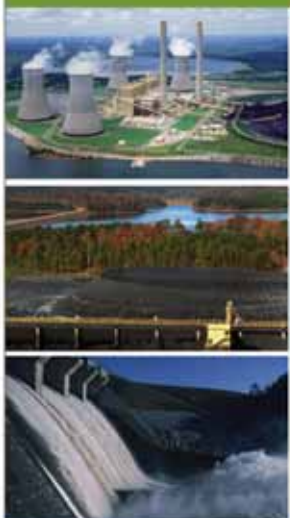



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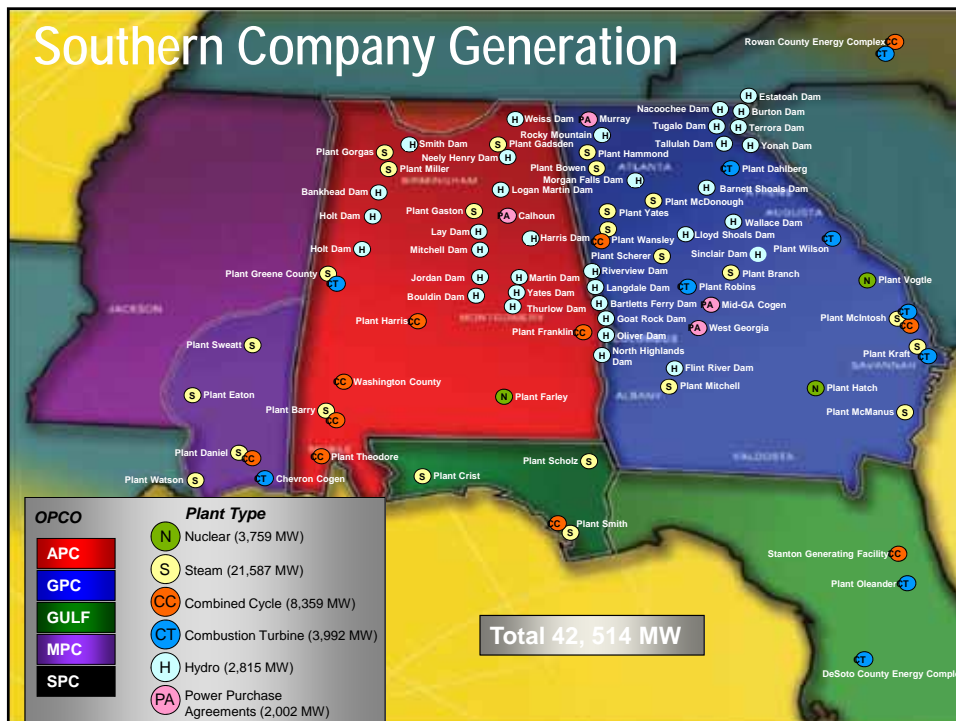


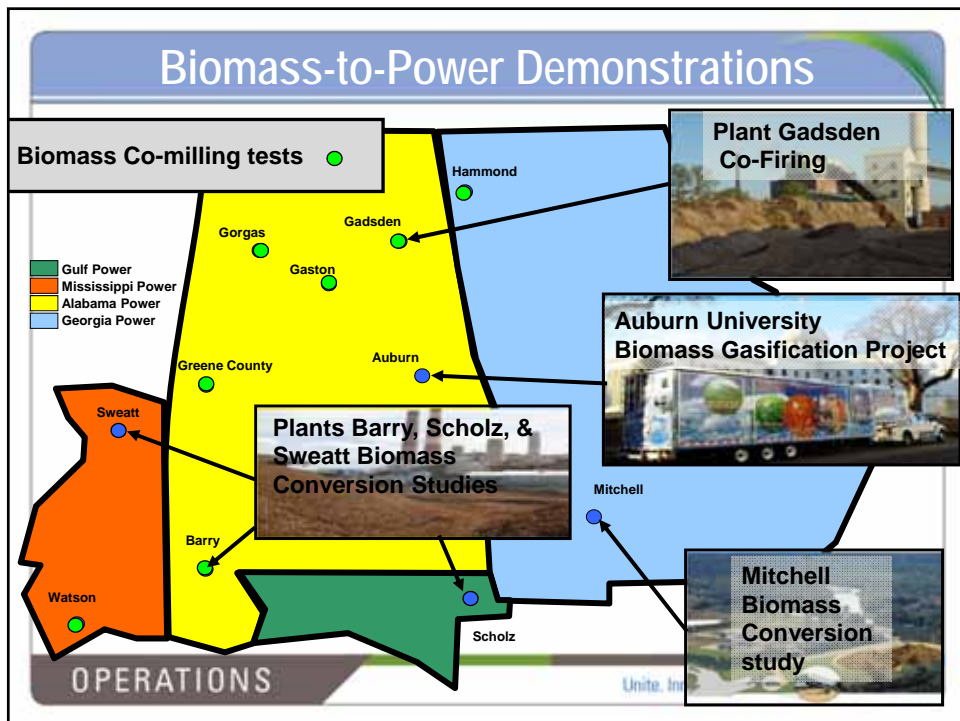
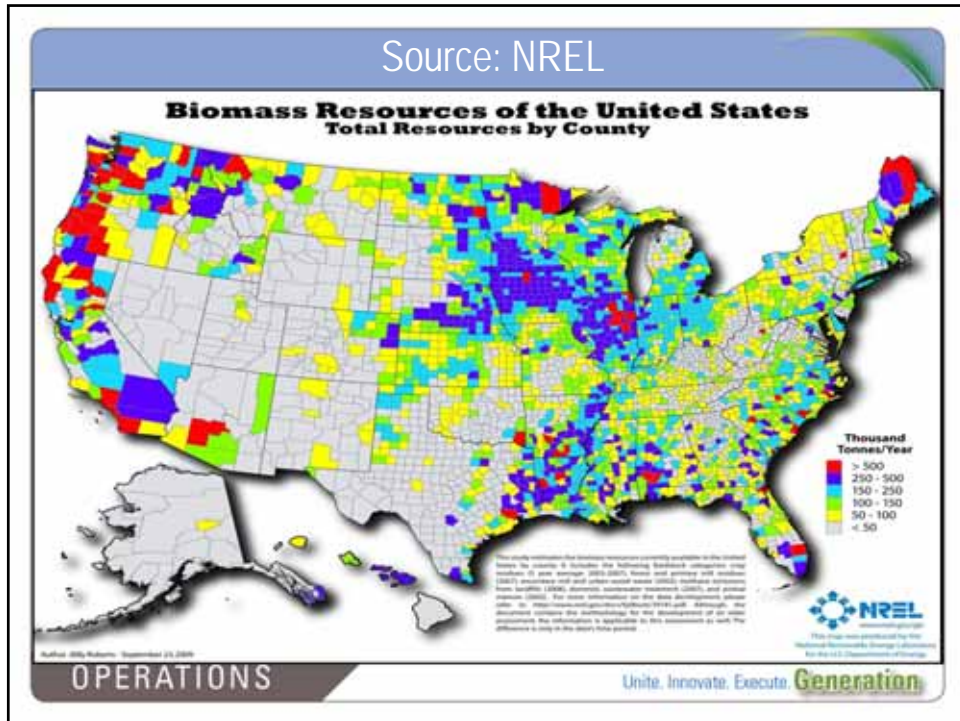
Biomass to Energy

10th Annual Southern BioProducts & Renewable Energy Conference

May 2011
Tony Smith

Generation





Potential Generation Methods

- Co-Firing
 - Co-Milling
 - Direct Injection
- Fossil to biomass conversion
- New Construction (Greenfield / Brownfield)
- Biomass Gasification

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Biomass Co-milling

- Biomass co-milling involves creation of a fuel mix of biomass with coal and sending this mix through the existing fuel handling system into the traditional fossil utility boiler
- Advantages
 - Little or no capital investment
 - Quick implementation




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Fuels Tested

- Pulp & paper size chips
- 1/2" to 3/4" minus whole tree chips
 - Pine thinnings
 - Mixed hardwoods
- Sawdust
- Urban wood waste
- Wood Pellets



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Biomass Co-milling



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Co-Milling Test Results

- Chips = ~1%–3% by energy
- Pellets = ~7% by energy
- Pulverizer related limitations
 - Particle sizing is key
 - Amount of spare capacity
 - Wood vs. coal
 - Pulverizer design & condition
 - Moisture
- Additional operational expenses
- Additional capital expense for pellet dry storage
- Emissions were unchanged or slightly lower
- Potential negative impact Ash sales

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Direct Injection

- Biomass direct injection involves the conveyance of a processed biomass material into an existing fossil fired boiler via dedicated equipment and injection points.
- Advantages
 - Projected higher output by energy
 - Quick implementation (as compared to fossil / biomass conversions and new construction)
 - Less capital than conversions or new construction

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APC Pit Gadsden Direct Injection Testing

- Wood chips
- Switch Grass
- Giant Miscanthus

Switchgrass

Giant miscanthus

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Direct Injection Test Results

- Wood chips
 - Requires two stages of milling
 - Requires drying
 - Particle size below 1/8" !!!
- Grasses (switch grass, giant miscanthus)
 - Emissions generally lower
 - Storage requirements
 - Dust control opportunities
 - Miscanthus required more grinding

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Biomass Repowering Considerations

- Biomass plants can be dispatched
- Repowering may be more cost competitive (makes use of existing plant equipment)
- Direct replacement for coal generation capacity (some unit capacity de-rate may occur)
- Economic transport radius of biomass supplies may limit repowered unit size



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New Construction / Re-Powering Considerations

Regulator Uncertainties !

- Feb, 2011 IB MACT rule issued yet "open for re-consideration"
- Limits :
 - Carbon Monoxide
 - PM particulate Matter
 - HCL Hydrogen Chlorides
 - Dioxins
 - Mercury
- "Some" limits are extremely stringent and raise concerns about achievability.
- Reconstruction issue needs further investigation to effectively categorize units as existing or new.

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Biomass Gasification Testing

- Auburn small scale gasifiers
 - 25 kW distributed gasification trailer
 - Pressurized (150 psi) gasification bench scale unit (based on GTI technology)
- UND EERC
 - Collaboration with EPRI
 - Transport Reactor Development Unit (pressurized)
- PSDF pilot plant Transport Reactor
 - Tested wood pellet feeding
 - Gasification test of 20% by energy



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Fuel Considerations


- Southeastern forest biomass resources plentiful
 - Availability of forest residual and waste materials dependent on other forest products activities (pulp and lumber mills)
 - Costs for biomass vary based on resource type
 - Round wood
 - Pulpwood
 - Residuals/wastes/hog fuel
- Economics for biomass generation projects vary widely based on fuel costs

STATE	Total Acres (Million)	Timberland Acres (Million)	% Private Ownership
AL	22.82	22.74	94%
FL	17.18	15.93	71%
GA	24.79	24.40	91%
MS	19.62	19.54	88%



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Technology Implementation Rank



Increased Capital Expenditures

- **Co-milling**
 - Small capital costs
 - Lower energy yield
- **Direct injection**
 - \$500/kW - \$1000/kW
 - Higher energy yield
 - ASTM ash sale issues
 - SCR catalyst considerations
- **Biomass Repowering (unit conversion)**
 - \$2,000/kW - \$4,000/kW
 - Industrial Boiler MACT considerations
- **Greenfield or Brownfield**
 - \$4,000/kW - \$6,000/kW

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Biomass as Fuel Considerations

- **Sensitivity to existing forest products industries as supply constraint possibilities increase with competition**
- **Strong focus on :**
 - Accurate inventory identification
 - Maximizing the utilization of lower value and previously un-merchantable biomass
 - Active R&D programs supporting healthy, sustainable fiber growth
 - Conversion technology advancement (i.e. additional direct injection testing. Pursue collaboration with DOE)

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Summary

- In regards to renewable energy, biomass is currently viewed as the most economical option for Southern Company
 - Cost impacts of deployment
 - Fuel diversity and availability
 - Impacts to other industries
- Southern Company must continue to balance an environmental stewardship obligation with the duty to supply low cost energy to our customers.

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**SOUTHERN
COMPANY**

QUESTIONS?