Chipping Biomass for Co-Milling with Pulverized Coal

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www.srs.fs.usda.gov/forestops/biomass.htm

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Problem Areas

- **Ecological Effects of Forest Operations**
- **Forest Operations Technology to Reduce Ecological Damage**
- **Performance and Costs of Forest Operations Systems**
- **Planning Tools and Decision Support Systems**

Plant Gadsden

Demonstration Project

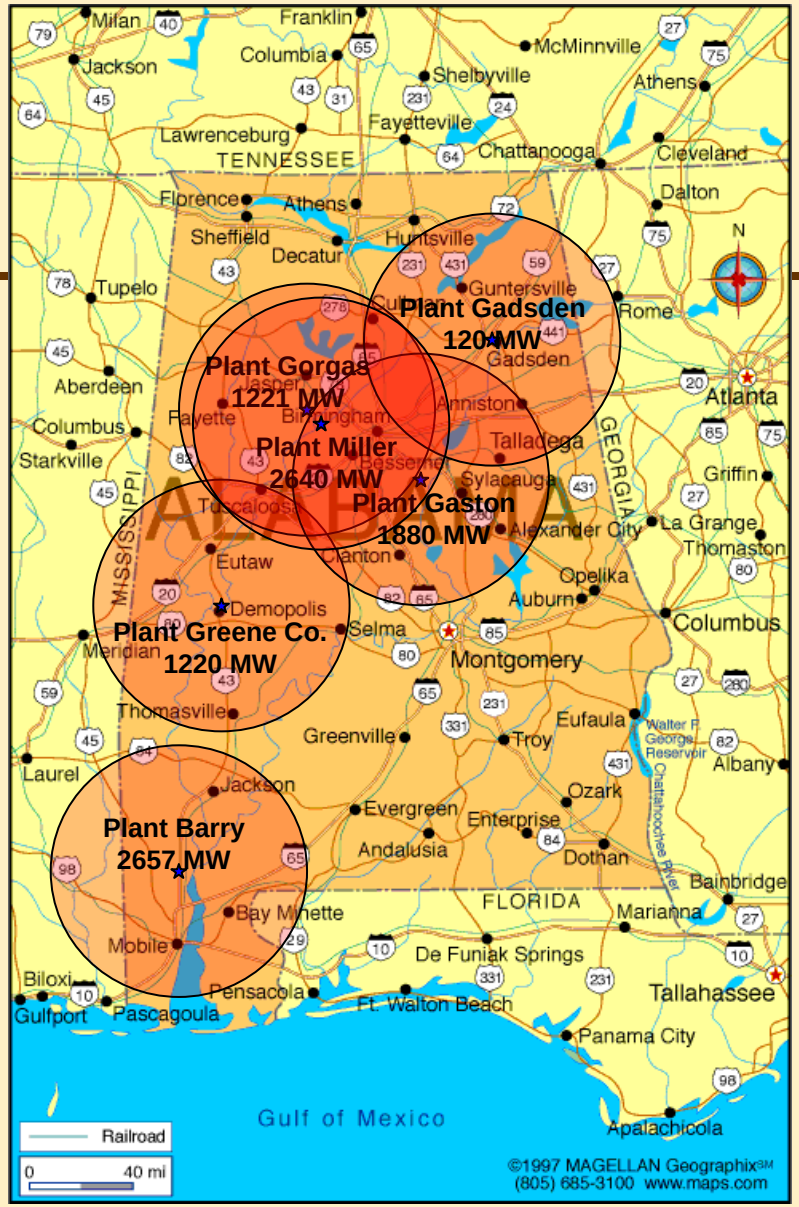
- Alabama Power/Southern Company
- Precision Husky Corp.
- USDA Forest Service, NF in Alabama & Southern Research Station
- Auburn University
- University of Alabama
- Forest-Based Economic Development Services
- Alabama Department of Agriculture and Industries
- USDA Natural Resource Conservation Service
- Others

Outline

- Power Plant Locations/Potential Use
- Handling/Processing within Plant
- Switchgrass & Other Trials
- Equipment Selection
- Biomass “Chip” Specifications
- Project Implementation

Coal-Fueled Generation

- 50-Mile Radius
- Yearly Potential
  800,000 green tons
  4% mix (energy basis)
- Feasibility studies in progress - biomass supply



Handling & Processing Coal

Pulverizer

Splitters

Other Trials

- Switchgrass
- Hardwood Sawdust

Switchgrass Trial

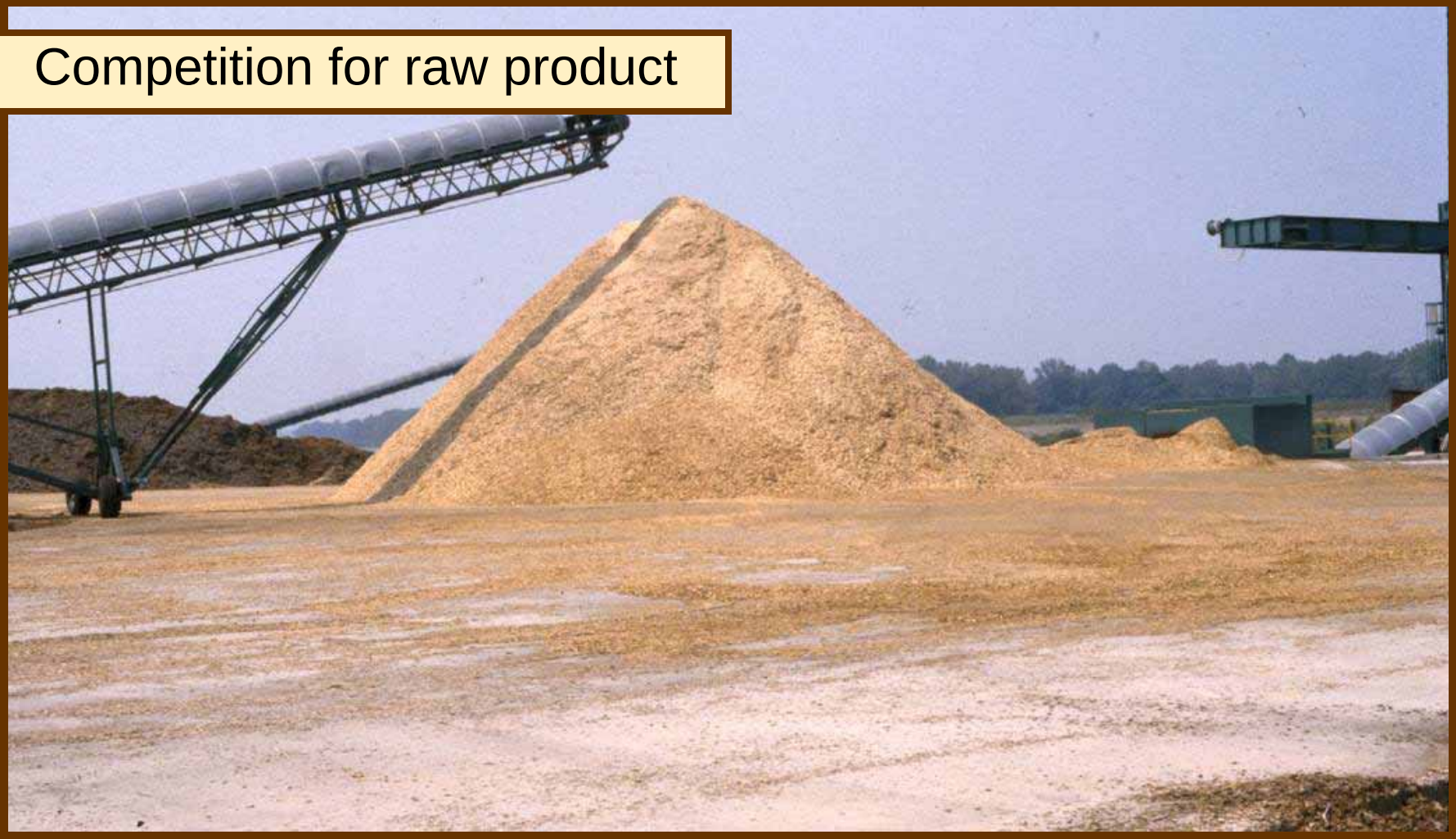
- Co-fired, not Co-milled

Switchgrass Trial

- Separate Handling
- Capital Investment

Sawdust Trial

- Competition for raw product



Step 1: Specifications

Determine desired biomass characteristics

Biomass Specifications

- Species
- Moisture Content
- Ash Content
- Size
- Fiber Orientation

Criteria

- Material Handling Criteria
- Burning Criteria

Equipment Selection

Equipment Selection

NF in Alabama, Oakmulgee Ranger District

Equipment Selection

Chipper Processing

Step 2: Equipment Selection

Precision Husky ProGrind

Equipment Selection

Tub Grinder vs. Chipper Output

Equipment Selection

Tub Grinder Chips

Approved Chip for Power Plant

Equipment Demonstration

Equipment

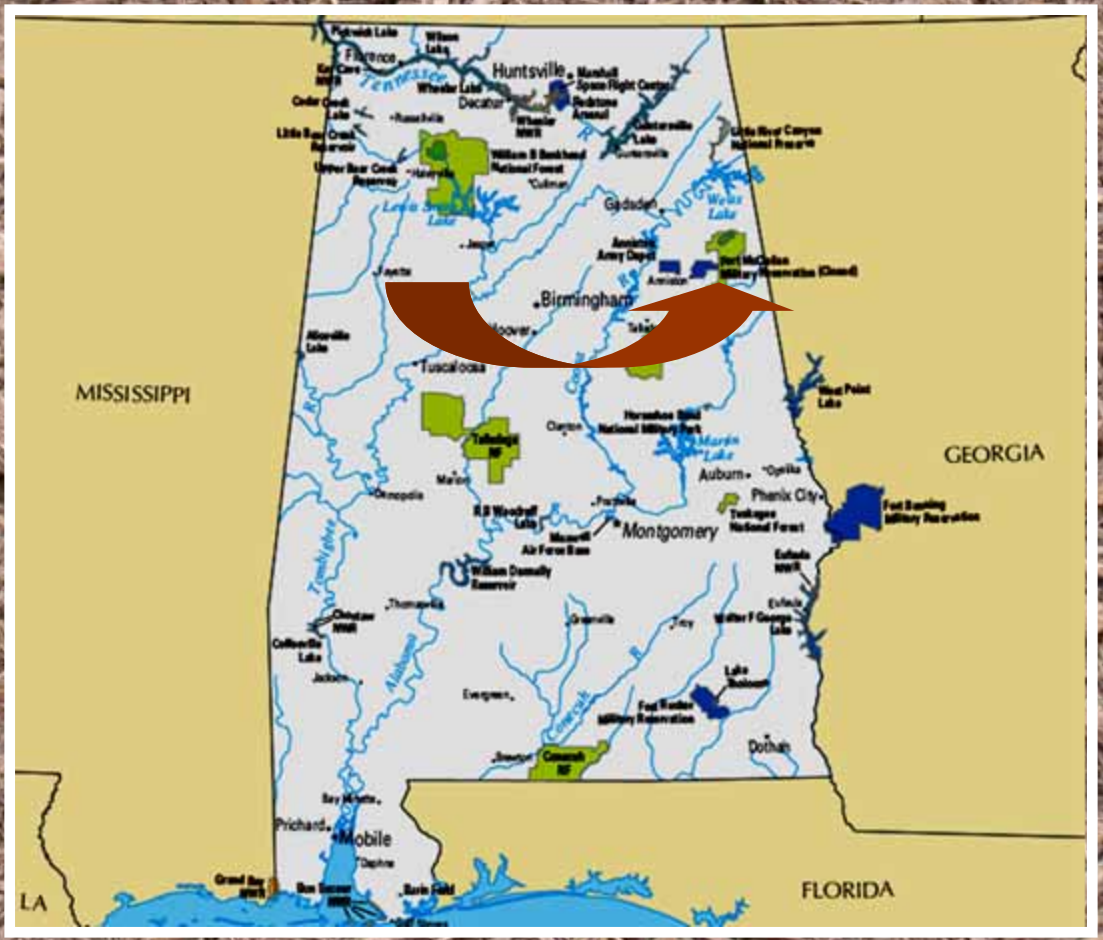
- ProGrind H3045
  - 525-hp
  - Proto-type
- Operations

Precision Husky ProGrind H-3045

Case Study

Shoal Creek Ranger District, Talladega National Forest, Heflin, Alabama

Demonstration Location



Stand Description

- Loblolly Pine Stand
  - 15-years old
  - 37 Acres, 96% pine
  - Avg dbh (removal) = 4.06 inches
  - Avg height (removal) = 31 feet
- Prescription = remove stems < 7.5” dbh

Traditional Ground-Based Equipment

Chip Types

Trials

- Clean small chips
- Dirty small chips
- Clean large chips
- Dirty large chips

Chipping Operation

Summary of Production[a]

	Pro-Grind H-3045
Total study time (hr) w/delays	29.0
Productive time (pmh)	18.2
Van loads produced	17
Chips produced (gt)	517.21
Utilization Rate (%)	63

[a] pmh=productive machine hour; gt=green tons

Chipping Operation

Pro-Grind H-3045Production Rates

Chipping time/van (incl. cycle wait time)	
Range	45-88
Average	64
Average payload (gt)	30.42
Average production rate (gt/pmh)	29

pmh=productive machine hour; gt=green tons

Summary

Recent Chipping Production Rates and Costs*

	Precision-Husky 1858 ($268,000)	**Bandit Beast 4680** ($480,000)	**ProGrind H-3045** ($285,000)
Machine Type	3-knife chipper	Horizontal Grinder	Horizontal Chipper
Horsepower	450	850	520
Avg. Stand DBH (in)	3.54 – 4.26	4.06	4.06
Product Output	Hog Fuel	Hog Fuel	Uniform “dirty” chips
Production Rate (gt/PMH)	67	43	29
Cost/gt ($US) machine rate w/o transport or operator	$4 (23%) $3 (63%)	$11 (23%) $8-$10 (63%)	$10 (23%) $6-$8 (63%)

Off-highway diesel prices updated to $3.60

* Individual machine rates, not for entire harvesting system

Biomass Specifications

- Power plants may have very narrow specification ranges
- Lots of equipment options
- Lots of places that processing and sizing can occur
  - Whole tree chips reground at plant
  - One pass machine in woods
- Screen deliveries for acceptable fuel size to give the power plant total control over what goes in the coal pile if risk of oversized material is too high

Plant Gadsden
Initial Test Results

- Moisture content increased from ~50% delivered to ~65% in outside storage.
- 10% energy mix is a lot of volume, so metering in plant must be adjusted – material handling.
- Clean and dirty fuel chips processed, but chemical outputs differ.
- Testing continues on these and other chips at Plant Gadsden.

Thank you

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