Bioenergy opportunities for MS

MS PSC Special Work Session
Renewable Energy in MS

August 17, 2016

Agenda

- Forestry and the economy
- Drax Biomass overview
- Drax's experience with coal-to-biomass conversion
- Bioenergy opportunities for Mississippi

Economic impact of Mississippi's working forests

Drax Group – a vertically integrated biomass energy co.

drax

Source

draxbiomass
A Drax Group company

Generate

draxpower
A Drax Group company

Supply

havenpower
A Drax Group company

BILLINGTON bioenergy
A Drax Group company

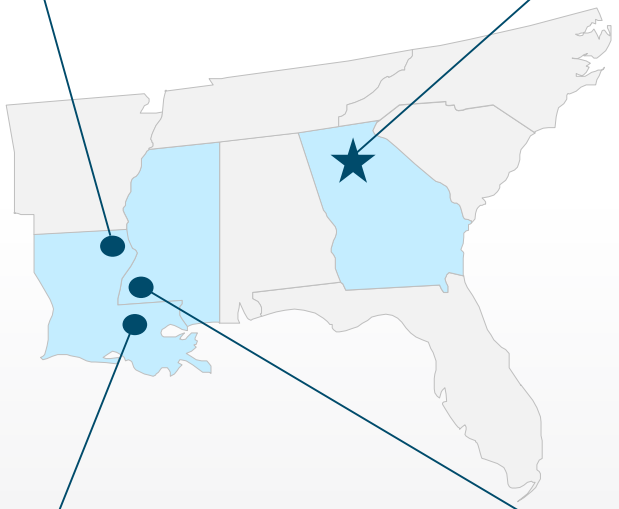
Drax Biomass operations

Headquarters… Atlanta, GA
- ~35 employees
- Leadership and most support functions

Morehouse BioEnergy… Bastrop, LA
- Fully commissioned in August 2015
- 60 employees
- Production capacity = 450,000 MT/year
- Rail-based infrastructure

Amite BioEnergy… Gloster, MS
- Fully commissioned in August 2015
- 60 employees
- Production capacity = 450,000 MT/year
- Truck-based infrastructure

Baton Rouge Transit… Port Allen, LA
- Fully operational in April 2015
- Multi-modal, deepwater port
- 10 employees (DBI and Host Terminals)
- 2 million MT/year handling capacity
- Up to 40 cargo vessels/year



Gloster, MS – an ideal location for a pellet mill

Strong wood basket

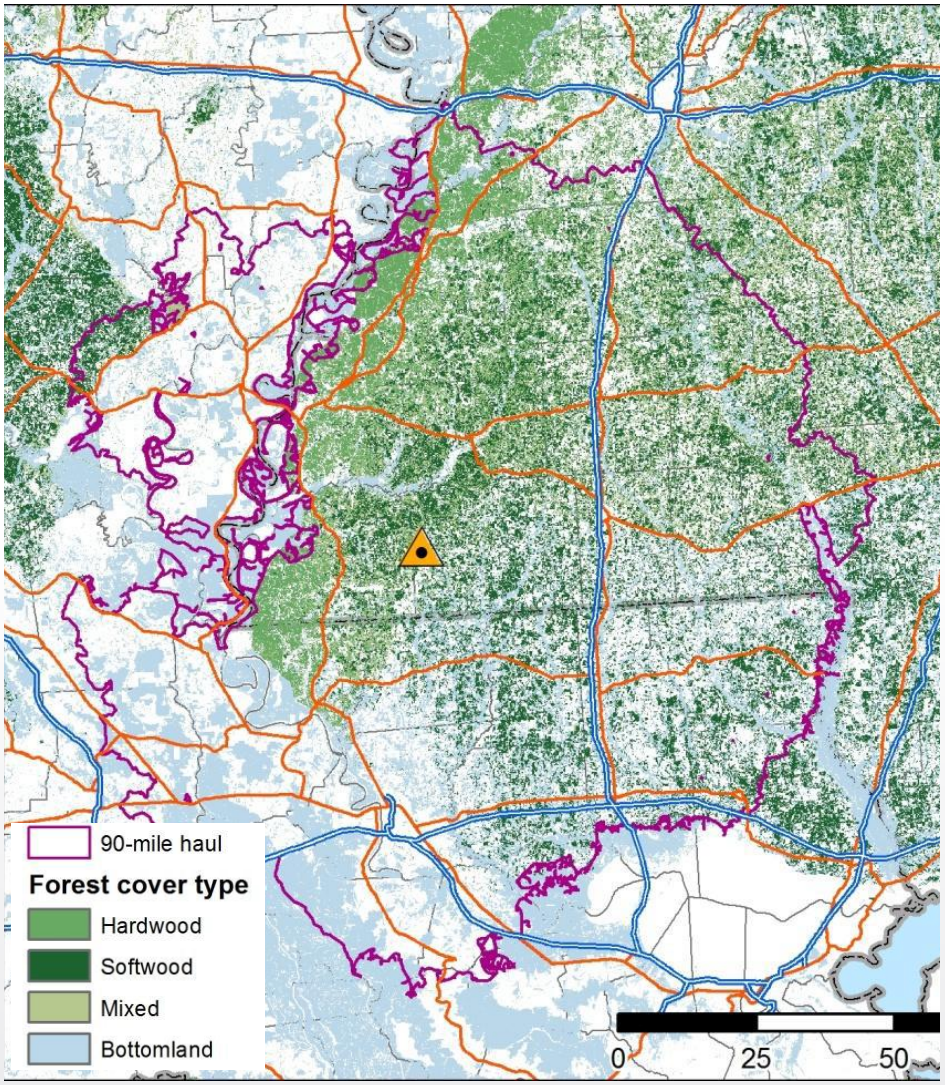
- Annual fiber demand = 1.0m MT/yr
- Total pine growth = 11.3m MT/yr[1]
- Total pine drain = 6.7m MT/yr[1]
- Growth-to-drain ration = 1.7:1[1]
- Total pine inventory = 135m MT[1]

Favorable market conditions

- Excess inventory due to mill closures
  - GP plywood mill (Gloster) – 0.5 m MT/yr
  - IP pulpmill (Natchez) – 1.4 m MT/yr
- Trained logging/hauling crews
- Available workforce with mill experience

Existing infrastructure

- Extensive road networks
- Proximity to deep-water port (60 road-miles to Baton Rouge)
- Mature trucking industry (Werner)

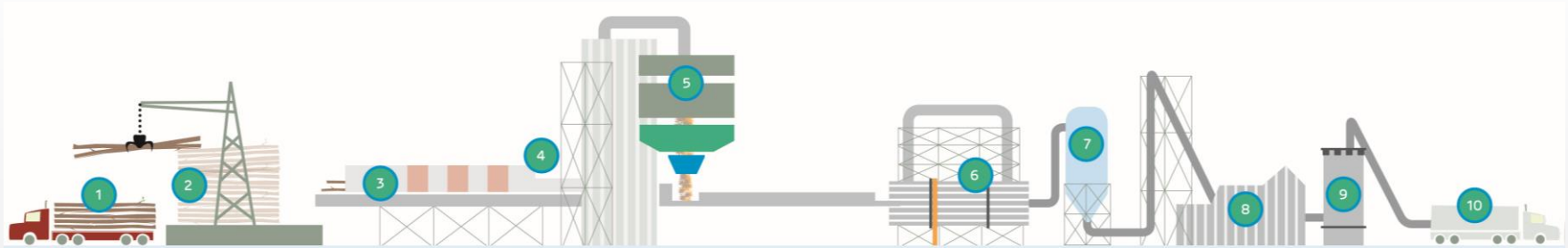


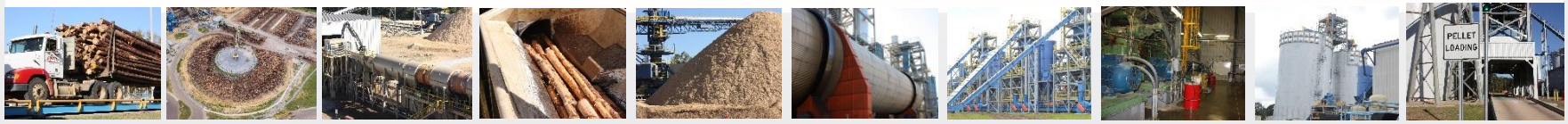
[1] 2015 Total Pine Inventory and 2015 Growth-to-Drain (GtD) ratio. Figures from analysis by Forisk Consulting of Sub-Regional Timber Supply (SRTS) model
Fiber Basket Graphic Source: BioResource Management, Inc. – 2012 Report on Biomass Feedstock Supplies for the Gloster, MS area

Our contribution to the local economy

Wood pellet manufacturing at a glance

- ✓ Efficient, cost-effective bulk transport
- ✓ Low moisture content = higher BTU value
- ✓ Adaptable for use at coal-fired facilities
- ✓ Stringent specs = reliable plant operations





Drax Power Station, pre-conversion (1975)

UK's largest power station… 4 GW (6 x 645 MW units)

Major emitter of CO2… 22 MM MT/yr at peak

Critical asset… 7-8% of total supply

Drax Power Station today

2 of 6 units fully converted to biomass, 3rd unit at 90% biomass

No loss of output, negligible impact on efficiency

20% of UK renewable generation, largest decarbonisation project in W. Eur

Coal-to-biomass: good for the environment

SO_x emissions

85%[1,2]

NO_x emissions

50%[3,4]

CO_2 emissions

80%[5,6]

[1]FGD-abated coal versus unabated biomass
[2]Abated sulfur content of coal = 200-300 mg/m[3]

[3]Unabated coal versus unabated biomass
[4]Normal operating conditions - Boosted Overfire Air system and low-NOx coal

[5]Fossil (geologic) emissions versus lifecycle (biogenic) emissions
[6]Includes emissions from production and transportation of biomass fuel

Coal-to-biomass: good for the grid

Coal-to-biomass: good for ratepayers

- ✓ Utilizes existing grid infrastructure
- ✓ Reduces risk of stranded assets
- ✓ Offers alternative to costly pollution control upgrades
- ✓ Provides cost-competitive complement to wind and solar

Technology	Levelized Cost of Elec. (DECC 2013)	System Integration Costs[1] (Average 2020-2030)	Whole System Cost (WSC = LCOE + SIC)
	£/MWh (2012)[(2)]		
Onshore Wind	100	10-14	110-114
Offshore Wind	132	10	142
Solar PV	123	12	135
Biomass Conversion	108	-1	107

[1]Includes costs of backing up intermittent generation and making the system flexible enough to adapt to fluctuations in demand; estimated relative to a benchmark technology (assumed nuclear power)

[2]Costs denominated in real 2012 prices for ease of comparison to the DECC (2013) levelised cost of energy

Source: UK Renewables Subsidies and Whole System Costs; NERA Economic Consulting/Imperial College London – Feb 2016

Bioenergy (pellet) opportunities in MS

Value proposition

- Readily available, renewable resource – 19.5 million forested acres
- Pellets offer resource diversification in state energy policy
- Biomass a potential state compliance mechanism for EPA CPP
  - Co-firing = flexible compliance option for achieving coal heat rate performance standard
  - Conversion/Greenfield = non-zero emitting renewable generation source potentially eligible for credits under rate-based plan

Possible next steps

- Identify candidate facilities (existing coal-fired stations)
- Perform pellet test-burns
- Conduct feasibility studies (engineering, resource availability)

Questions?