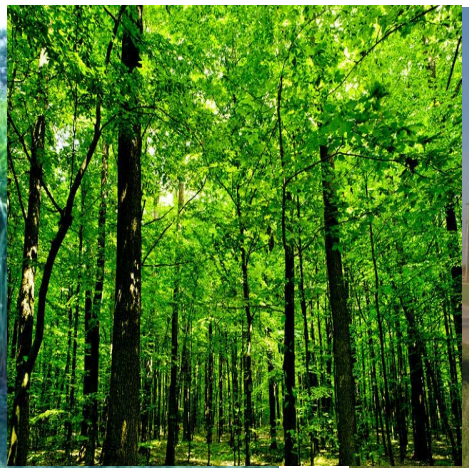
Opportunities for Small Scale Suppliers of Biomass Feedstock in Claiborne County, Mississippi.

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EXECUTIVE SUMMARY

Claiborne County, Mississippi has the potential produce biomass feedstock in commercial quantity. This offers an opportunity to create jobs and improve the wealth and wellbeing of the populace. The over 40,000 acres of woodland land in the county is capable of providing good yield for energy crops like freedom brand of the *Miscanthus* x *giganteus*. One-eight (5,000 acres) of the woodland can grow energy crops to sustain a commercial cellulosic biofuel plant. The county's 970 million cubic feet of forested resources (pinewood and saw timber) can also support a wood pellet mill with a capacity of 500,000 tons per year.

Developing a supply chain for the biomass is critical to creating opportunities in the county. The county has no rail infrastructure, a fair road network and a port lacking some basic infrastructure such as a barge loader and access road. However, the Three-County Roadway Improvements grant from DOT worth $17.8m promises to improve the road transportation infrastructure. The biggest challenge to the suppliers in the county will be the absence of a conversion facility (biomass consumer) within a 50 mile radius of the county. Proposed facilities like Ergon Inc. at Vicksburg and a wood pellet mill at Hazlehurst may offer market potential if they are actualized.

Claiborne County is encouraged to seek the services of a professional intermediary, a go between the county and potential buyer for the product. The intermediary serving as an energy broker may be helpful in recruiting a conversion facility and planning a suitable supply chain. Further study is needed to tell the economic impact of introducing a biomass industry. The study may be able to tell the number of direct and indirect jobs that will be created in each role.

PROJECT DESCRIPTION AND OBJECTIVES

Claiborne County in South West Mississippi boasts of sizeable land for agriculture and forestry. These resources give the county the potential to embark on biomass feedstock production as an avenue to improve the economic wellbeing of residents. To assess the feasibility of the county to take advantage of biomass feedstock production; using dedicated energy crops, forest and agricultural residues, the biomass supply chain as a whole needs to be evaluated. The supply chain for woody biomass to the timber industry is well defined; this is not the case for the collection, processing, and transportation of energy related feedstock.

This study tried to look into the different key factors that can affect small scale biomass supply as it relates to Claiborne County. Such factors may include the transportation and biomass assets/potential, distribution, processing, biomass type and form amongst others. The aim of this project is to provide county officials and farmers with information on the opportunities for small scale suppliers of bio-mass feedstock in Claiborne County Mississippi by attempting to:

1. Analyze the bio-mass industry and its supply chains
2. Determine best practices for systems of small scale operations bio-mass feedstock supply chains
3. Analyze the bio-mass and transportation assets in Claiborne County
4. Develop recommendations for the development of small scale suppliers of bio-mass feedstock in Claiborne County Mississippi

INTRODUCTION

Biomass production provides job opportunities for collection, construction, and facility operations, and secondary jobs through local and regional economic impacts. Jobs are created in both rural and urban areas but particularly benefit rural areas where forest and agricultural biomass is located. Biomass energy projects have a diversity of positive impacts on local and regional economic development:[1]

- Building and maintaining biomass energy systems (from production, processing, transportation and conversion) creates and sustains jobs in the region's economy.
- All the jobs and economic activity created by biomass projects also generate important local, state, and federal tax revenues.
- Biomass energy keeps dollars spent on fuel in the local economy - compared with fossil fuel systems, which generally export fuel dollars.
- By making new use of forest byproducts for fuel, biomass energy also strengthens the whole regional forest-products industry, giving it new local markets and improving the forest resource, along with creating jobs.

The biomass production and supply chain has the potential to increase wealth and create jobs and with roles ranging from farmers, truck drivers, tree farm workers, mechanical engineers, harvesting equipment mechanics, equipment production workers, chemical engineers, chemical application specialists, chemical production workers, biochemists, agricultural engineers, genetic engineers and scientists to storage facility operators

Biomass supply chain optimization is essential to overcome barriers and uncertainties that may inhibit the development of a sustainable and competitive bioenergy asset.[2] Supply Chain management is essential to biomass production for two reasons: it ensures that there is continuous feedstock and that the costs associated are competitive. Several entities make up the supply chain for viable biomass production targeted at enhancing economic development. In discussing the supply chain; production, processing, storage and transportation are all important components.

[1] http://www.biomasscenter.org/resource-library/fact-sheets/economic-development
[2] Gold , S., & Seuring , S. (2011). Supply Chain and logistics issues of bio energy production. Journal of Cleaner Production, 32-42.

Identifying a 'low hanging fruit', that is, a biomass resource which the county has an abundance of, or which the county is capable of producing with minimal input, is often the first step in developing a sustainable supply chain. A close look at the county's potentials provide a clearer understanding of it's 'low hanging fruit'. These resources may range from agricultural (grain, specially grown crops), forest and industrial products. Claiborne County can boast of ample forest resource and arable land to grow specific energy dense plants like switch grass and Miscanthus.

Having decided on a biomass product, it is important to understand the roles of the different actors in the supply chain. These roles are the opportunities for job creation within the County. If well planned, more dollars can be attracted and kept in the area through jobs and taxes. The proper functioning of these actors ranging from the landowners, farmers, harvesters, transporters are all important to maintaining a long term contract with the buyers of the biomass product.

Biomass is relatively cheap but moving the bulk material from farm to point of conversion is expensive, hence, the need to go for a 'low hanging fruit' and also the need to adopt pre-processing techniques that will help in making the product denser. The Idaho National Laboratory (INL)[3] recently proposed a concept that tries to conduct some of the preprocessing activities like drying and densification at an early stage of the supply chain, this yields products like pellets (compacted wood chippings) that have improved stability, handling, and transportability. Figure 1A shows a simple biomass supply chain which illustrates the major points; the main operations in the upstream are production, harvesting and collection, storage, transport and pre-processing.[4] Models B and C are adoptable for small scale suppliers of biomass. Single harvesting procedures that combine multiple steps can also be helpful in curbing costs. Storage and transportation account for most part of the supply chain, in terms of activity and cost. Figure 1B suggests possible combination of roles along the supply chain.

[3] www.inl.gov/bioenergy
[4] Ibid

Figure 1A: Stages in biomass supply Chain

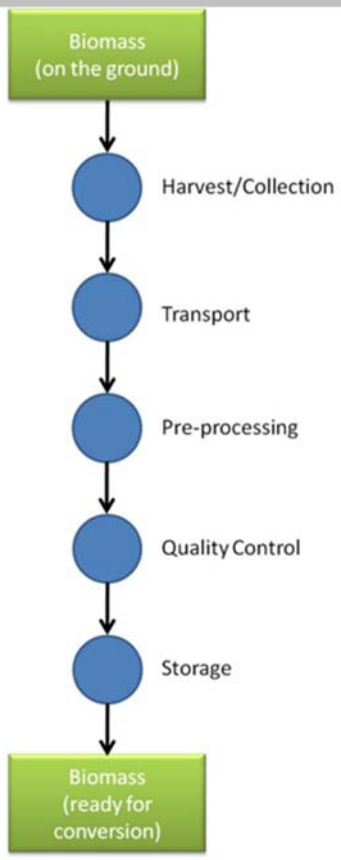
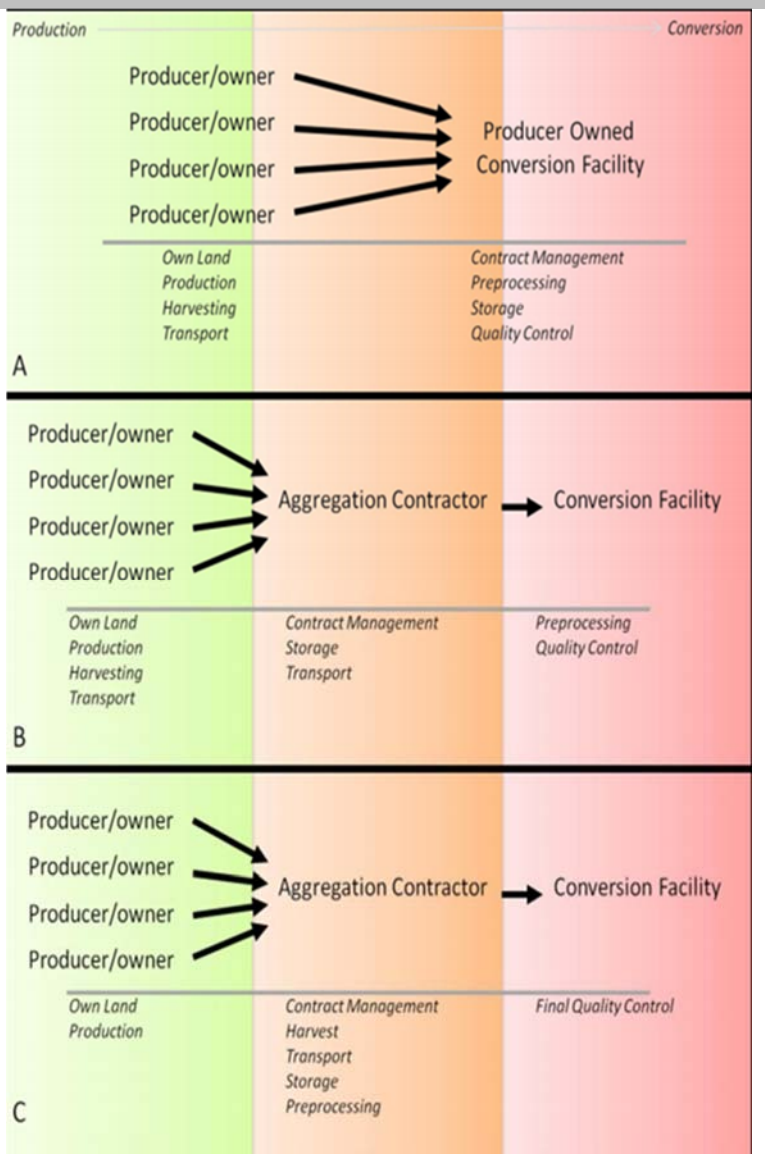


Figure 1B: Potential Models for Biomass Supply Chains



Source: http://renewables.morris.umn.edu/biomass/documents/USDA_Report/SII_SupplyChain.pdf

THE BIOMASS INDUSTRY TREND

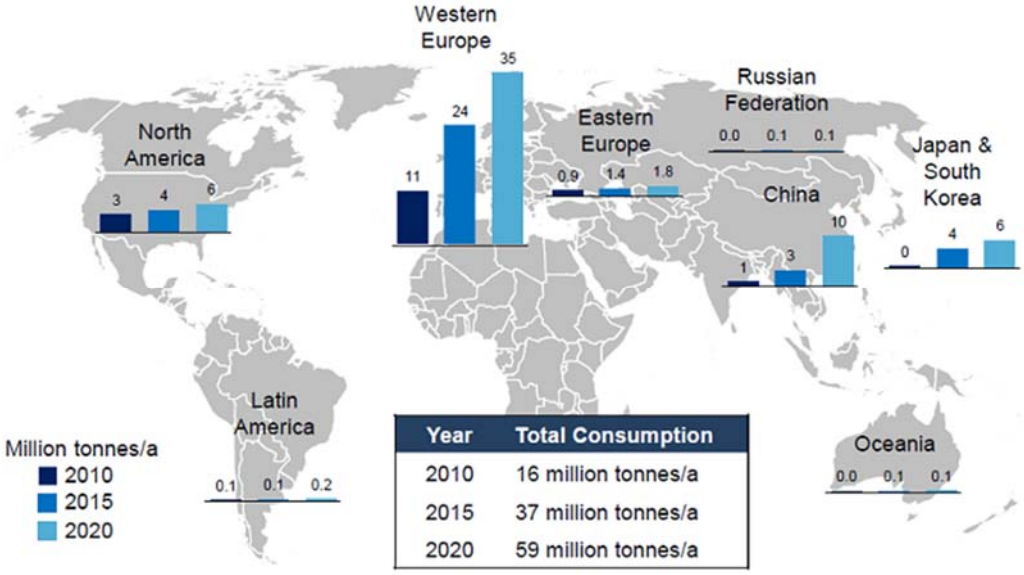
The biomass industry has enjoyed marked growth over the last decade, mainly with wood pellets and liquid biofuels like ethanol and biodiesel. Wood pellets are the most common product on the international biomass market[5] with liquid biofuels topping the chart for the local United States market. While wood pellets are sourced solely from woody biomass (timber and forest residues) and may be substituted by briquettes made from grass such as switch grass and miscanthus, liquid biofuels are made from a myriad of sources; from wood, forest residues, energy crops, agricultural and industrial wastes. The challenge in most cases is a suitable conversion technology.

The main driver for the growth in the wood pellet segment of the industry is policy-driven demand from Europe. United States Department of Commerce – International Trade Administration asserts that "Beyond 2015, demand for wood pellets should continue to grow, particularly in markets where emissions policies encourage the use of co-firing or dedicated biomass. This includes markets outside Europe. In Korea, for example, a policy mandate from the Government has increased demand for pellets from the U.S., dramatically increasing exports over the past two years. Similar policy incentives from other Asian markets may have similar impacts – particularly for pellet manufactures in the American Northwest, which would be well positioned geographically to supply product to growing Asian markets"[6]. The South Eastern United States and Canada are the world's largest producer of pellets. Europe's continuous drive to reduce carbon emission will keep the demand growing up to 2020 based on the forecast below.

[5] http://www.wwrgroup.com/en/biomass-market/the-wood-pellet-market

[6] United States Department of Commerce – International Trade Administration, Sector Case Study: Biomass Pellets. p2. http://export.gov/build/groups/public/@eg_main/@reee/documents/webcontent/eg_main_070720.pdf

Figure 2: Wood Pellet Market forecast

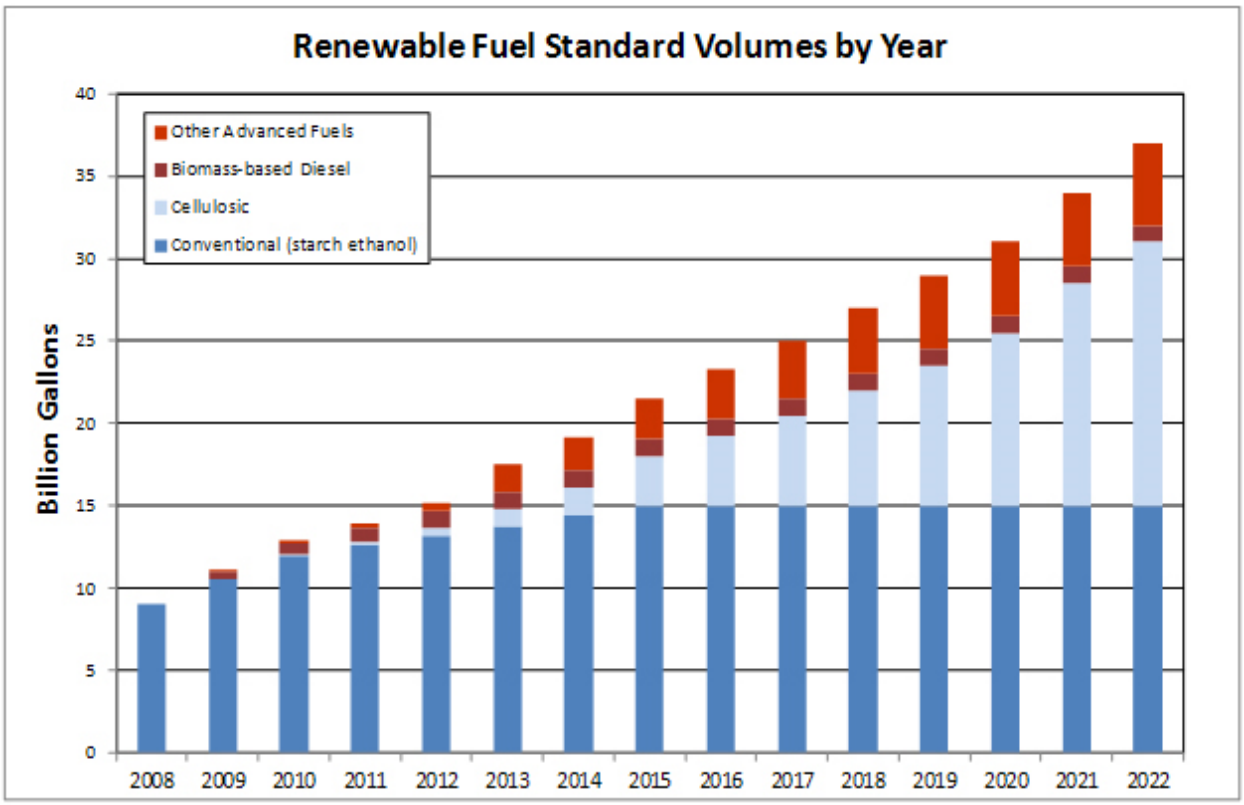


Source: http://www.wwrgroup.com/en/biomass-market/the-wood-pellet-market

The liquid biofuels segment comprising products such as ethanol and biodiesel is enjoying growth in the United States due to Renewable Fuel Standard (RFS) legislation under the Energy Policy Act (EPAct) of 2005. The Renewable Fuel Standard (RFS) targets 36 billion gallons of by 2022. The Renewable Fuel Standard (RFS) is a federal program that requires transportation fuel sold in the U.S. to contain a minimum volume of renewable fuels. The Energy Independence and Security Act of 2007 (EISA) set yearly RFS volume requirements for each renewable fuel category. EPA updates volume requirements each year based on fuel availability[7]. This growth is likely to remain steady in the coming decade due to the targets set by the legislation.

[7] http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm

Figure 3: Renewable Fuel Standard Targets by Year



Source: http://www.afdc.energy.gov/laws/RFS

Current Challenges

The core challenges in the industry are faced by segments requiring complex technologies and inadvertently, large capital. Wood pellet production requires minimal technology, the segment's major challenge is likely to be supply chain optimization. More complex processes like cellulosic ethanol production from non-conventional feedstock like energy crops require the development of new technologies. Research and development require significant financial investment. Some technologies proven at demonstration level also require investment to scale up to commercial levels. Companies like KiOR and Ergon Inc. and several other companies have failed to successfully implement the scaling up of their technologies. The industry's development is mainly backed by public funding.

The Challenge of capital availability is largely driven by regulatory uncertainty. Investors' fear of changing policies hinders the injection of capital which in turn impede commercialization prospects. Stability in policies and regulations will also have a stabilizing effect on the industry which will be required for the growth experienced to continue.

Feedstock availability and pricing are important to the location and operating margins of a biomass facility. Further research and development efforts need to be channeled into providing better yielding and more energy dense feedstock. Companies are also choosing to locate near feedstock streams to enhance supply chain optimization and cost lowering.

CLAIBORNE COUNTY'S BIOMASS POTENTIAL

The success of any bioenergy project like other production requires a steady supply of quality feedstock. While Claiborne County is unlikely to be the sole supplier of feedstock to a conversion facility, its delivery must be consistent and sustainable. Conversion facilities often opt for a few bulk suppliers of feedstock who in turn can source the biomass from several small scale farmers. This provides some level of assurance for the facility to remain operational in the event that a supplier fails. The ability of the county to ensure a consistent supply will be extremely important to getting a contract and the chances of attracting a company to the area.

Dedicated energy crops such as giant miscanthus, unlike forest and crop residues, might offer opportunities to better utilize underperforming acreage. While not an asset for Claiborne County at the moment, it presents potentials for the county to be a major player. Energy crops are optimized for harvest annually beginning from the second year of cultivation. This isn't the case with forest trees, requiring several years to grow. In determining the county's potential production of commercial quantities of dedicated crops, two key factors come into play: the amount of land available and the potential yield of the crop.

A top rated energy crop is considered. Miscanthus × giganteus, commonly referred to as 'Giant miscanthus' is a tall perennial grass that grows unusually well in temperate climates.[8] It has been used as an energy crop across Europe for two decades. Freedom™ Giant Miscanthus was developed by

[8] http://www.freedomgiantmiscanthus.com/docs/FreedomFactSheet.pdf

Mississippi State University as a superior variety for the United States, especially the Southeastern region. At full maturity, it produces yields up to 25 tons per acre with superior height, standability, and vigor. It is heat and drought tolerant, and tolerates poor soils[9]. It is commercially available through a company named Repreve Renewables. [10]

A key social concern with biomass feedstock production is that it is considered to take away 'valuable' land that could be used for other purposes such as food crop production, hence driving demand and consequently, the price of food. However, a dedicated biomass crop like miscanthus can be grown on marginal land that is not suitable for most crops and other agricultural productions. Deforested and marginal lands might be better suited for crop production under a cooperative or lease agreement with private land owners.

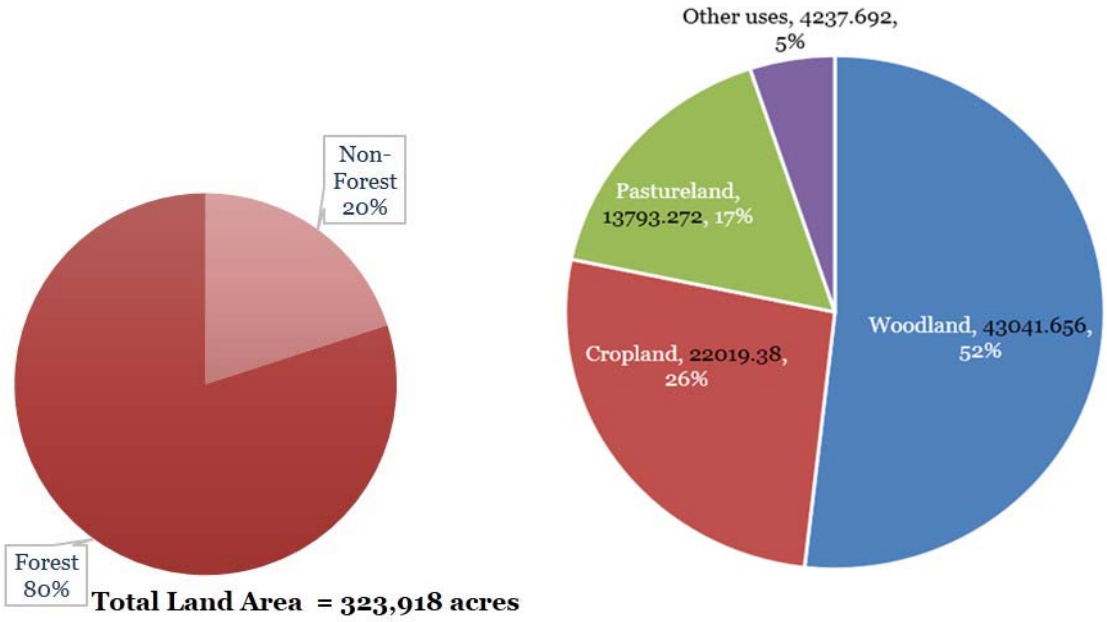
A biomass conversion plant aiming to produce about 40 million gallons of biofuel[11] (gasoline, ethanol, etc) will require over 100,000 tons of biomass a year to operate[12]. With a yield of approximately 20 tons per acre for the Freedom™Miscanthus, about 5,000 acres of land is required. Claiborne County's land resource should be able to cover for this need. The County shows great promise due to the amount of land area that could be potentially available for biomass feedstock production and the amount of biomass the land can yield compared to other places.

CLAIBORNE COUNTY'S BIOMASS ASSETS

Claiborne County is blessed with an abundance of land suitable for agricultural production. With a total land mass of 323,918 acres, 80% is forested and a fraction of the remainder is utilized for crop production and other non-farm developments With majority of land that bears forest cover (80%) being in private ownership, leaving the rest to industries and the government, the county's biomass asset is joined held by several producers. These landowners are potential small scale producers and suppliers of biomass. (see Figure 2). [13]

[9] Ibid
[10] http://www.repreverenewables.com/docs/FreedomGrowing-GR1010d.pdf
[11] http://www.kior.com/content/?s=6&s2=56&p=56&t=Production-Facilities
[12] http://www.economist.com/news/technology-quarterly/21584452-energy-technology-making-large-amounts-fuel-organic-matter-has-proved-be
[13] http://msucares.com/pubs/publications/p2047.pdf

Figure 4: County Land Area and Land Use by Land in Farms

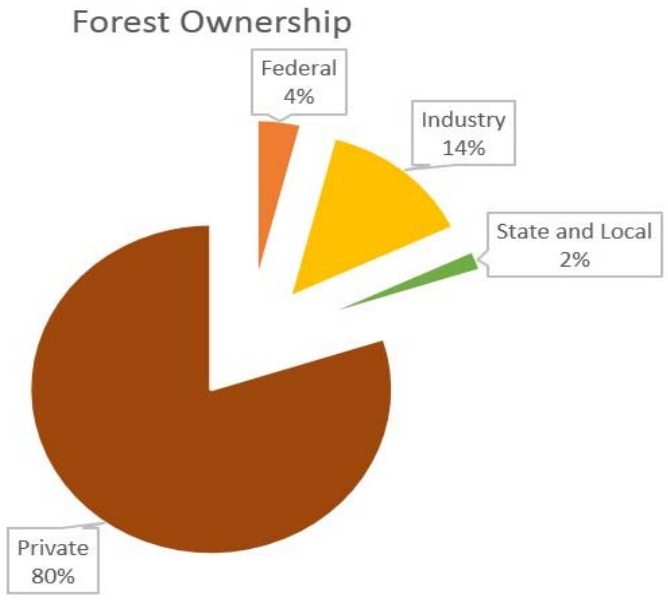


Source: Mississippi State University Extension Service[14]

Of the 249 farms in the county operating on 83,092 acres, only about 40 farms (16%) of these farms cultivated portions of land that were 500 acres or more. All others fall below this range. Hence, most of the farmers operate on a small scale[15]. More than half the farmers do not have farming as their primary occupation. While Whites constitute 14% of the county's population of 9,253, more than 50% of the farms are owned by whites. The value of sales from over 65% of the farms is below $2,500, this indicates that most of the farms are operated on very small scales and by persons who have other means of livelihood asides farming. A vast majority of the land in farms is likely in the ownership of a few individuals or families[16]. This may pose a challenge to creating a program that will impact on the less affluent segment of the county's population as most of the land are unlikely to be in their ownership. It is however, worthy to note that the land is available and depending on the current owner's plans, negotiations may be made to secure lands for biomass production.

[14] http://msucares.com/pubs/publications/p2047.pdf
[15] http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Mississippi/cp28021.pdf
[16] Ibid

Figure 5: Forest Ownership in Claiborne County



Source: Mississippi State University Extension Service

Table 1: Claiborne County Forest Cover Types and Volume

CLAIBORNE COUNTY FOREST FACTS

STRATA	Acres	Pulpwood Volume	Sawtimber Volume	Sampling Error %
PINE	86,719	2,497,494	1,691,984	5.9
HARDWOOD	145,669	3,339,908	3,339,908	10.5
FORESTED	**232,543**	**5,841,763**	**3,855,721**	6.9
	Total Forest Volume = 970,000			

Source: http://www.mifi.ms.gov/documents/2013_Forest_Inventory_Southwest_Region_MS.pdf (All volumes are expressed in 100s of cubic feet outside bark. Stem counts are expressed in 1,000s.)

With about 80% forest cover, Claiborne has strong assets in forest resources that can be useful for woody biomass production, in most cases, wood pellets. 80% of the forest is in private ownership. This study was unable to ascertain the owners of the properties. However, the total volume of forest biomass in the county as shown in Table 1 above is about 970 million cubic feet. Table 2 below attempts to compare Claiborne's assets with that of Northampton, North Carolina that houses Enviva Inc.'s 500,000 tons per annum wood pellet mill plant. It shows that within a 50 miles radius, which is often the target of biomass supply chain models, Claiborne County has more than required to support such a plant.

Table 2: Forest Resource Potential[17]

	Northampton, NC (Enviva)	Claiborne, MS
Pellet capacity (tons/day)	1,575	
Pellet capacity (tons/year)	551,155	
Required feedstock (wet tons)	865,314	
Required Clean lumber (1000 ft3)	55,826	
Required forest Output (1000 ft3)	83,739	
Wood Supply, 50mi radius (1000 ft3)	463,541	970,000

Asides forestry, the main crops produced include grain crops and hay. As normal with crop production, a considerable amount of crop residues in the form of straw, stalk and chaff are produced as bye-products. These residues are either left on the field to replenish the soil or burned. The use of crop residues as biomass feedstock in the biofuel industries adds to the county's biomass assets and can provide Claiborne farmers with additional markets for their crops and residues and increased employment opportunities.

The challenges that will hinder the county from solely using the crop residue can range from limited availability, scattered distribution, low conversion efficiency, and storage and transportation costs due to its low bulk density. However, crop residue may be used for feedstock as a biomass asset in combination with other dedicated energy crops.

[17] M.G Little, S. Appold, I. Cagiran, C. Primmer, M. Gültekin; Summer 2013, North Carolina's Role in the Global Biomass Energy Market. University of North Carolina Biofuel Center of North Carolina

THE TRANSPORTATION CHALLENGE

There are a number of business and financial factors that must be taken into consideration regarding the feasibility of biomass industry. One factor is the facility must be located within 50-75 miles of abundant, reliable and quantifiable biomass in order to be economically feasible. Figure 6 shows the 75 radius from Claiborne County that encompasses the Natchez and Vicksburg region. Available transportation system and accessibility to biomass feedstock must also be taken into consideration. Typically, the market for the biomass feedstock should be within a 50 mile radius but may be extended based on contracts.

In general, there are many options for transporting feedstock via truck, railway, pipeline or port. However Claiborne County would be limited to trucking as the port is currently inactive and there is no rail access. One major challenge in the biomass production is minimizing the cost associated with transportation. There are a number of factors to consider when it comes to the cost of biomass feedstock transportation such as distance to be covered, moisture content of the biomass feedstock, bulk density, transport capacity (volume and weight), supply frequency, labor (loading/unloading), and contracts.[18] [19][20]

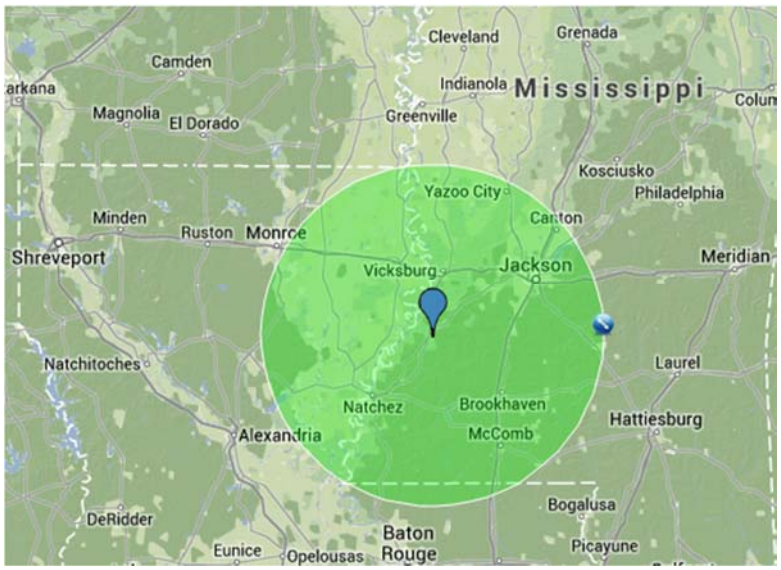
In Claiborne County the agricultural-based biomass feedstock is contiguously located and may require shorter transportation distances compared to the woody biomass feedstock which are scattered. Although the distance may be shorter for the agricultural-based biomass, this type of feedstock has a low bulk density and lower energy value which results in higher transportation costs. The moisture content and bulk density of biomass feedstock will have an impact on the number of trucks or railcars required and must be taken into consideration. Increased moisture content will result in a higher metric tonnage and high transportation cost as compared to dry biomass feedstock.

Figure 6: 75 miles Radius from Claiborne County

[18] http://www.sciencedirect.com/science/article/pii/S096195340700205X

[19] http://www.wearemichigan.com/JobsAndEnergy/Biomass/Documents/The_relative_cost_of_biomass_energy_transport.pdf

[20] http://www.biocap.ca/rif/report/Sokhansanj_S.pdf



Source: www.maps.google.com

Transport costs for biomass feedstock will vary based on plant location, distance to port and means of transport (trucking, railroad, and ship tonnage). Transport contract terms such as frequency and consistency also have an effect on the cost.[21] There is a positive relationship between tonnage and transportation costs in that the higher tonnage the higher the transportation costs.[22] This higher tonnage and costs also are more likely to experience weight-related transportation restrictions.

Table 3: Transportation Cost

Truck Rates
Truck rate - grain, 2008, <= 25 mi ($/mi) = $ 4.75
Truck rate - grain, 2008, <= 100 mi ($/mi) = $ 3.00
Truck rate - grain, 2008, <= 200 mi ($/mi) = $ 3.00

Source: Source: USDA & USDOT, Study of Rural Transportation Issues, April 2010. (pg. 427, 429)

[21] M.G Little, S. Appold, I. Cagiran, C. Primmer, M. Gültekin; Summer 2013, North Carolina's Role in the Global Biomass Energy Market. University of North Carolina Biofuel Center of North Carolina

[22] http://www.sciencedirect.com/science/article/pii/S0960852411011035

The transportation distance will have an impact not only cost but the mode of transport whether it be by truck, rail, or port. Transportation distance must also take into consideration road restrictions, conditions and availability such as weight limits on county and state bridges. The shortest route may not necessarily be the most economical due to high traffic volume which can slow down travel time.

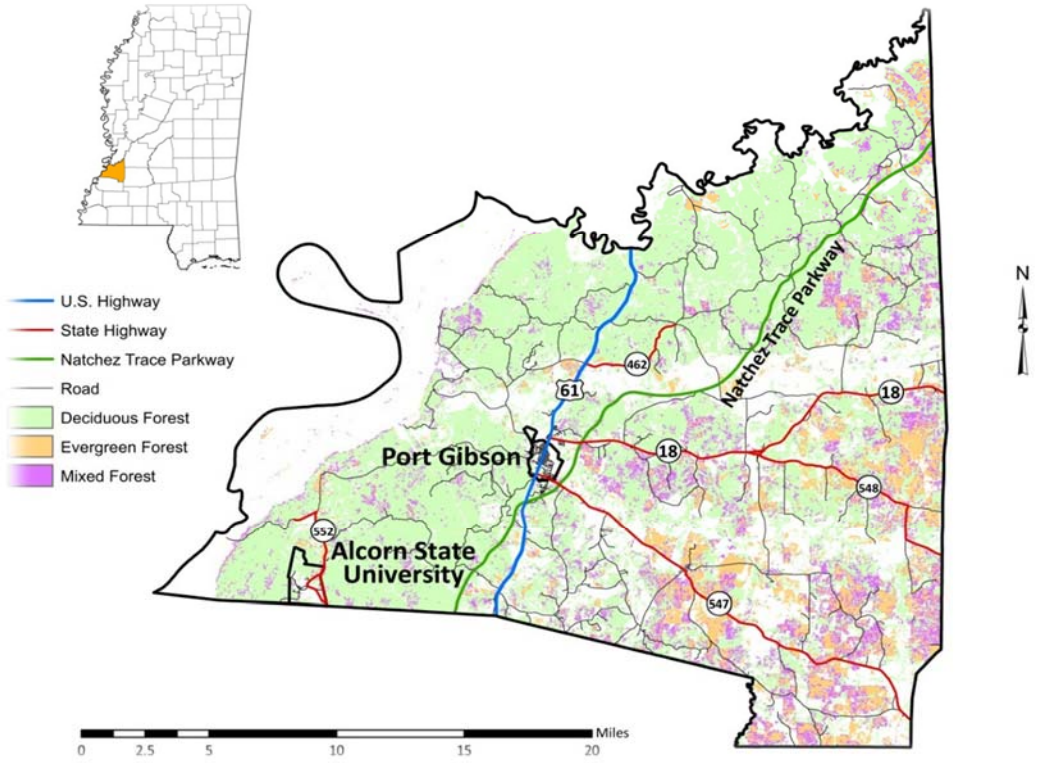
Mississippi has approximately 73,000 miles of highway. In Claiborne County there is one major highway, U.S. 61, and three state highways, Highway 18, Highway 547 and Highway 548. State and federal highways in Mississippi are maintained by the Mississippi Department of Transportation. Claiborne County highways and bridges are rated in fair conditions, and they function at a basic level of efficiency, providing linkage between corners of the county and access to the 4-lane highway system that links to a major interstate, Interstate20. The road serving the port at Port of Claiborne in Port Gibson is in a worn out condition, same as other roads in the inner parts of the county.

However, the county will benefit from the three-county roadway improvements program, also dubbed the TIGER project which aims to create a modernized, dependable network of "farm-to-market" roads that will allow the citizens of Claiborne, Franklin and Jefferson Counties to safely and quickly accomplish major transportation goals such as a fully-connected and safe county transportation system, rehabilitation of critical evacuation routes, and the creation of safe routes to local schools. The $17.8m grant from the Department of Transport will be used to repair 41.61miles of strategic county roads and construction of 18 new bridges.[23]

For small scale biomass production, truck transportation is the most economical option. To transport biomass feedstock by truck, the bio refinery normally bears the responsibility of transporting the feedstock through company-owned trucks or independent contractors. Having the bio refinery be responsible for the transportation of the feedstock poses a number of advantages which includes eliminating the need for trucking equipment investments. For Claiborne county, collaborating with an agriculture equipment manufacturing company not only encourage the project to be done smoothly but the expansion and job creation in the area as they will require additional drivers.

[23] http://www.dot.gov/sites/dot.gov/files/docs/TIGER14_ProjectFactSheets.pdf

Figure 7: Transportation assets in Claiborne County



Source: Mississippi Development Authority GIS Unit, August 2014

There are a few considerations that needs to be taken into account when transporting by truck such as the weight supported by the highways or roads. Each road has a specific weight restriction that needs to be considered, in order to determine the maximum allowed tonnage per truck, trailer or freight will be used in order to consider the most appropriate transportation routes. The other consideration is the height and length restrictions that has to be adhere to which will have an impact on the size of the truck trailer used. There are many trucks and trailers common to trucking companies which are compatible to transport biomass feedstock.

The type of truck/trailer used will depend on the form of the biomass feedstock used. For example, a common practice for transporting bales is by flat deck trailer whereas other types of feedstock are transported by dry bulk trailers. The size of the truck/trailer will have an impact on the costs. A larger truck may lower the transportation cost because this allows for fewer trips.

Figure 8: Transporting Miscanthus Bales

Source: http://larksen.com/transport-logistics/

BIOMASS STORAGE

Biomass is generally of low energy density so very large amounts are needed for conversion. Storage also becomes necessary as there will be several suppliers harvesting the feedstock at a time in the year but needing to deliver all year round. Proper planning for biomass storage hinges on a couple of key issues, the first being storage site selection and the second being designing for daily operations. A good storage facility should be sited so that it has good transportation infrastructure for receiving and shipping or using biomass. Whether by road, rail or barge, the infrastructure must be in place to handle bulky shipments of biomass.[24]

With Claiborne County's vast experience in forestry and crop production, the need to for storage in facilities that will optimally maintain the quality of the feedstock should be familiar. Several storage options and styles are available but they must protect the biomass from weather elements. Common storage location for biomass logistics in which bales can be stored: pile/roadside (feedstock source) and intermediate depot.

[24] http://renewables.morris.umn.edu/biomass/documents/USDA_Report/SII_SupplyChain.pdf

Figure 9: Biomass Storage options

Source: Iowa State University Center for Crop Utilization Research:
http://www.ccur.iastate.edu/news/newsletters/2011/mar_apr/bcrf_update.html

An example of a facility in the county that can serve as a storage facility is the 200 acre Moon Property Site along Highway 61, with extra 600 developable acres. The property was originally built for agricultural purposes and should be a good fit. The old and abandoned Port Gibson Oil Works may also prove to be another collection and storage asset. It is close to the city center as well as the Port of Claiborne. However, the choice of a storage location is dependent on proximity to farm and conversion facility.

INTERMODAL TRANSPORT OPTIONS

Majority of biomass products are shipped by trucks[25]. However, a port may be preferred because it meets the challenge of global trade. Whether or not port transportation is more economically feasible than truck transportation will depend on the distance the biomass is shipped. In a transshipment model, biomass feedstock is brought to the port by truck where it is stored until there is sufficient quantity for it to be shipped.

Rail cars are an excellent means of moving bulky materials over long distances. Claiborne County does not currently have rail infrastructures, making this an unfeasible option. Waterborne transportation is generally used in the cases of long distances, and can be used to enhance international transport. It has

[25] R. Schroeder, B. Jackson, and S. Ashton. 2010. Biomass Transportation Equipment.
http://www.extension.org/pages/26579/biomass-transportation-equipment#.VBTB-cVdXE4

a cost structure similar to rail transportation, requiring high capital investment in ships and freighters, but incurring low variable costs and low energy use per Mg-km.[26] Barges, operated in groups of tows, have been employed for moving items, mainly agricultural produces along the Mississippi river for generations. It presents a cost efficient means of moving bulk materials compared to truck and rail. This cost efficiency is largely dependent on the size of the material to be shipped and the distance to which it is to be shipped.

Biomass production in Claiborne County can benefit from this option if the Port of Claiborne at Port Gibson can be harnessed. The features of the port include:[27]

- 14-foot deep slack water port with 3 dolphins 800 feet off the main river channel.
- 572-foot long barge wharf with a pre-cast concrete dock supported by steel piles that can support loads up to 800 pounds per square foot.
- 600-foot long by 400-foot wide turning basin.
- 10-acre access area above the 100-year flood mark.
- 400-acre adjoining industrial park area.

Currently, the port is not in use and will require works. Basic infrastructure like a crane/barge loader is needed and reinforcement of the dock platform may be required.

[26] Miao, Z., Shastri, Y., Grift, T. E., Hansen, A. C., & Ting, K. C. (2012). Lignocellulosic biomass feedstock transportation alternatives, logistics, equipment configurations, and modeling. Biofuels, Bioproducts and Biorefining, 6(3), 351-362. doi: 10.1002/bbb.1322

[27] http://www.portgibsononthemississippi.com/port.html

CONCLUSION

Considering over 720 million cubic feet of forested volume and over 43,000 acres in woodland, the opportunities for producing biomass feedstock from an array of sources such as forest woody biomass, dedicated energy crops and farms wastes exist in Claiborne County. The availability of experienced foresters, farmers and arable land presents an advantage. Three-County Roadway Improvements program promises to improve the transportation infrastructure for the trucking option. The provision of a barge loader at the Port of Claiborne at Port Gibson will also improve the waterway infrastructure for transportation via barges.

However, sustaining a biomass industry in Claiborne County does not appear to be feasible at this time based on the absence of a market. Being that transport distance of feedstock should be within the range of 50-75 miles and there are no active conversion facilities within this distance range. If the county develops its own facility or a biomass plant begins operation within the 50-75 miles radius, either option would justify opportunities for small scale farmers. It is important that a long term contract be ascertained before production begins.

Further work is needed to understand the potential economic impact for small scale suppliers in the county. A number of variables and primary data will have to be considered, which we couldn't access during the course of this study. Modeling softwares like IMPLAN and EMSI may be helpful.

RECOMMENDATIONS

1. Show Capability

The initial step to creating opportunities for small scale biomass suppliers in Claiborne County lies with officials. With the understanding that the county has the capability to produce enough biomass to sustain or cater for most of the need of a conversion plant, an intermediary that can help plan a supply scheme and attract a conversion facility should be approached. Without a definite consumer of the feedstock within range of 50 miles, production may not be worthwhile.

2. Improve transportation infrastructure

The Port of Claiborne is currently not capable of handling biomass logistics via the waterway. A barge loader needs to be installed and the loading platform reinforced. Such infrastructure tend to show readiness to prospective biomass plant. The recently approved $17.8m TIGER grant from the Department of Transport will improve the network of “farm-to-market” roads and bridges.

3. Improve the organization of small scale farmers and other players

The players in the process ranging from farmers to drivers should be organized as cooperatives. The deliberate formation of farmer-owner’s grouping is seen as a major instrument to increase mobilization of feedstock from underutilized, small-scale farms. Owners can profit from enhanced co-operation with biomass industries, most times through intermediaries (like Genera Energy, see scenario). This can facilitate the initiation and co-ordination of feedstock production and subsequently, supply chain management.

4. Establish public-private partnerships to jointly develop markets

Public-private partnerships (PPPs) can, if adapted to local business environments, facilitate sustainable feedstock supply chain structures and thus support feedstock mobilization. PPPs are business ventures which are financed and managed by a partnership between the government and a private company. Companies like DuPont in the scenario above may be considered. Ergon Biofuels, Vicksburg and a

possible wood pellet plant at Hazlehurst are potential markets. Contact should be made with these companies with a view to initiating a contract.

5. Provide support investment to farmers

Financial support for companies of the forest-based or wood-energy sectors may come from both private and public institutions. Moreover, support could be given to companies for the modernization of their processes and machinery. Another technique is to provide grants and incentives to farmers. There are a number of grant available and incentives these can be sourced and used as encouragement to farmers to take part and plant energy crops. The state of Mississippi has incentives to encourage major employers in the clean energy industry; more should be done to the local players in the supply chain.

6. Examine new technologies systems

The presence of Mississippi State University and Alcorn State University, both already conducting researches into the cultivation of dedicated energy crop is an advantage. However, their research should go beyond cultivation to developing improved harvesting, collection and transportation technologies. Long transport distances and the resulting costs can limit the economic feasibility of supplying feedstock and hence impede the mobilization of feedstock. Adequate technology can reduce the cost and hence make the process more competitive.

APPENDIX

SCENARIO: Small Scale Suppliers in East Tennessee

In East Tennessee, DuPont Danisco plans a Cellulosic Ethanol plant. Thanks to financial support from the state of Tennessee, along with federal sources like the DOE, researchers at the University of Tennessee and Oak Ridge National Laboratory are able to come up with a biomass production and conversion process that fits the uniqueness of the region.

Genera Energy was contacted to offer expertise on the supply chain needs of the project allowing other stakeholders concentrate on the core of their business. Based on the need of the conversion plant, Genera Energy secured a 3 years supply contract with 61 farmers, growing biomass on 5,000 acres within a 50 miles radius of the DuPont Danisco Plant in Vonroe, East Tennessee. Most of the farmers grew other plants or reared cattle before the deal with Genera Energy. Each farmer only contributed a fraction of his farm.

In the first year of the contract, the farmer is paid a set price of $450 per acre to help get the crop established. The following years paid using sliding percentage technique. The first year contract targeted farmers with experience working high quality land, suitable for row crops in order to ease the learning curve. Second and third year contracts embraced lower quality pasture lands managed by part-time, more inexperienced farmers. Having clear understanding of the distribution of the biomass resource as well as the infrastructure in the region, Genera Energy also came up with a model to for collection and delivery of the feedstock to the conversion plant.

Farmers that participated in the program claimed there is an increase in their profits per acre cultivated compared to whatever was grown on the land previously. Following the success of this endeavor, DuPont Danisco plans to increase its commercial capability at the plant, requiring between 60,000 – 70,000 acres of biomass cultivated.

Source: http://www.biomasslogistics.org/links.html

The case study above offers a model that can be adopted in Claiborne County. Conversion plants tend to locate near the source of their feedstock. Claiborne County has the assets that can be harnessed to meet the needs of a biomass plant. Like the location in the case, an energy broker may be sought to communicate the County's assets and potential to a company that may be willing to locate in the area.

GRANTS

Biomass Crop Assistance Program for FSA

http://www.fsa.usda.gov/FSA/webapp?area=home&subject=ener&topic=bcap

The Biomass Crop Assistance Program (BCAP) provides financial assistance to owners and operators of agricultural and non-industrial private forest land who wish to establish, produce, and deliver biomass feedstocks. BCAP provides two categories of assistance:

Matching payments may be available for the delivery of eligible material to qualified biomass conversion facilities by eligible material owners. Qualified biomass conversion facilities produce research, heat, power, biobased products, or advanced biofuels from biomass feedstocks.

Establishment and annual payments may be available to certain producers who enter into contracts with the Commodity Credit Corporation (CCC) to produce eligible biomass crops on contract acres within BCAP project areas.

Repowering Assistance Program

http://www.rurdev.usda.gov/BCP_RepoweringAssistance.html

The Repowering Assistance Program provides payments to eligible biorefineries to replace fossil fuels used to produce heat or power to operate the biorefineries with renewable biomass. It provides reimbursement payments to help offset the costs associated with converting existing fossil fuel systems to renewable biomass fuel systems.

The program encourages the use of renewable biomass as a replacement fuel source for fossil fuels used to provide process heat or power in the operation of eligible bio refineries.

The amount of assistance is determined by the availability of funds, the project scope, and the ability of the proposed project to meet all the scoring criteria. In particular, the percentage reduction in fossil fuel used by the biorefinery, the quantity of fossil fuels replaced by a renewable biomass system, and the cost effectiveness of the renewable biomass system.

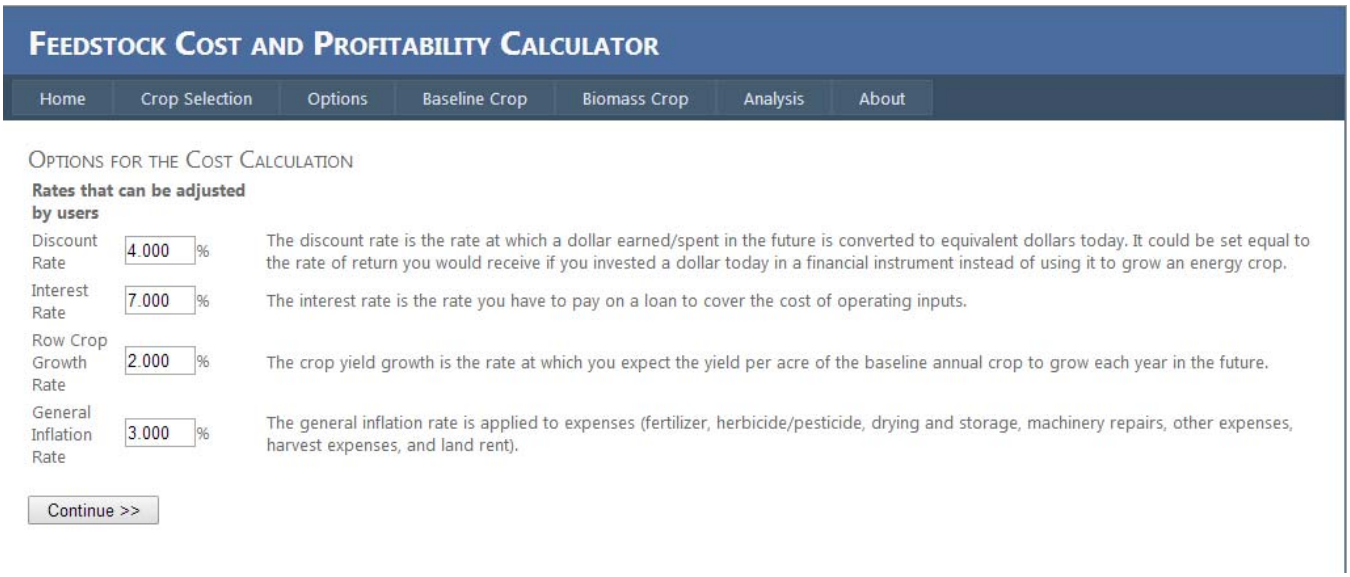
Rural Energy for America Program - Renewable Energy System and Energy Efficiency Improvement Guaranteed Loan and Grant Program

http://www.rurdev.usda.gov/BCP_ReapResEei.html

The Rural Energy for America Program (REAP) provides financial assistance to agricultural producers and rural small businesses in rural America to purchase, install, and construct renewable energy systems; make energy efficiency improvements to non-residential buildings and facilities; use renewable technologies that reduce energy consumption; and participate in energy audits, renewable energy development assistance, and feasibility studies.

REAP creates opportunities for economic development for rural businesses by supporting renewable energy and energy efficiency projects, via loan guarantees and grants. The program provides assistance to qualified applicants to finance renewable energy (renewable biomass, anaerobic digesters, geothermal for electric generation, geothermal for direct use, hydroelectric (30 megawatts or less), hydrogen, small and large wind, small and large solar and ocean (including tidal, wave, current, and thermal) and energy efficiency projects. It expands the existing private credit structure by providing a credit enhancement via a loan guarantee.

Other forms of assistance from DOE and USDA can be viewed at
http://www.afdc.energy.gov/fuels/laws/BIOD/US



BIOMASS CROP INCOME STATEMENT

CHEROKEE, OKLAHOMA - MISCANTHUS (LOW COST)

	Line Item	Year 1	Year 2	Year 3	Year 4	Annualized
	Miscanthus					
Edit Reset	Yield, ton/ac	0.00	15.00	20.00	20.00	17.85
	EXPENSE, $/acre					
Edit	Nitrogen	9.37	8.28	8.28	8.53	9.63
Edit	Phosphorus	3.13	3.22	3.32	3.41	3.79
Edit Reset	Potassium	0.00	13.00	13.00	13.39	13.84
Edit	Lime	20.00	0.00	0.00	0.00	1.73
Edit	Herbicide/Pesticide	2.85	0.44	0.00	0.00	0.28
Edit Reset	Seed Cost	700.00	88.00	0.00	0.00	67.85
	Preharvest Machinery repair, fuel, and hire					
Edit	Chisel / Plowing	12.50	1.94	0.00	0.00	1.24
Edit	Harrowing	8.75	1.35	0.00	0.00	0.87
Edit	Seeder/Planter	31.27	4.83	0.00	0.00	3.11
Edit	Fertilizer/Spreader	3.75	3.86	3.98	4.10	4.55
Edit	Spraying/Chemicals	4.00	0.62	0.00	0.00	0.40
	Harvesting Expense					
Edit	Mowing/Conditioning	0.00	7.22	8.75	9.01	9.19
Edit	Raking	0.00	2.76	3.34	8.50	7.94
Edit Reset	Baling	0.00	58.00	88.00	90.64	91.20
Edit	Staging and Loading	0.00	113.09	155.32	159.98	161.85
Edit Reset	Storage	0.00	29.72	72.07	74.23	73.21
	Interest on Op. Inputs	51.47	7.91	1.72	1.77	6.80
Edit Reset	Transportation	0.00	8.00	8.00	8.24	8.52
Edit	Other	0.00	0.00	0.00	0.00	0.00
	Total operating cost, $/acre	847.09	352.24	365.78	381.80	466.01
Edit	Cost of Marginal Land, $/acre	32.67	33.65	34.66	35.70	39.64
	Cost of Crop Land, $/acre	127.38	137.18	147.25	147.25	204.79
	Revenue above cost of Marginal Land, $/acre	-879.76	-385.89	-400.44	-417.50	-505.65
	Revenue above cost of Crop Land, $/acre	-974.47	-489.42	-513.03	-539.40	-670.80
	Calculated breakeven price for marginal land, $/ton		25.73	20.02	20.88	22.01
	Calculated breakeven price for crop land, $/ton		32.63	25.65	26.97	30.01

Source: http://miscanthus.ebi.berkeley.edu/Biofuel/BiomassCrop.aspx