tombigbee Waterway.

Based on our review, the best strategy for realizing bioenergy economic development in the region is to proactively work with industry, consultants and county organizations to:

- Develop one or more corn/ethanol destination plants that capitalize on local advantages that more than offset the transportation cost of corn from the Midwest.
- Develop one or more stand-alone biodiesel plants that purchase oil and fat feedstocks on the open market and produce biodiesel competitively for local and regional markets thus capitalizing on excellent infrastructure for transporting oil, fat, and methanol feedstocks “in” and biodiesel and glycerol by-product “out”.
- Recruit energy-intensive industry based on opportunities for providing relatively low-cost process heat from biomass.
- Develop one or more wood pellet plants on the Tennessee-Tombigbee Waterway producing bulk product to be barged to Mobile and shipped on to Europe for use by power plants and in district heating.
- Develop a commercial demonstration of an emerging technology for producing ethanol from woody (cellulosic) materials, taking advantage of the plentiful and competitively priced supplies of woody materials and excellent transportation infrastructure for transporting ethanol to southeastern and eastern U.S. markets.
- Consider establishment of a bioenergy alliance among interested county organizations

The TRPDD district has the biomass and infrastructure resources to be very competitive in attracting bioenergy projects in all of the above opportunity areas. It has the available experienced work force and groundwork laid by bioenergy projects and technologies being developed in the region, and institutional support for bioenergy development and commercialization from universities and other state and regional organizations. Given the current tremendous emphasis on the nation moving rapidly toward implementing alternative energy production, it would be well worth the time and expense to aggressively pursue these initiatives.

References

Aden, A., M. Ruth, K. Ibsen, J. Jechura, K. Neeves, J. Sheehan, B.Wallace, L. Montague, A. Slayton, and J. Lukas. 2002. Lignocellulosic biomass to ethanol process design and economics utilizing co-current dilute acid prehydrolysis and enzymatic hydrolysis for corn stover. National Renewable Energy Laboratory: http://www1.eere.energy.gov/biomass/pdfs/32438.pdf

ASU. 2002. Renewable & Bioenergy Database in Mississippi. Alcorn State University: http://www.mississippi.org/energycd/index.htm

Best, Mike, George Shumaker, Archie Flanders & John McKissick. 2005. The economic feasibility of operating an advanced ethanol production facility in Georgia. Pub. Number FR-0509: http://hosting.caes.uga.edu/gacoop/pdf/FinalAdvancedEthanolReport.pdf

Bock, B. and J. Broder. 2006. Feasibility of renewable energy from poultry litter in the TVA region. EPRI. Palo Alto, CA. 1010486.

Burdine, Bill. 2006. Personal communication.

Des Moines Register. 2006. Ethanol plant counts on coal for power. http://www.desmoinesregister.com/apps/pbcs.dll/article?AID=/20060205/BUSINESS04/602050315/1033

EIA. 2007. Energy Information Administration. Short-term energy outlook, January 2006: http://www.eia.doe.gov/emeu/steo/pub/contents.html

EPACT. 2005. Energy Policy Act of 2005: http://energy.senate.gov/public/_files/ConferenceReport0.pdf

Ethanol Producer Magazine. 2006. Biomassive ventures. July 2006: www.ethanol-producer.com/article.jsp?article_id=2155&q=page=all

FBA. 2003. Frazier Barnes & Associates. Statewide biodiesel feasibility study report for the Mississippi Biomass Council and the Mississippi Technology Alliance: http://www.mississippi.org/content.aspx?url=/page/3092&

FUE. 2007. First United Ethanol: http://www.firstunitedethanol.com/presentation.html

Garrard, Amy W. and Liam Leightley. 2005. Characterizing wood waste for wood products companies in north Mississippi. Research Report, Forest and Wildlife Research Center, Mississippi State University.

GP. 2006. Georgia-Pacific Blue Sheet. http://www.gp.com/forestry/pdf/southeastern.pdf

Jarrett, Larry. 2006. Certification of private non-industrial forests in Mississippi: protecting biodiversity and restoring ecosystems. Draft manuscript.

Mani, Sudhagar. 2006. Simulation of biomass pelleting operation. Bioenergy Conference & Exhibition 2006. Prince George, British Columbia: http://www.bioenergyconference.org/docs/speakers/2006/Mani_BioEn06.pdf

Miles, T.R. and B.R. Bock. 2006. North Alabama Integrated Poultry and Ethanol Production (IPEP) Feasibility Study. Final report for NRCS agreement 68-3A75-3-144: http://www.brbock.com/RefFiles/IPEP_68_3A75_3_144s.pdf

Overend, Ralph P. 2004. The mochemical biomass gasification technologies and products. Stanford University: Global Climate and Energy Project (GCEP) April 27: http://gcep.stanford.edu/pdfs/energy_workshops_04_04/biomass_overend.pdf

Pellet Fuels Institute. 2006. Newsletter. January-March 2006.

Perkins, Brian, Robert Smith, and Gerry Jackson. 2005. Potential utilization of small diameter timber in northern Mississippi. Department of Wood Science & Forest Products Center for Forest Products Marketing & Management. Virginia Polytechnic Institute & State University: http://www.nrims.org/FINAL-SDT03182005.pdf

Rummer, Bob, Dan Len, and Obie O'Brien. 2004. Forest residues bundling project: new technology for residue removal. Southern Research Station. Auburn, Al: http://www.fs.fed.us/forestmanagement/WoodyBiomassUtilization/products/bundling/documents/bundler_report_final.pdf

Rummer, Bob. 2007. Personal communication. USDA Forest Service. Auburn, Alabama.

Schuetzle, Dennis. 2006. Thermochemical conversion of rice straw to ethanol. California Biomass Collaborative Meeting. Fresno, California. January 26: http://biomass.ucdavis.edu/pages/forum/3rd/DSchuetzle.pdf

Sokhansanj, S., A. Turhollow, and R. Parlack. 2002. Stochastic modeling of costs of corn stover costs delivered to an intermediate storage facility. ASAE Paper No. 024190: http://bioenergy.ornl.gov/papers/asae2002/stochastic_modeling.html

Steil, Jim. 2004. Mississippi biodiesel feasibility study: a GIS analysis. Mississippi State University Georesources Institute: http://www.mississippi.org/content.aspx?url=/page/3092&

Stuart and Stewart. 2002. Inventory analysis of northeast Mississippi. Department of Forestry. Mississippi State University.

Swann, John. 2006. Wood pellets. Bioenergy Opportunities 2006 Technology Trade Mission. September 19: http://www.meia.mb.ca/documents/JohnSwaan_KeynoteAddress_WoodPellets.pdf

Timber Mart—South. 2006a. Southwide prices, third quarter of 2006. http://www.tmart-south.com/tmart/prices.html

Timber Mart—South, 2006b. New logging rate survey in fourth quarter of 2005. http://www.tmart-south.com/tmart/pdf/PR4q05_Logging_Rate.pdf

TSS Consultants. 2005. Gridley ethanol demonstration project utilizing biomass gasification technology: pilot plant gasifier and syngas conversion testing. National Renewable Energy Laboratory: http://www.nrel.gov/docs/fy05osti/37581.pdf

Westbrook, Michael D., Jr., W. Dale Greene, and Robert L. Izlar. 2006 Harvesting forest biomass by adding a small chipper to a ground-based tree-length southern pine operation. Center for Forest Business Warnell School of Forestry & Natural Resources. University of Georgia: http://www.warnell.uga.edu/h/news/archive/biostudy/biomass.pdf

Appendix A

Table 1. Logging Residues Supply Curve.[1/]

County	<$25	<$30	<$35	<$40	<$45
	logging residues price, $/dry ton				
	dry tons logging residues/year				
Three Rivers Planning and Development District:					
Calhoun	6,340	11,992	26,620	31,669	31,669
Chickasaw	4,823	8,341	18,552	22,038	22,038
Itawamba	5,225	12,042	26,632	31,774	31,774
Lafayette	8,077	15,029	33,374	39,694	39,694
Lee	1,571	1,743	3,927	4,620	4,620
Monroe	7,119	17,155	37,913	45,260	45,260
Pontotoc	5,824	10,418	23,155	27,522	27,522
Union	4,030	8,465	18,752	22,345	22,345
Total	43,009	85,185	188,925	224,922	224,922
Perimeter Counties:					
Alcorn	3,305	9,559	21,068	25,203	25,203
Benton	3,828	12,100	26,637	31,894	31,894
Clay	5,560	9,837	21,868	25,987	25,987
Grenada	6,387	16,483	36,387	43,474	43,474
Lowndes	5,665	12,300	27,233	32,465	32,465
Marshall	6,366	18,620	41,033	49,092	49,092
Prentiss	4,984	14,853	32,722	39,156	39,156
Tippah	4,183	11,316	24,965	29,843	29,843
Tishomingo	6,226	16,852	37,176	44,441	44,441
Webster	4,984	10,095	22,379	26,652	26,652
Yalobusha	5,497	10,608	23,539	28,013	28,013
Total	56,985	142,623	315,007	376,220	376,220
Grand Total	99,994	227,808	503,932	601,142	601,142

[1/]Renewable and bioenergy database: www.mississippi.org/energycd/biomass/Log.htm .

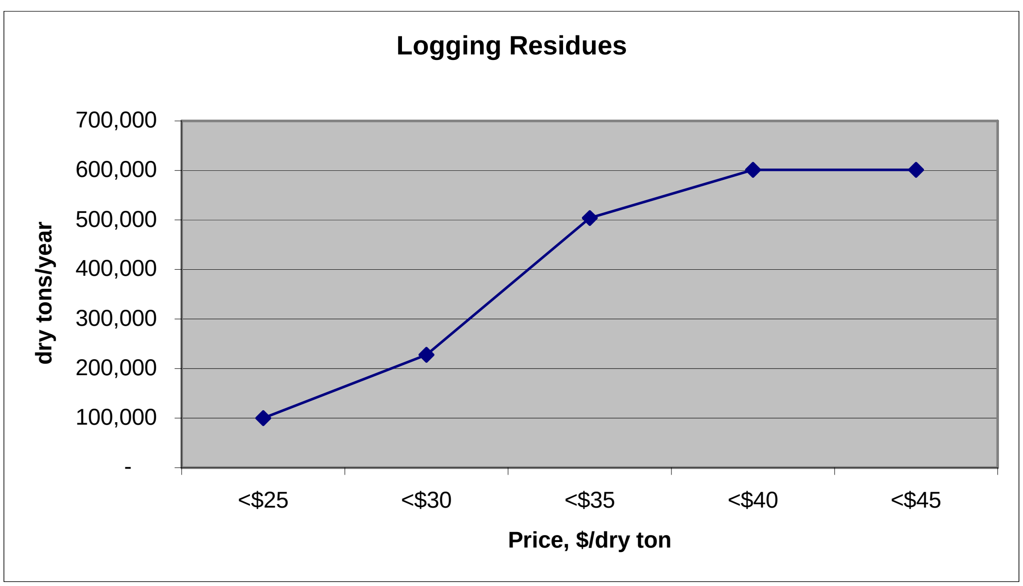


Table 2. Cull Wood Supply Curve.[1/]

	cull wood price, $/dry ton					
	<$25	<$30	<$35	<$40	<$45	<$50
County	dry tons cull wood/year					
Three Rivers Planning and Development District:						
Calhoun	7,252	14,191	19,863	21,310	22,665	24,713
Chickasaw	5,022	9,344	12,968	13,869	14,731	16,052
Itawamba	7,343	15,714	22,301	24,046	25,631	27,974
Lafayette	9,082	17,620	24,627	26,407	28,080	30,614
Lee	1,020	1,231	1,549	1,593	1,663	1,797
Monroe	10,479	22,804	32,442	35,011	37,334	40,754
Pontotoc	6,283	11,925	16,607	17,783	18,899	20,599
Union	5,143	10,590	14,942	16,078	17,122	18,680
Total	51,624	103,419	145,299	156,097	166,125	181,183
Perimeter Counties:						
Alcorn	5,875	13,555	19,442	21,043	22,466	24,538
Benton	7,455	17,614	25,343	27,461	29,333	32,044
Clay	5,930	11,181	15,554	16,649	17,691	19,280
Grenada	1,093	22,490	32,103	34,688	37,008	40,407
Lowndes	7,484	15,632	22,104	23,802	25,358	27,669
Marshall	11,447	26,496	38,019	41,156	43,943	47,997
Prentiss	9,136	21,255	30,518	33,046	35,288	38,545
Tippah	6,940	15,701	22,459	24,285	25,918	28,303
Tishomingo	10,335	23,384	33,450	36,171	38,602	42,154
Webster	6,124	12,401	17,452	18,760	19,971	21,783
Yalobusha	6,421	12,698	17,803	19,111	20,333	22,172
Total	78,240	192,407	274,247	296,172	315,911	344,892
Grand Total	129,864	295,826	419,546	452,269	482,036	526,075

[1/] Renewable and bioenergy database: www.mississippi.org/energycd/biomass/cull.htm .

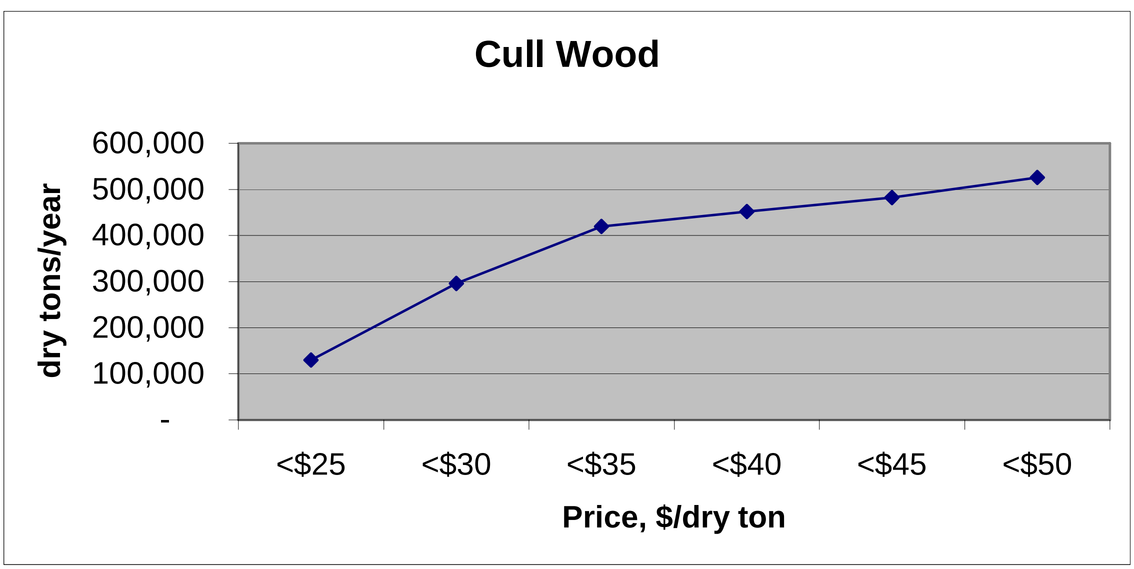


Table 3. Urban Wood Waste Supply Curve.[1/]

	urban wood waste price, $/dry ton					
	<$25	<$30	<$35	<$40	<$45	<$50
County	dry tons urban wood waste/year					
Three Rivers Planning and Development District:						
Calhoun	3,378	4,221	4,221	4,221	4,221	4,221
Chickasaw	4,109	5,136	5,136	5,136	5,136	5,136
Itawamba	4,781	5,976	5,976	5,976	5,976	5,976
Lafayette	7,917	9,896	9,896	9,896	9,896	9,896
Lee	17,054	17,054	17,054	17,054	17,054	17,054
Monroe	8,669	10,856	10,856	10,856	10,856	10,856
Pontotoc	5,824	7,280	7,280	7,280	7,280	7,280
Union	5,469	6,837	6,837	6,837	6,837	6,837
Total	57,201	67,256	67,256	67,256	67,256	67,256
Perimeter Counties:						
Alcorn	7,501	9,376	9,376	9,376	9,376	9,376
Benton	1,835	2,293	2,293	2,293	2,293	2,293
Clay	4,911	6,138	6,138	6,138	6,138	6,138
Grenada	5,091	6,363	6,363	6,363	6,363	6,363
Lowndes	13,724	17,155	17,155	17,155	17,155	17,155
Marshall	7,329	9,161	9,161	9,161	9,161	9,161
Prentiss	5,555	6,943	6,943	6,943	6,943	6,943
Tippah	4,777	5,972	5,972	5,972	5,972	5,972
Tishomingo	4,250	5,312	5,312	5,312	5,312	5,312
Webster	2,411	3,014	3,014	3,014	3,014	3,014
Yalobusha	2,863	3,579	3,579	3,579	3,579	3,579
Total	60,247	75,306	75,306	75,306	75,306	75,306
Grand Total	117,448	142,562	142,562	142,562	142,562	142,562

[1/]Renewable and bioenergy database: www.mississippi.org/energycd/biomass/urban.htm .

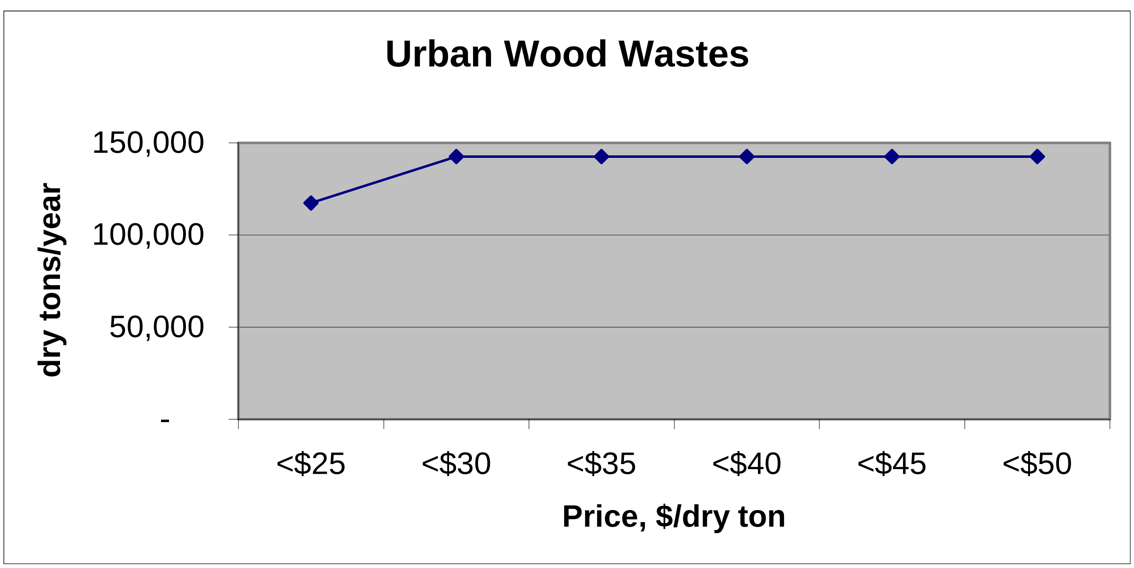


Table 4. Switchgrass Supply Curve.[1/]

	switchgrass price, $/dry ton				
	<$30	<$35	<$40	<$45	<$50
County	dry tons switchgrass/year				
Three Rivers Planning and Development District:					
Calhoun	35,553	101,813	102,150	113,255	140,770
Chickasaw	5,129	161,903	161,903	161,618	161,618
Itawamba	4,244	95,288	118,364	128,885	117,144
Lafayette	35,553	101,813	102,150	113,255	140,770
Lee	4,244	95,288	118,364	128,885	117,144
Monroe	5,129	161,903	161,903	161,618	161,618
Pontotoc	4,244	95,288	118,364	128,885	117,144
Union	4,244	95,288	118,364	128,885	117,144
Total	98,340	908,584	1,001,562	1,065,286	1,073,352
Perimeter Counties:					
Alcorn	4,244	95,288	118,364	128,885	117,144
Benton	35,553	101,813	102,150	113,255	140,770
Clay	5,129	161,903	161,903	161,618	161,618
Grenada	35,553	101,813	102,150	113,255	140,770
Lowndes	5,129	161,618	161,618	161,618	161,618
Marshall	35,553	101,813	102,150	113,255	140,770
Prentiss	4,244	95,288	118,364	128,885	128,885
Tippah	4,244	95,288	118,364	128,885	128,885
Tishomingo	4,244	95,288	118,364	128,885	128,885
Webster	41,535	110,161	138,871	144,640	145,192
Yalobusha	35,553	101,813	102,150	113,255	140,770
Total	210,981	1,222,086	1,344,448	1,436,436	1,535,307
Grand Total	309,321	2,130,670	2,346,010	2,501,722	2,608,659

[1/]Renewable and bioenergy database: www.mississippi.org/energycd/biomass/switchgrass.htm .