Developing Commercial Scale Bioenergy Projects, Some Steps to Consider

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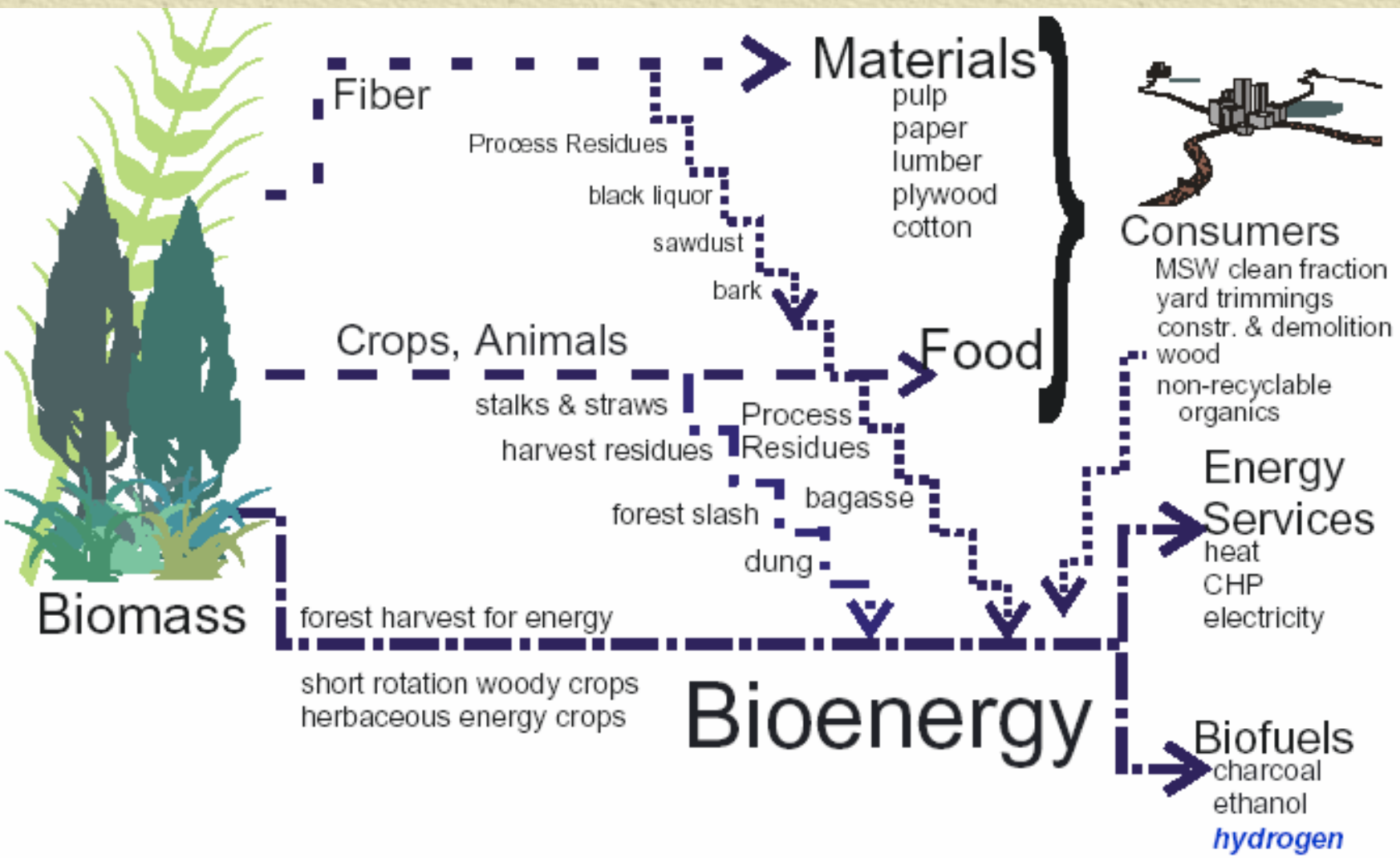
Overview

- Introduction
- Conversion Technology
- Initial Steps
- Some Lessons Learned
- Ten Basic Steps to Consider

Biomass – Organic matter in trees, agricultural crops and other living plant material.

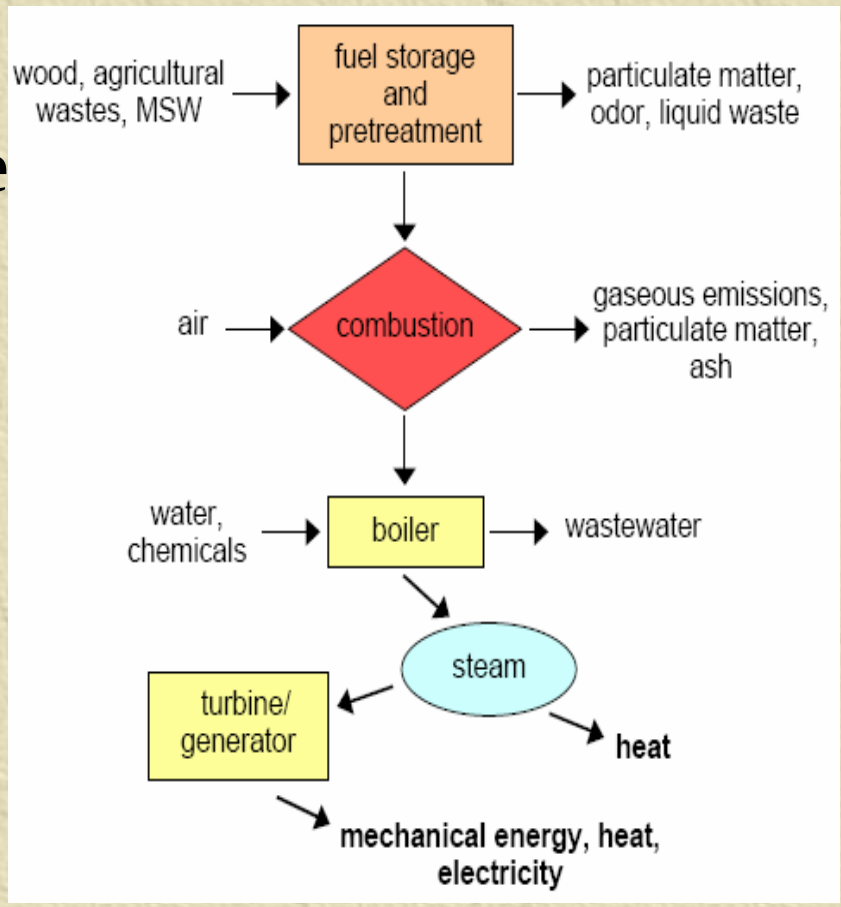
Mapping the Territory



With grateful acknowledgements to Bob Shleser

Combustion

- Most commercial biomass power applications today use direct combustion to produce steam to run turbine generators



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

Biomass Energy – Some Rules of Thumb

- 1 MW (1,000 kW) is enough power for 1,000 homes.
- Biomass fuel is purchased on a Bone Dry Ton basis.
- Typical amount of biomass recovered during fuels treatment is 10-14BDT/acre.
- Typical “burn rate” is 1 BDT/MW hr.
- 10MW plant consumes 10 BDT/hr.
- Assuming that 14 BDT/ac is recovered, a 10 MW plant would purchase biomass from the treatment of around 5,600 acres/year.

Scale of the Technology

Industrial:

5 MW+

Commercial:

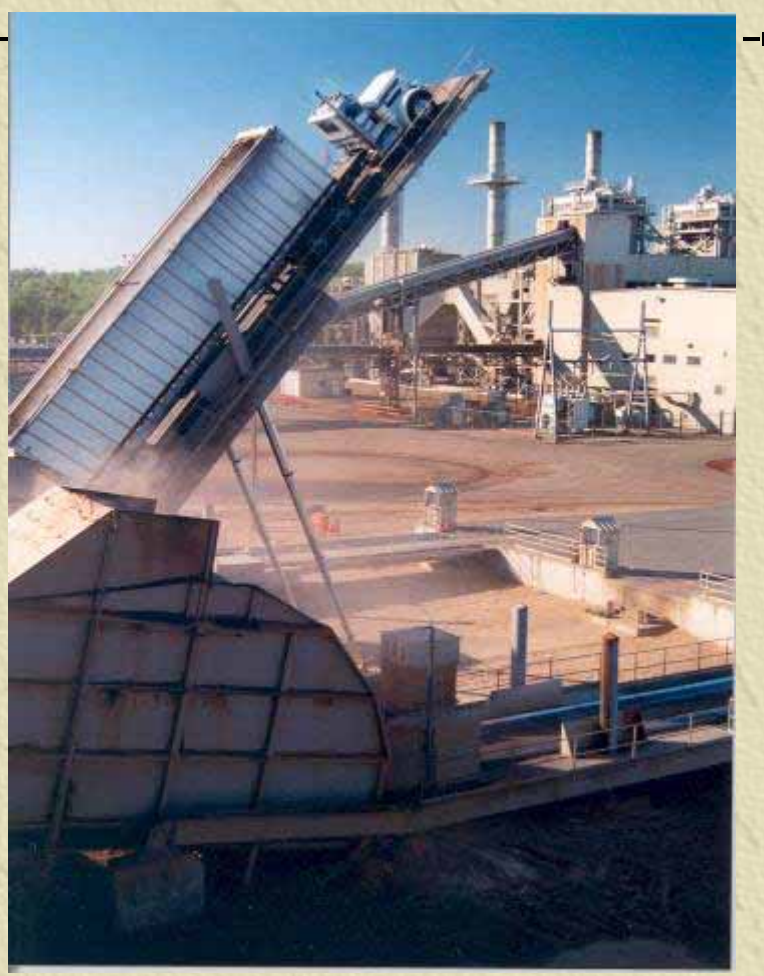
.5 to 4 MW

Small:

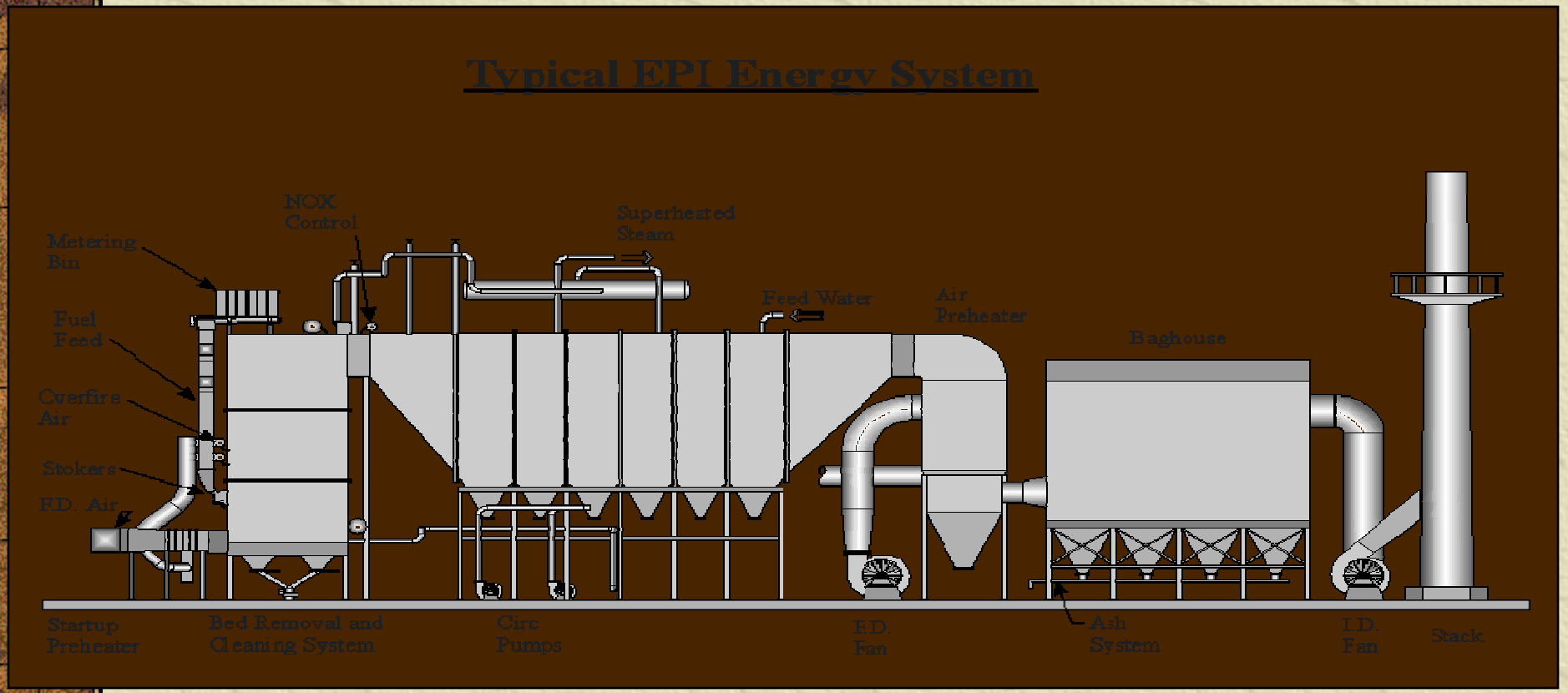
100 to 499 kW

Micro:

15 to 99 kW



EPI System Technology



Preliminary Feasibility Study

- Approach – Fatal Flaw Analysis (look for the deal killers).
- Components:
  - Community Support
  - Fuel Resource Availability
  - Appropriate Technology Review
  - Siting Analysis
  - Environmental Review
  - Preliminary Economic Analysis

Preliminary Feasibility Study Objective

Assess the feasibility of a sustainable energy project using locally available biomass resources.

Community Support

- Best to have grass roots support. Pride of ownership carries well.
- Poll key stakeholders:
  - Local peer groups
    - Bd of Supervisors
    - Chamber of Commerce
    - Conservation community
    - Local, State and Federal agency representatives
    - Private sector resource managers, landowners

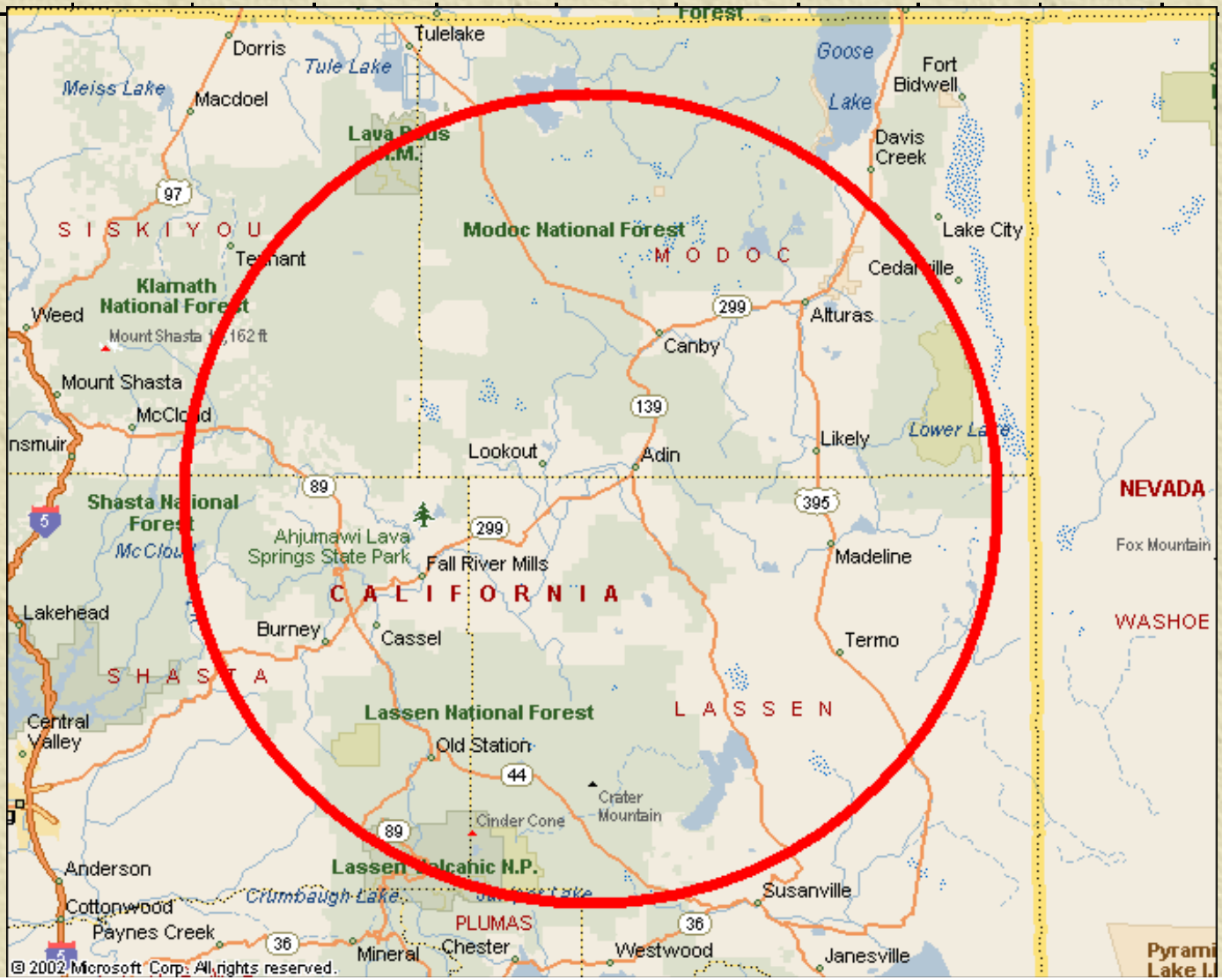
Fuel Resource Review – Typical Fuel Types

- Woody biomass from fuels treatment/harvest activities
- Woody biomass residuals from forest products manufacturing operations
- Urban wood (C&D, trimmings)
- Ag by-products (shell, prunings, pits)

Fuel Resource Review – cont.

- Sustainable long term supply located within close proximity (25 to 75 mile radius)
- Environmentally available
  - Environmentally available over the long term
- Economically available
  - What are the costs to collect, process and transport to a facility
  - Are there competing uses for the potential fuel/feedstock
- Meets quality specifications
- Available in quantities and from diverse sources that support project financing:
  - Minimum 10 year supply, 70% under contract
  - Quantities that are 2 – 3 times minimum volume for plant operation

Target Study Area – Shasta County, California



Appropriate Technology Review

- 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

Sitting/Infrastructure Part I

- Co-locate with existing commercial or industrial project
  - Forest products manufacturing facility
  - Coal fired power generation facility
- Sites past uses consistent with biomass plant operation
  - Abandoned forest products manufacturing site
- Typical project requires at least 20 acre site

Siting/Infrastructure Part II

- Water readily available (10 + gpm min)
- Location incentives – Enterprise zones
- Transportation system
  - Highway
  - Rail
- Ash/Waste water disposal
- Public health and safety
  - Fugitive emissions
  - Noise

Siting/Infrastructure Part III

- Natural gas available
- Air quality standards
- Cultural resources
- Biological resources
- Power sales and interconnection
  - Power substation nearby
  - Transmission/distribution available

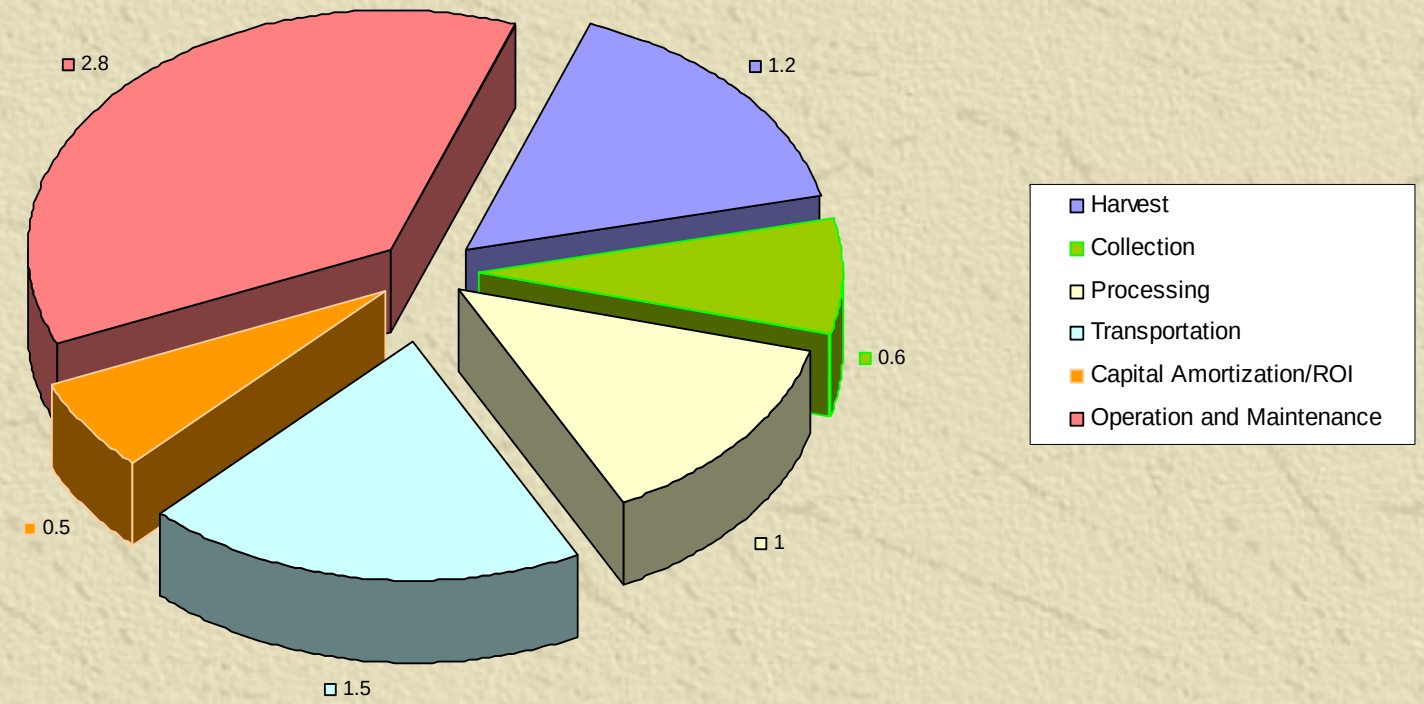
Environmental Review & Principal Environmental Issues

- Air Quality
- Land Use
- Water Use
- Transportation
- Visual/Aesthetics
- Noise
- Solid Waste Disposal

Preliminary Financial Analysis

- Markets for heat and power
  - Market values support justifies capital investment
- Delivered cost of fuel
- Operating/Maintenance costs
- Return on investment
  - Minimum ROI of 19%
- Economies of scale
  - Combustion efficiencies
  - Labor and overhead

Cost Centers from Forest to Bus Bar = 7.6¢/kWh



Nechodom, Mason & Hartsough *in press;* TSS Consultants *Unpubl.*

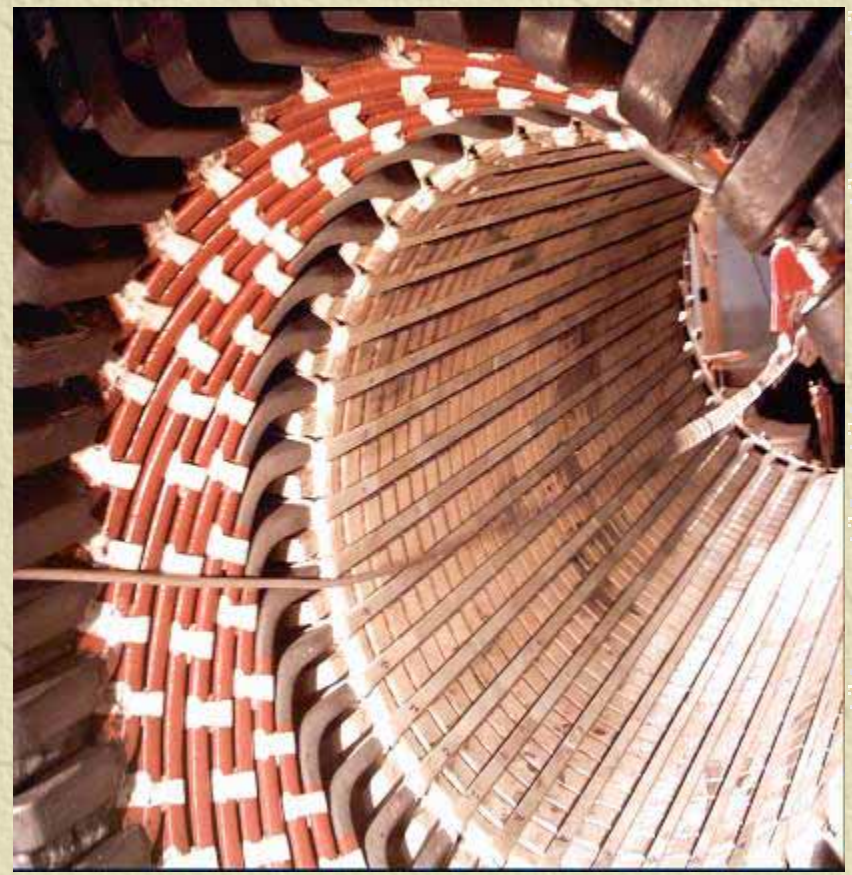
Lessons Learned/Observations

- Do not over sell
- Do not set project scale before assessing fuel resource
- Expect 24 to 36 months for successful project development
- Community involvement is key

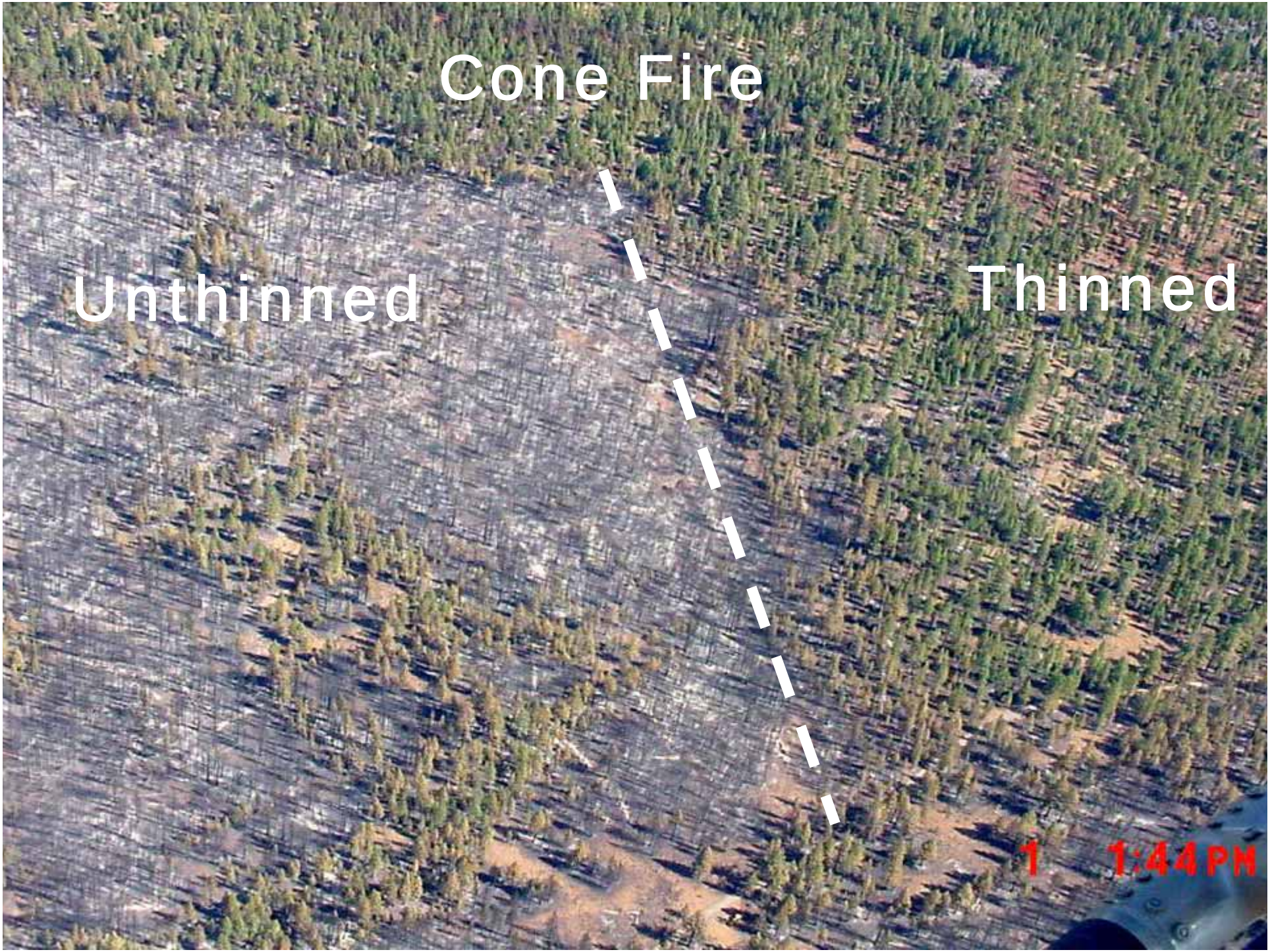
Project Development Steps Part I

- 1.Conduct preliminary feasibility study
- 2. Confirm community support
- 3.Assess fuel resource availability
- 4.Consider siting and infrastructure issues
- 5. Complete due diligence Feasibility Study

Observations on Next Steps Part II



- 6. Secure developer and /or equity partners
- 7. Secure power purchase agreement/thermal delivery agreement
- 8. Secure financing
- 9. Engineer/construct project
- 10. Generate renewable energy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