

BIOMASS ENERGY CONVERSION TECHNOLOGIES AND TRENDS IN CALIFORNIA



Sierra Nevada Alliance

Sept. 21, 2012

Tad Mason, TSS

Presentation Overview

- Introduction
- What is Biomass
- Woody Biomass Utilization
- Conversion Technologies
 - Combustion
 - Gasification
- Advantages/Societal Benefits
- Community Scale Project Example



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 per the Federal Energy Act of 2005.



Woody Biomass Utilization

A variety of value-added end uses have evolved over time – Some are commercially proven and some are still in the RD & D Phases.

- Lumber products, composite panels, pulp
- Soil amendments
- Densified fuel pellets
- Animal Bedding
- Landscape cover
- Biofuels (ethanol, renewable diesel)
- Biomass power (generation or cogeneration)

Biomass Power – Some Rules of Thumb

- 1 MW (1,000 kW) is enough power for 800 to 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” for a biopower facility is 1 BDT/MW hr.
- 10MW biopower plant consumes 10 BDT/hr.
- Biopower facilities are designed to operate 24/7 and deliver baseload power. Power utilities purchase the power under LT contracts.

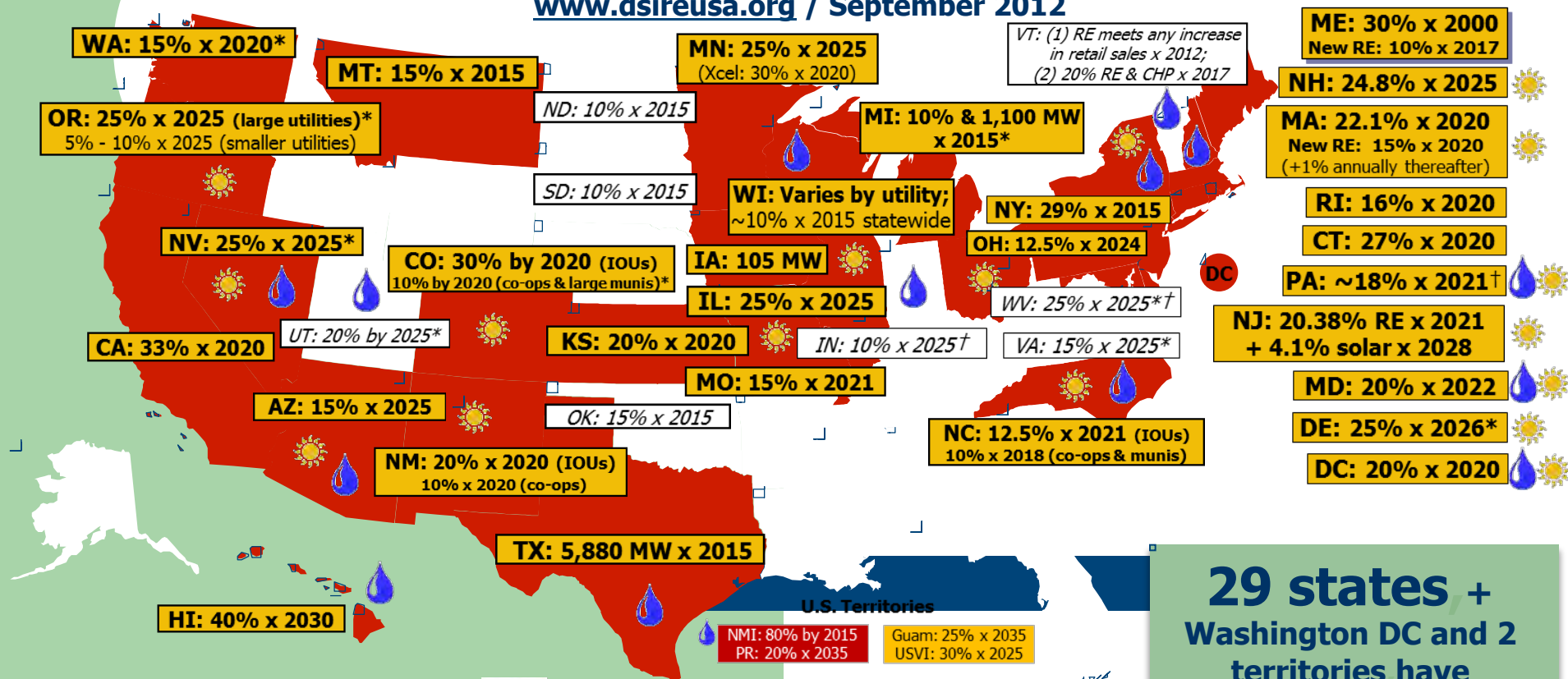
Abbreviated History of the California Biomass Power Sector

- PURPA 1978
- Market response – 60 new biopower plants.
- Power contract buyouts.
- Currently 33 biopower plants, 28 operating.
- RPS – 33% renewable by 2020.
- Feed in tariff program.



Renewable Portfolio Standard Policies

www.dsireusa.org / September 2012



- Renewable portfolio standard
- Renewable portfolio goal
- Solar water heating eligible



Minimum solar or customer-sited requirement



* Extra credit for solar or customer-sited renewables



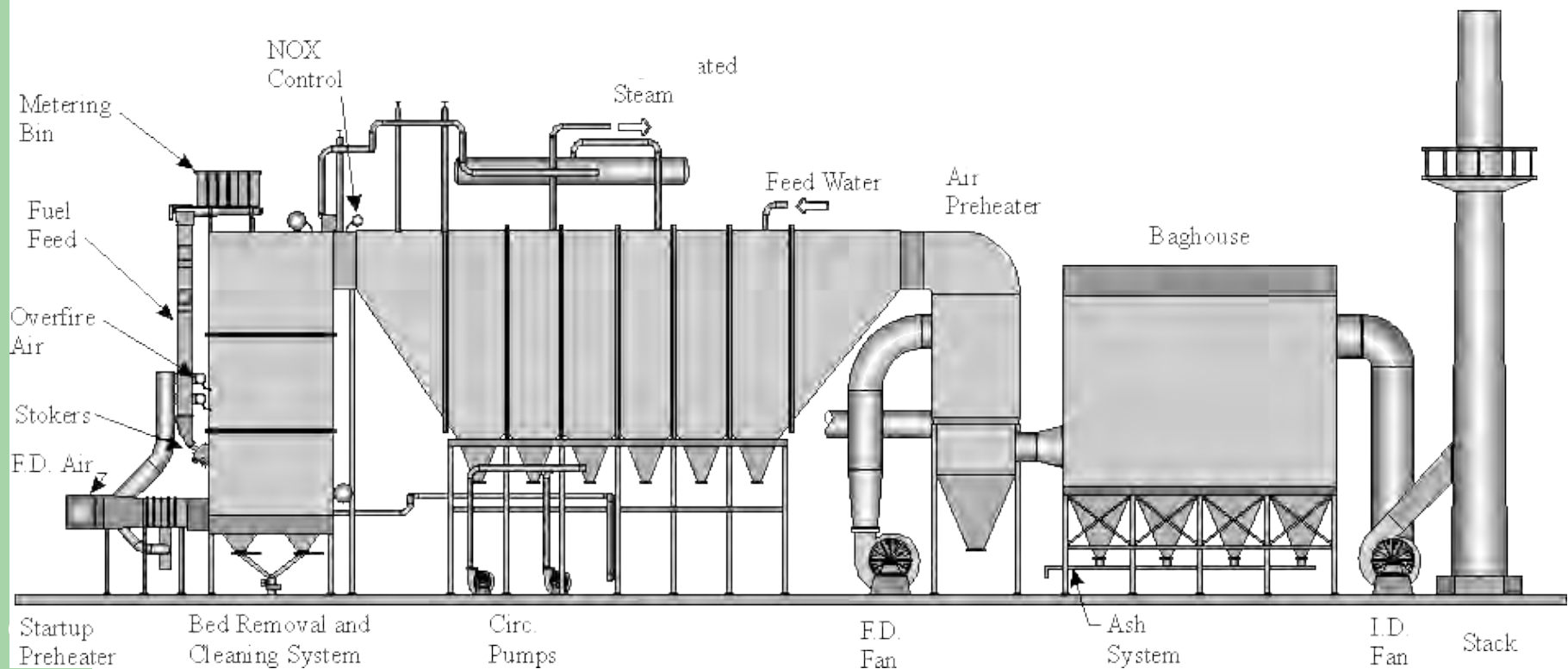
† Includes non-renewable alternative resources

**29 states +
Washington DC and 2
territories have
Renewable Portfolio
Standards**

*(8 states and 2 territories have
renewable portfolio goals)*

Current Combustion Technology

Typical EPI Energy System





Burney Forest Power 31 MW CHP at Burney, CA

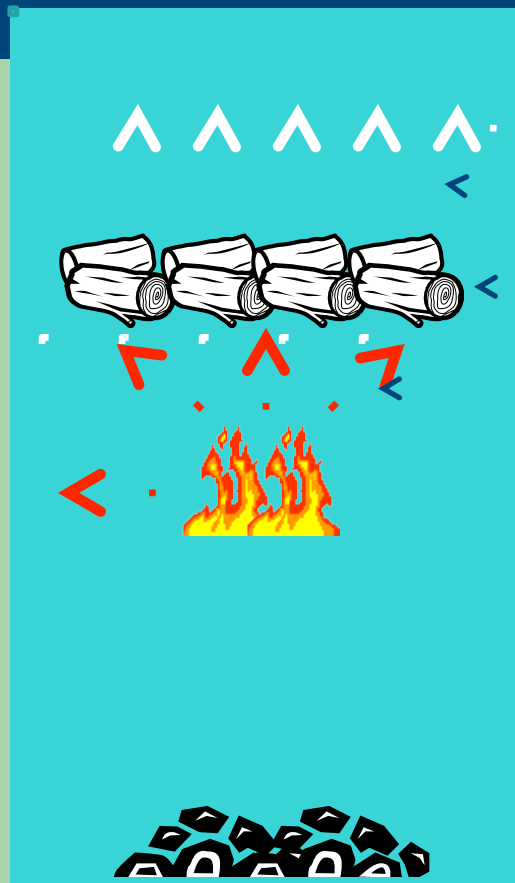
Small Scale Combustion



3.5 MMBtu/hr Advanced Recycling

Gasification

Updraft



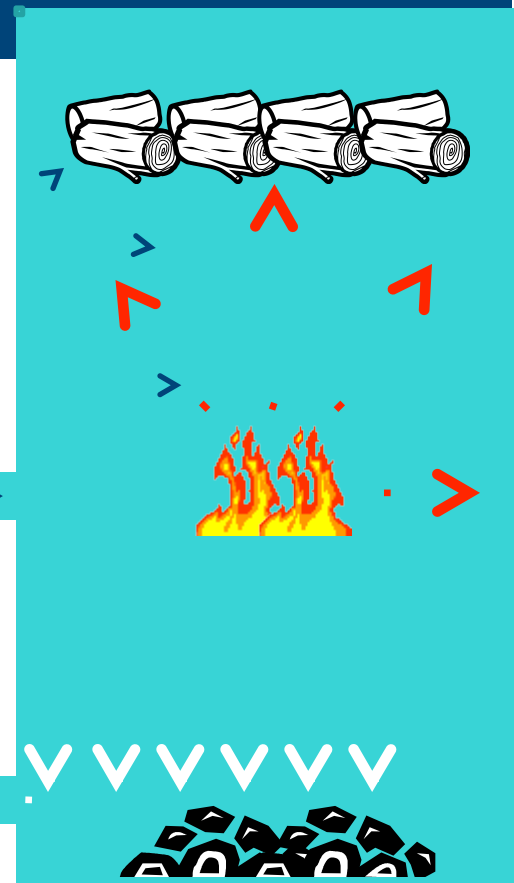
· Gas ·
· Feedstock ·
· Heat ·

Air Intake

· Syngas ·
· Capture ·

· Biochar ·

Downdraft





Community Power Corp Gasifier - 12.5 KW,
Philippines



Community Power Corp BioMax 50 kWh CHP at
Dixon Ridge Walnut Farm, Winters, CA



Phoenix Technologies Biomass 500 kWh
Gasification Unit at Merced, CA

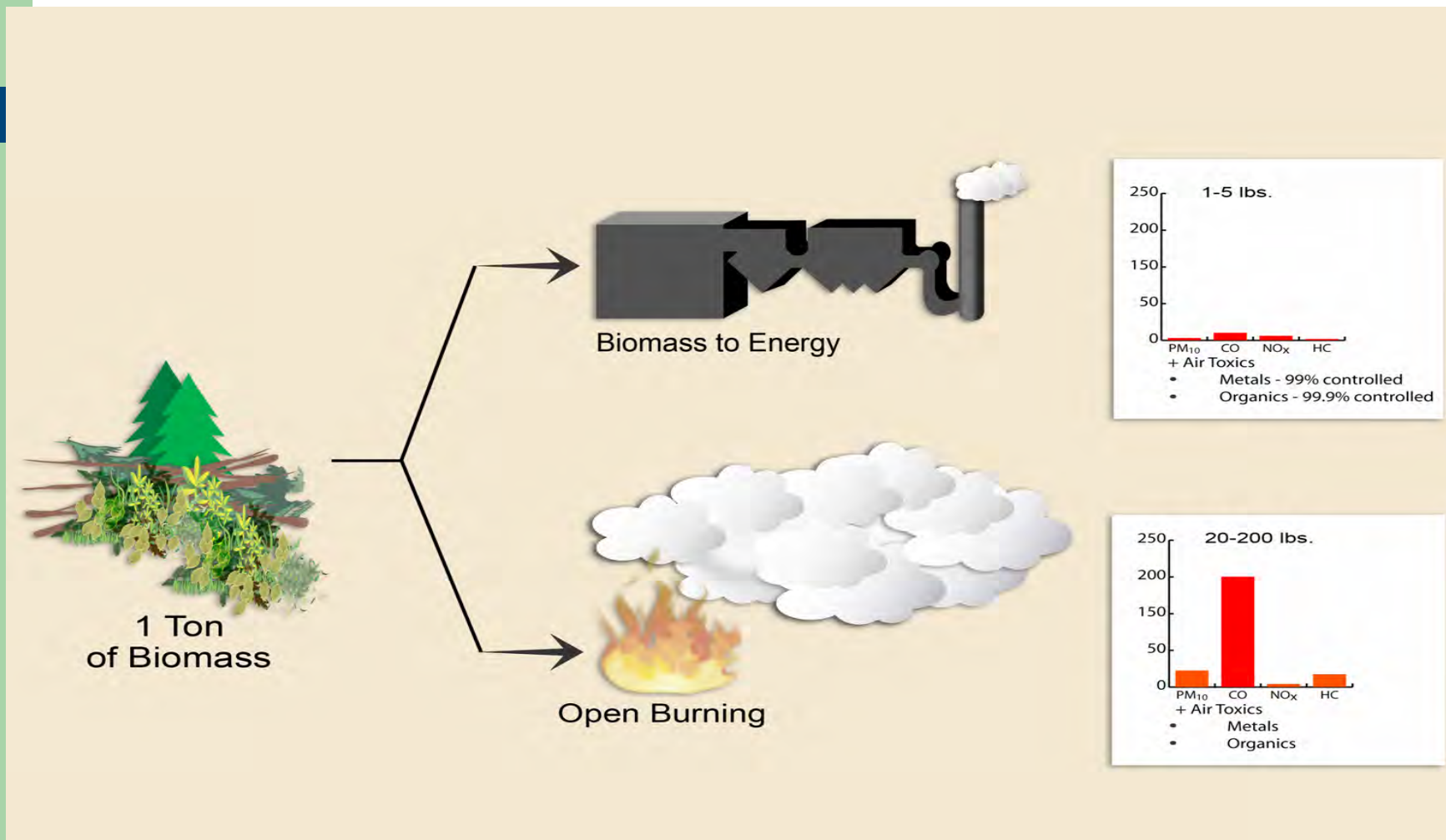
Community Scale Biopower Facility Example

- 1 MW project being considered at North Fork, California.
- New plant construction cost = \$4 to \$5 million.
- Consumes about 23 BDT/day (about 1BDT/MW/hour burn rate).
- Biomass transported about 30 miles (maybe farther).
- Delivered biomass fuel cost at \$45 to \$60 per BDT
- Average electrical energy production cost
~ \$0.14 - \$0.16/kWh

Advantages of Biomass Power Generation

- 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

Improving Air Quality

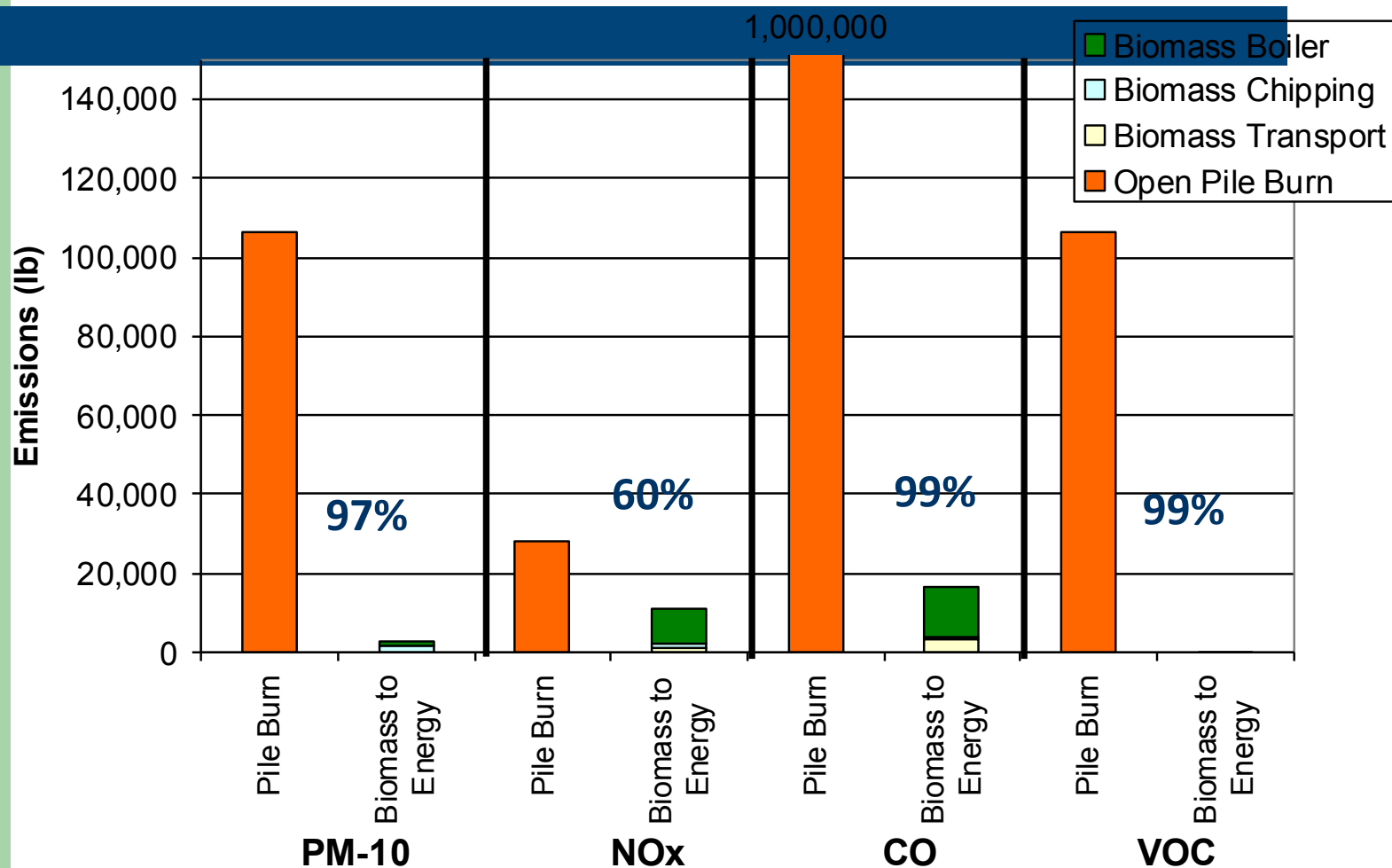




Biomass Project Air Benefits

Criteria Air Pollutants

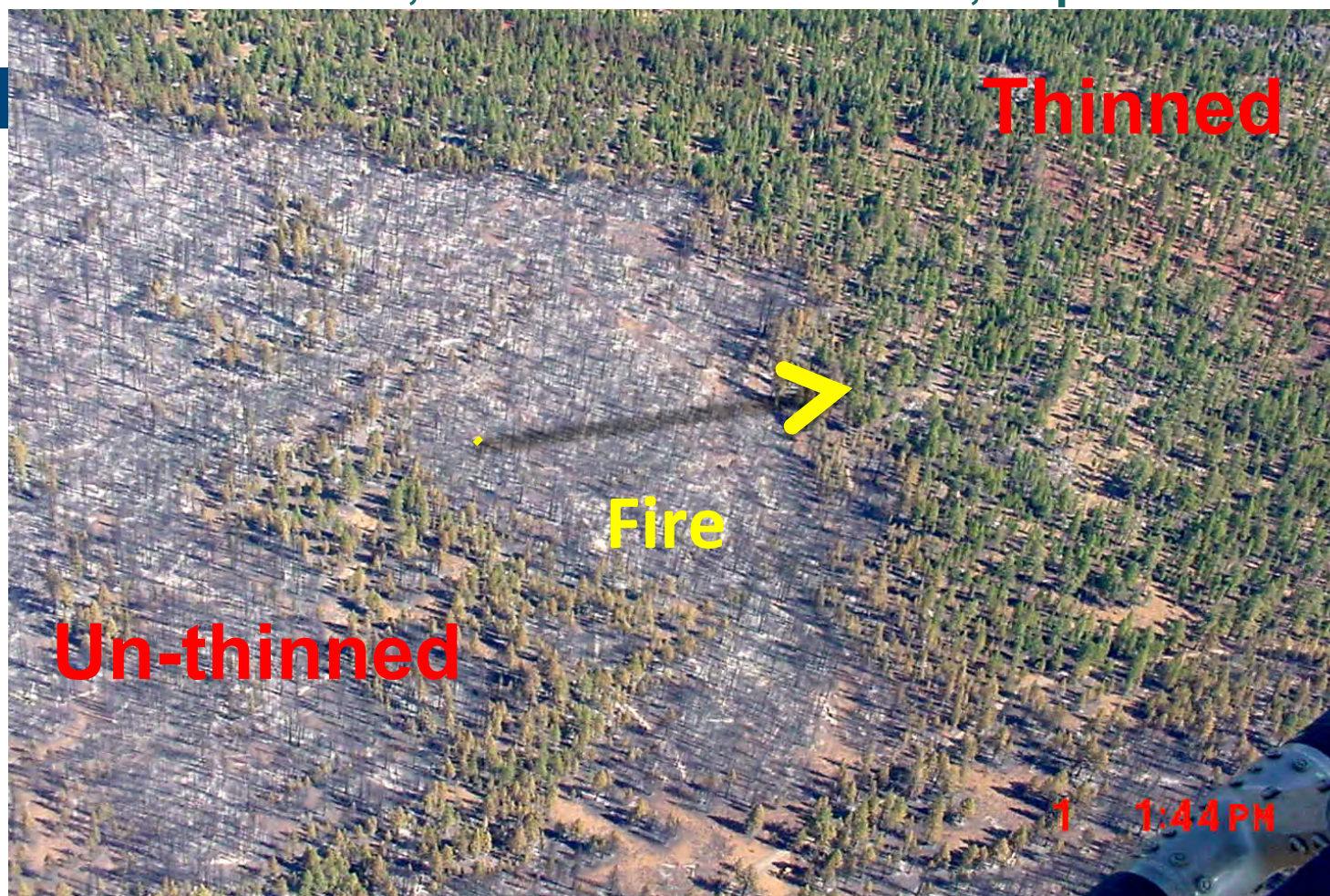
Results from biomass energy project that processed 6,800 BDT biomass from thinning project on USFS Tahoe National Forest American River District





Positive Effects of Fuel Treatments

Cone Wildfire, Lassen National Forest, Sept 2002





Tad Mason, CEO
TSS Consultants
2724 Kilgore Road
Rancho Cordova, CA 95670
916.266.0546
tmason@tssconsultants.com
www.tssconsultants.com