Commercial Scale Bioenergy Technology




Biomass Utilization Workshop

Sonora, California

May 22, 2008

Presentation Overview

- Introduction
- Bioenergy Technology
- Bioenergy Advantages
- New Influencing Factors
- Sourcing Wood Fuel
- Project Development

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What is Biomass?

- **Biomass** – any solid, nonhazardous, cellulosic material derived from: forest-related resources, solid wood wastes, agricultural wastes, and plants grown exclusively as a fuel.*

*based on the definition of biomass in the 2005 Energy Act

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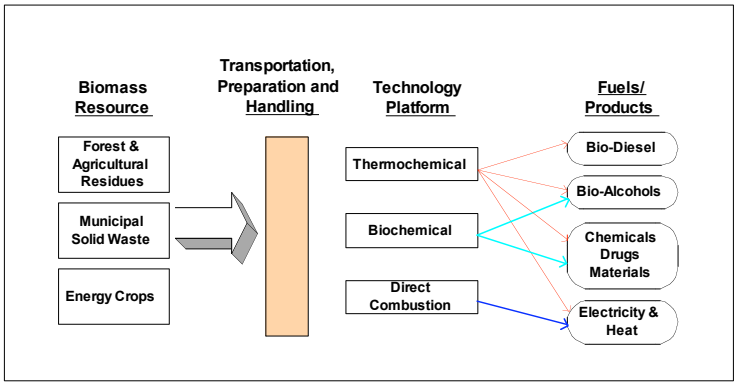
Bioenergy Power and Fuels



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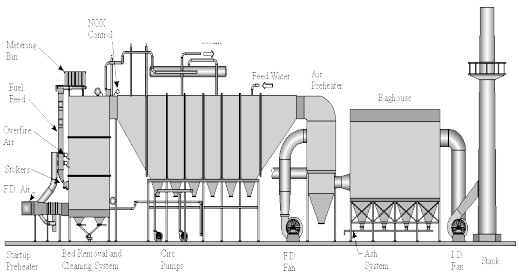
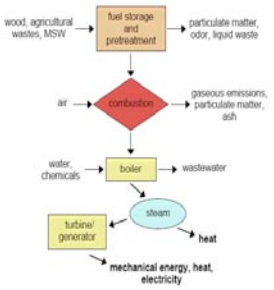
Combustion Technology

Typical EPI Energy System





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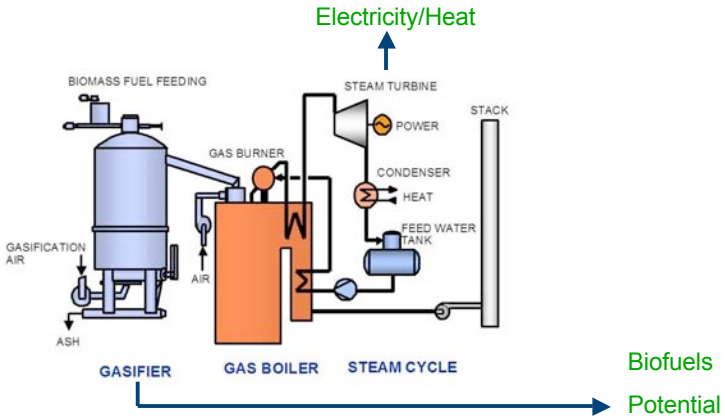
Gasification – The Future?



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Other Utilization Opportunities – Ethanol and Biofuels

- Cellulose to biofuels is coming - technologies appear promising.
- Transportation fuel diversity and security
- Value-added use for forest biomass

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Advantages of Biomass When Compared to Wind and Solar Energy

- Provides baseload renewable energy (24/7) on a cost effective basis.
- Has numerous societal benefits:
  - Supports hazardous fuels reduction and healthy forests
  - Provides employment (4.9 jobs/MW)
  - Greenhouse gas reduction displacing fossil fuels
  - Reduces waste material destined for landfills
  - Net improvement in air quality

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Improving Air Quality

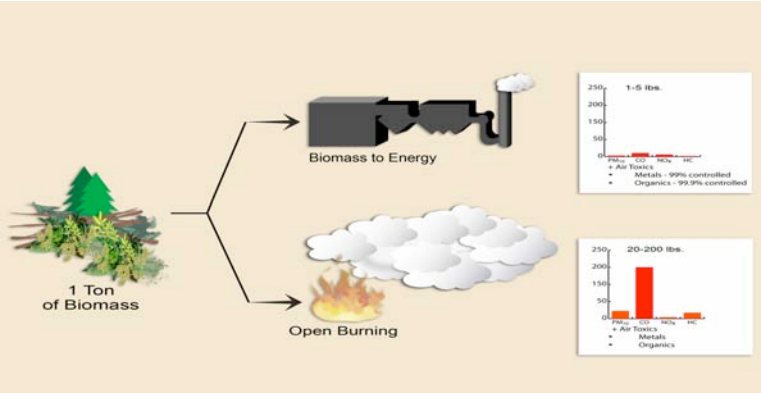

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Diagram courtesy of Placer County Air Pollution Control District

Improving Air Quality (cont'd)

- Over 97% (and more) of all pollutants can be removed by converting the woody biomass to energy over current open burning practices
- And this is with older technology

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New Influencing Factors Effecting Biomass Plants (old and new)

- Growing waste disposal issues/opportunities
- Renewable energy gov't mandates/incentives
- New financial and owner groups looking for renewable energy business deals
- Fossil fuel pricing – abrupt current and future price increases
- Acceleration in the development of new biomass to energy conversion technologies
- Greenhouse gas reduction opportunities

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Bioenergy Power in North America Current Industrial Technology

- Nearly 10,000 U.S. megawatts
- Almost all systems are combustion / steam turbine
- Most are grate stokers.
- 5-110 MW (avg. 20 MW).
- Heat rate 11,000-20,000 BTU/kWh.
- Installed cost $1700-$3500 per kW.

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Bioenergy Power Facility Example

- 20 MW plant produces enough power for about 20,000 homes
- New plant construction cost = $50 to 60 million +
- Consumes about 160,000 BDT/yr (1BDT/MW/hour burn rate)
- Biomass transported up to 50 miles (maybe farther)
- Delivered Biomass valued at $15 - 50 per BDT
- Average electrical energy production cost
  ~ $0.07 - $0.10/kWh

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Three Major Components For a Viable Bioenergy Project

- Supply
- Market
- Financing

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Woody Biomass Supply Sources

- Timber harvest residuals
- Forest fuels treatment residuals
- Forest products manufacturing residuals
- Urban wood waste
- Agricultural byproducts

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Potential Power/Heat Purchasers

- Regulated utility – SCE, PG&E
- Unregulated utility - Municipals
- Forest products manufacturing facility
- Oil Fields
- Others

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Bioenergy Project Development - Deal Killer Issues to Consider

- Fuel/Feedstock Supply
- Community Support
- Project Economics
- Appropriate Technology
- Siting/Infrastructure & Permitting

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Fuel/Feedstock Supply

- Sustainable long term supply located within close proximity (25 to 50 mile radius)
- Economically available
- Environmentally available
- Meets quality specifications
- Available in quantities and from diverse sources that support project financing:
  - Minimum 10 year supply, 70% under contract
  - At least 2.5 – 3 times facility usage (fuel supply coverage ratio)

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