Commercial Scale Biomass Power Plant Technologies

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Presentation Overview

- Introduction
- Biomass Technology
- Biomass Facilities & Siting/Infrastructure
- Project Development
- Project Economics

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.*

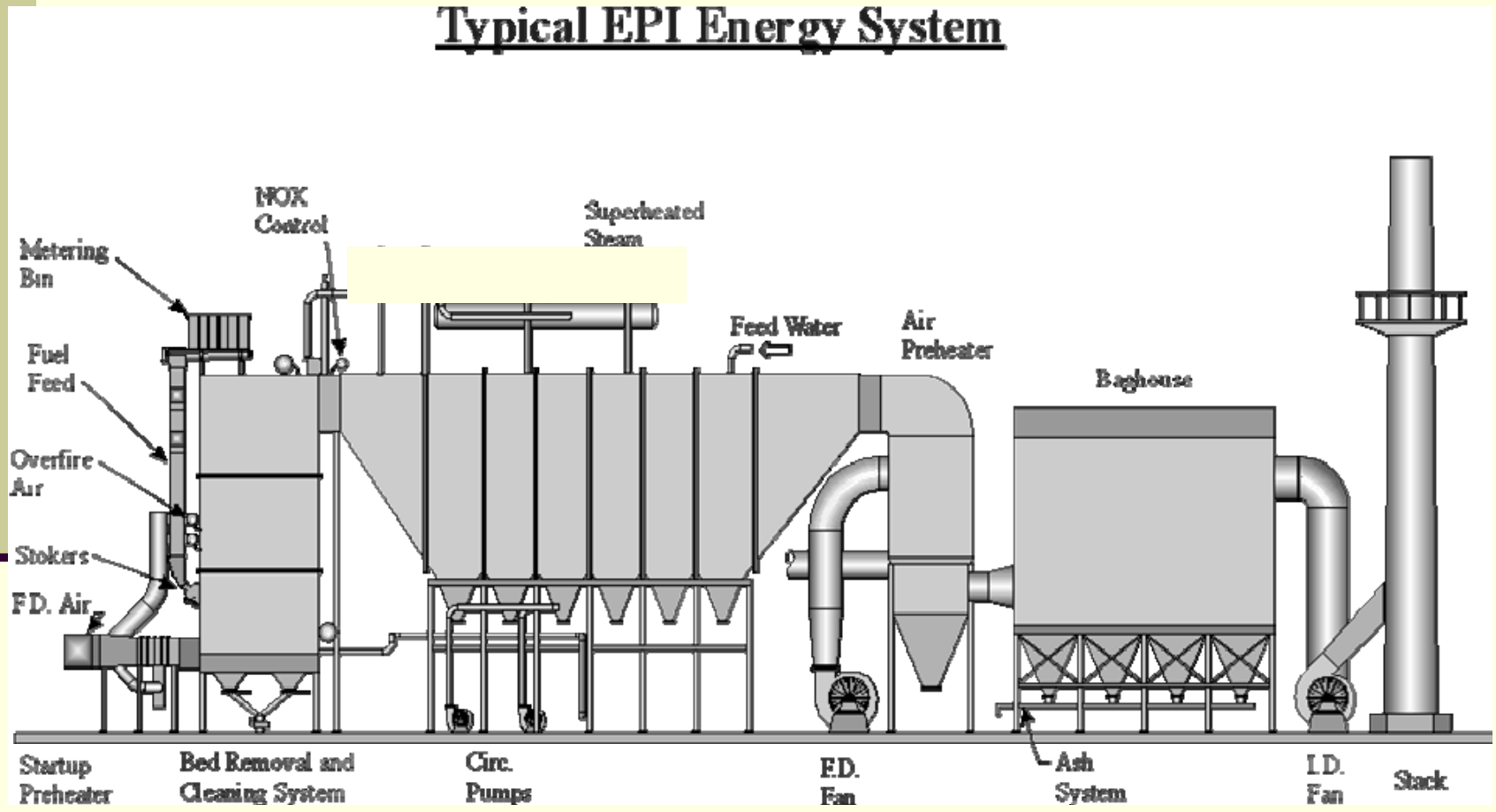
*based on the definition of biomass in the 2005 Energy Act

Biomass Power Technology

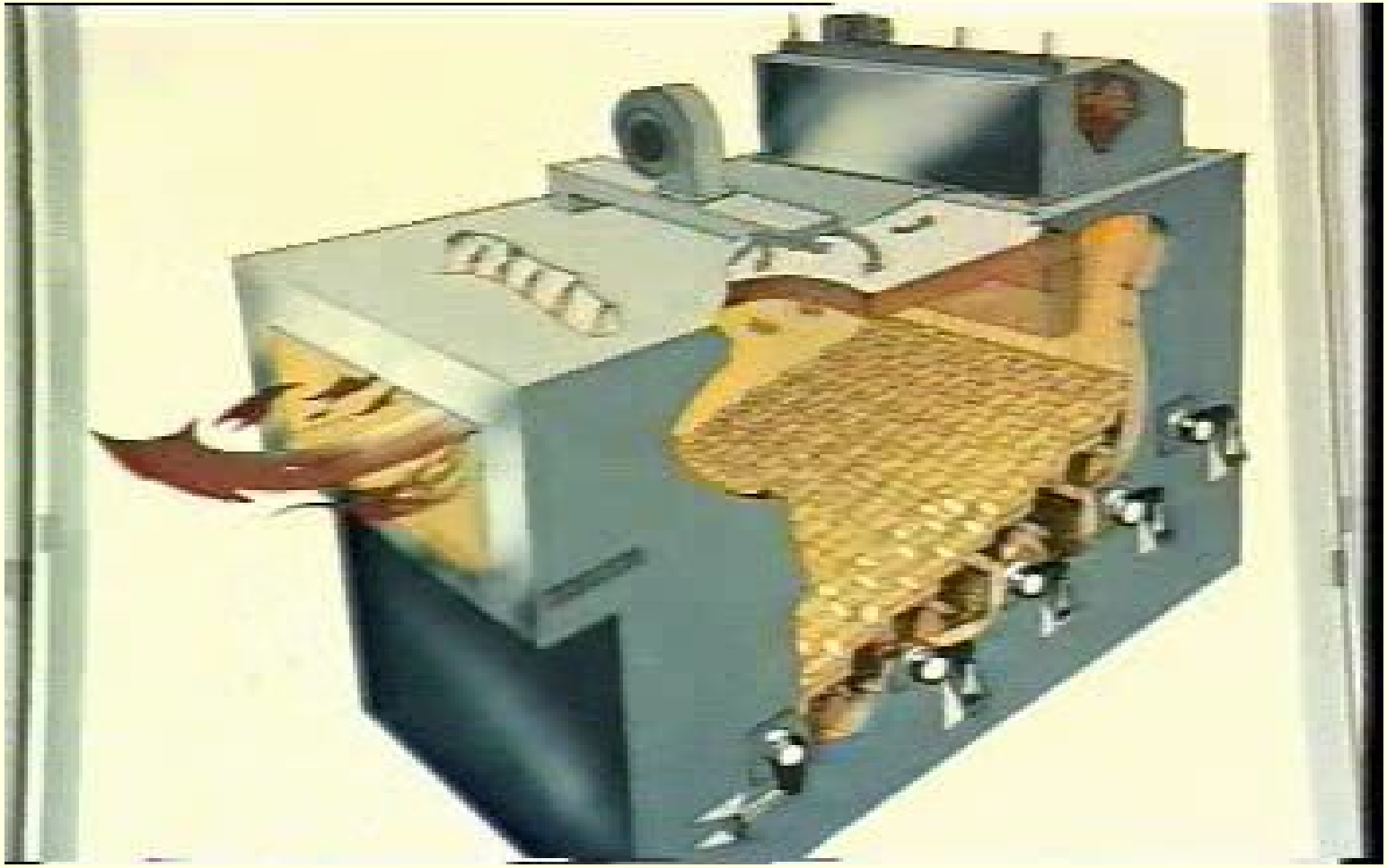
Two main components:

- An energy conversion system that converts biomass to useful steam, heat, or combustible gases
- A prime mover that uses the steam, heat, or combustible gas to produce power

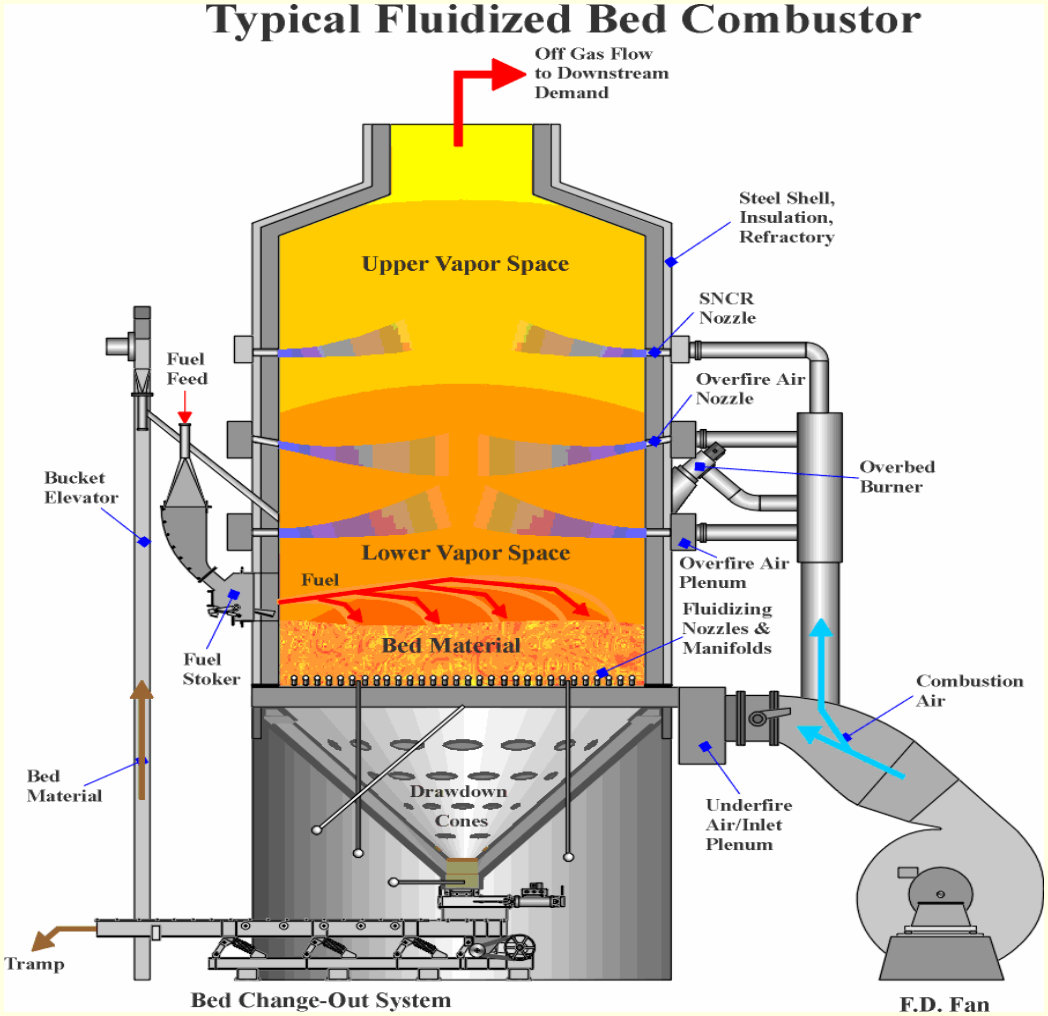
Combustion Technology



Combustion Technology – Traveling Grate Stoker

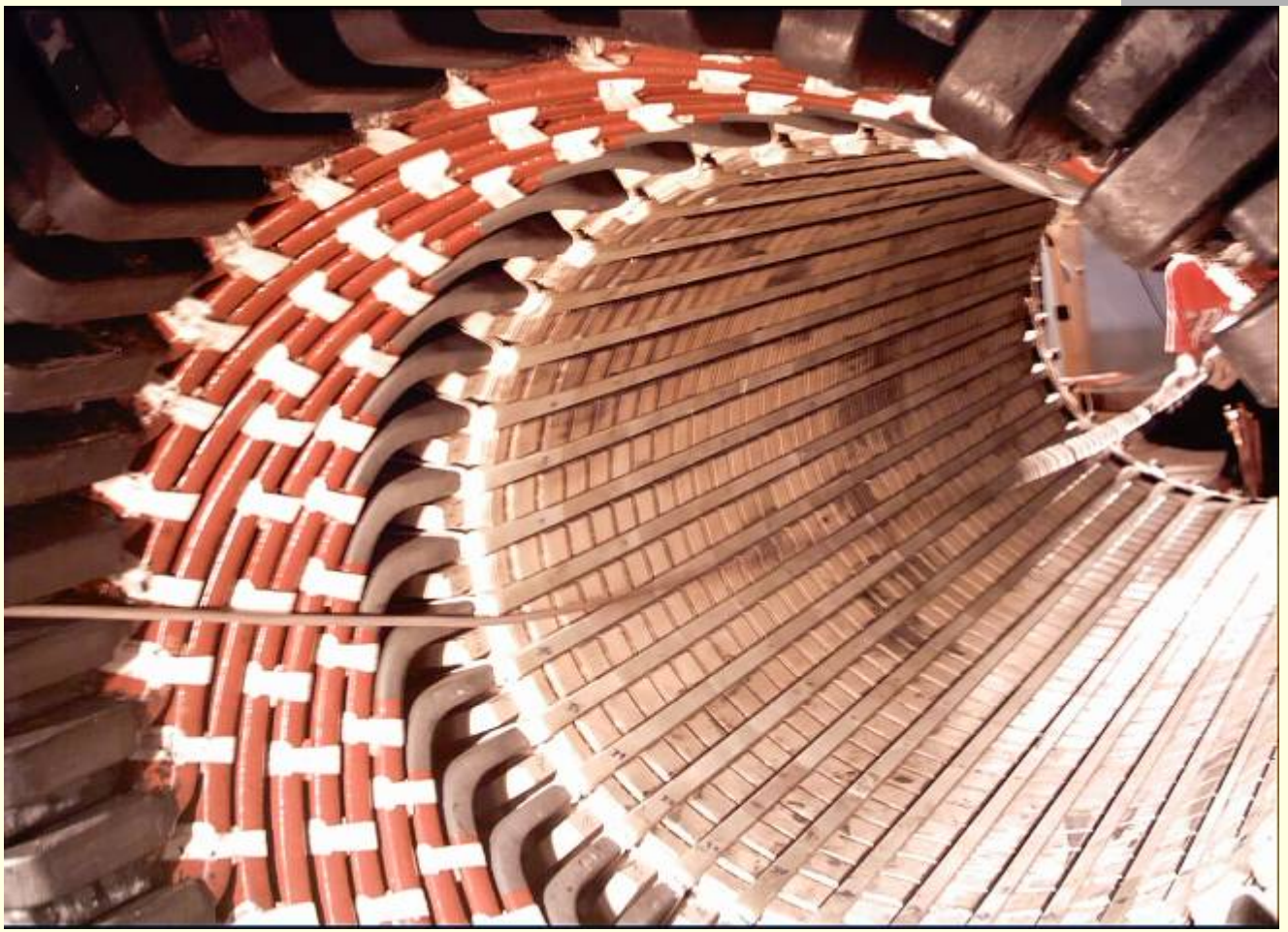


Combustion Technology – Fluidized Bed Combustor

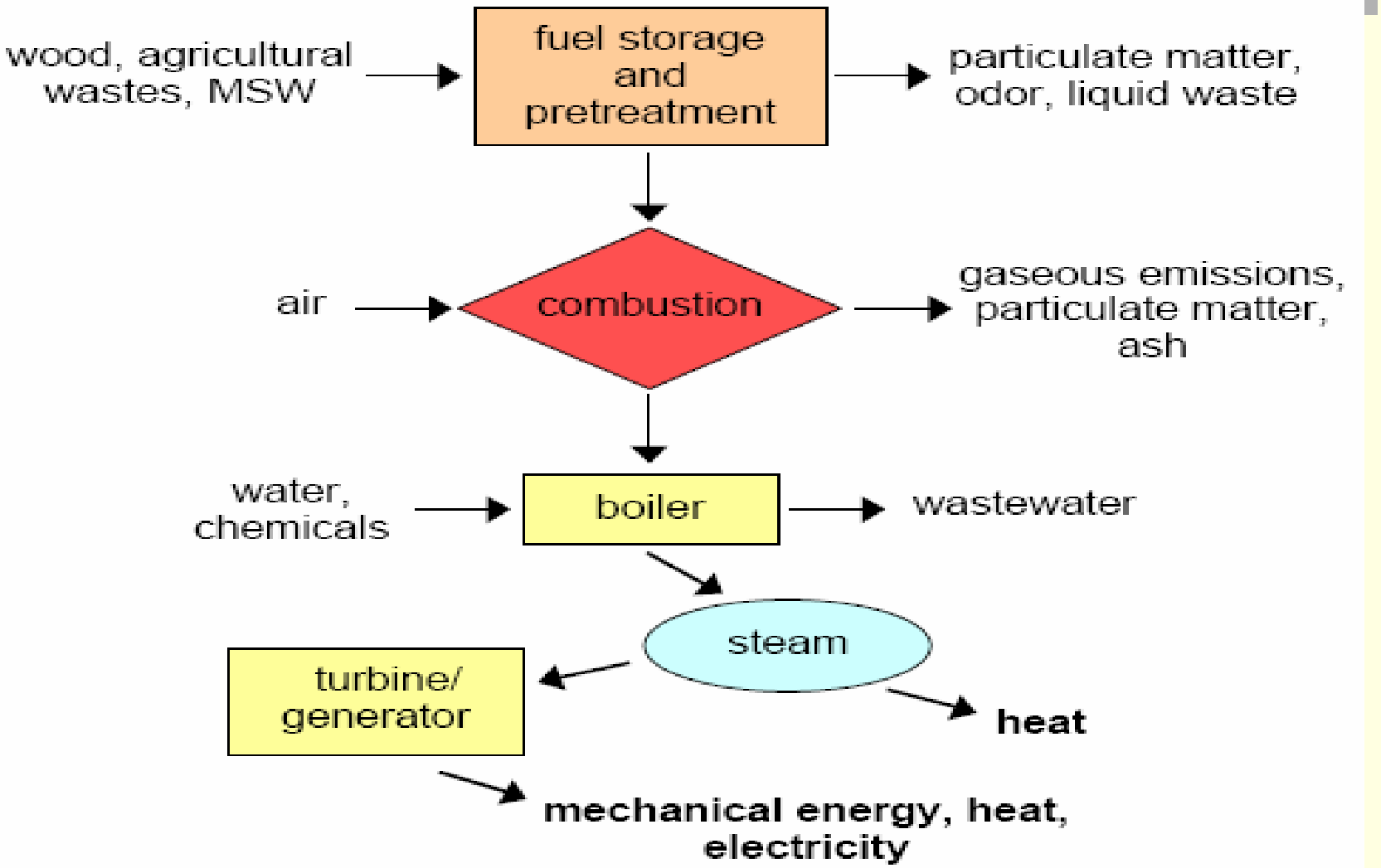


Combustion chamber and related components

Prime Mover – Turbine/Generator



Combustion And Power Generation Continued



Scale of the Technology

Industrial:

5 MW+

Commercial:

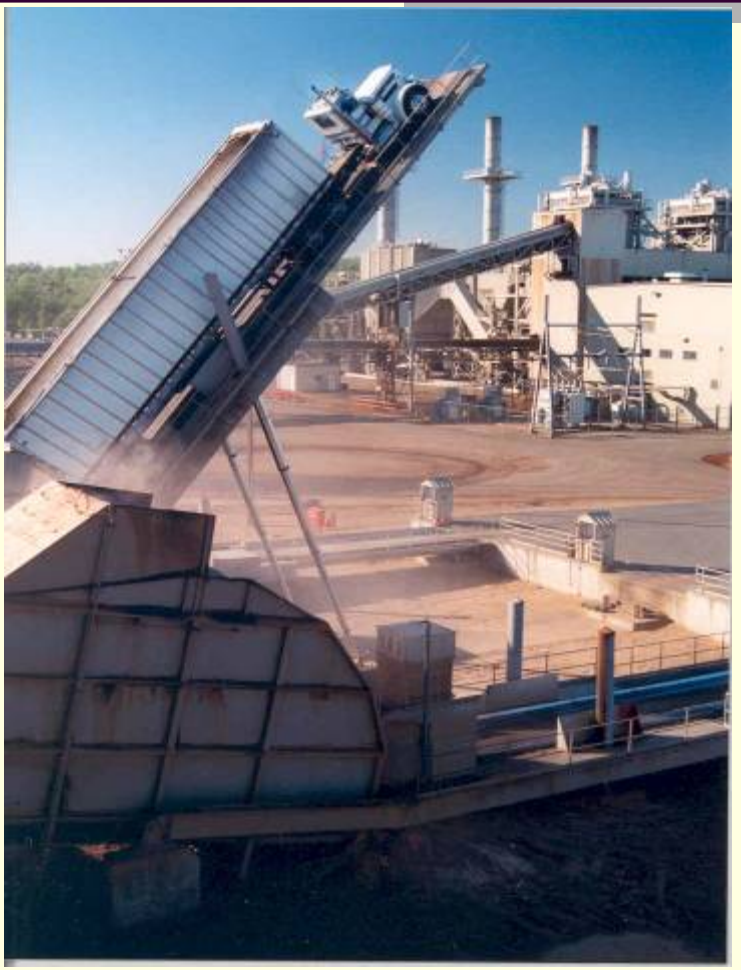
.5 to 4 MW

Small:

100 to 499 kW

Micro:

15 to 99 kW



Advanced Recycling - Challenger

Community Power Corporation

Biomass Power in North America
Current Industrial Technology

- 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.

Itasca Power 20 MW Plant
Prince Edward Island, Nova Scotia

Appropriate Technology

- Search for most appropriate technology considering project location and fuel supply
  - Ability to convert local fuel supply into heat/power
  - Must meet local permitting specifications
- Technology must be proven:
  - Commercially available
  - Operates efficiently on available fuel supply
  - Operates cleanly on available fuel supply
  - Appropriate for site and local resources

Woody Biomass Supply Sources

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

Fuel 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)

Community Support

- Best to have grass roots support
- Poll key stakeholders:
  - Local peer groups
    - County Commissioners
    - Tribal Council
    - Chamber of Commerce
    - Conservation Community
    - Local, State and Federal agency representatives
    - Private sector resource managers, landowners

Project Economics

- Sustainable and economical fuel supply
  - Fuel supply typically represents the highest variable cost for a bio-power facility
- Existing incentives
  - Production Tax Credits
  - Business Energy Tax Credits
  - Local incentives – enterprise zone
- Markets for heat and power
  - Market support justifies capital investment
- Return on investment
  - Minimum ROI of 7% (after taxes)

Siting/Infrastructure Part I

- Co-locate with existing commercial or industrial project
  - Forest products manufacturing facility that has on site demand for heat and power
- Adjacent to power transmission/distribution system
- Typical project requires at least 8 acre site

Siting/Infrastructure Part II

- Water readily available (10 + gpm minimum)
- Location incentives – Enterprise zones
- Transportation system
  - Highway
  - Rail
- Ash/Waste water disposal
- Public concerns
  - Fugitive emissions
  - Noise
  - Odor

Biomass Facility Example

- 20 MW plant produces enough power for about 20,000 homes
- New plant construction cost = $40 to 45 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

  ~ $0.06 - $0.09/kWh

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

Questions, Comments, Heckling Remarks ?

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