BIOMASS POWER GENERATION IN CALIFORNIA – AN OVERVIEW

NAEMI Biomass & Business Training Workshop

May 17, 2006

Frederick Tornatore & Tad Mason

TSS Consultants

www.tssconsultants.com

Definition

- **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

Pioneering Efforts – Biomass Utilization

California Experience – Early Days

- Initial biomass plants developed in response to air quality/waste management issues.
- All biomass plants were co-located and generally operated as CHP.
- Most biomass waste was disposed of in landfills or burned in the open.

Along Comes PURPA

- Public Utilities Regulatory Policy Act of 1978:
  - Requires that investor owned utilities must purchase privately produced power at "avoided cost" rates.
  - Created the market context that stimulated the development of the independent power industry in the US.

Other Incentives

- Renewable energy incentives of 1970's and 1980's caused renewed interest and development:
  - Investment tax credits
  - Energy tax credits
  - CA tax incentives

California Private Sector Response

- Within 15 years approximately 1,000 MW of biomass power was developed and brought into service (60+ facilities). Enough renewable energy for about 750,000 homes.
- Consumed biomass fuel at the rate of around 15,000,000 GT/year:
  - Forest-sourced biomass
  - Agricultural waste
  - Urban wood

Scale of the Technology

Industrial:

5 MW+

Commercial:

0.5 to 4 MW

Small:

100 to 499 kW

Micro:

15 to 99 kW

PURPA Contracts – Standard Offer 4 and the Boom Years

- 30 year contracts let from 1983 – 1985.
- First 10 years at fixed rates ($.07 -.13/kWh).
- Year 1- 10 rates based on energy forecasts with prices escalating well into future.
- Year 11 – 30, rates are based on wholesale energy rates (most floated based on natural gas rates).
- Power producers need to meet certain firm delivery standards to be considered a qualifying facility (QF).

Biomass Cost of Electricity

Year --- >	1990	2000	2010	2020
		(cents/kWh)		
Utility Scale and Large Distributed Power				
Cofiring (incremental)	NA	2 - 4	1 - 3	1 - 2
Direct-Fired Biomass	10 - 15	8 - 12	7 - 8	6 - 7
Gasification	NA	6 - 8	5 - 7	4 - 6
Small Modular - Distributed Generation				
Solid Biomass	NA	15 - 20	8 - 12	6 - 10
Biogas	NA	8 - 12	5 - 8	2 - 8

Source: Biopower Technical Assessment: State of the Industry and Technology, March 2003

Then Came the Bust

- With the 1986 world oil market crash SRAC prices fell to half their previous levels.
- Standard Offer 4 contract rates fell.
- Few SO 4 contracts let after 1985.

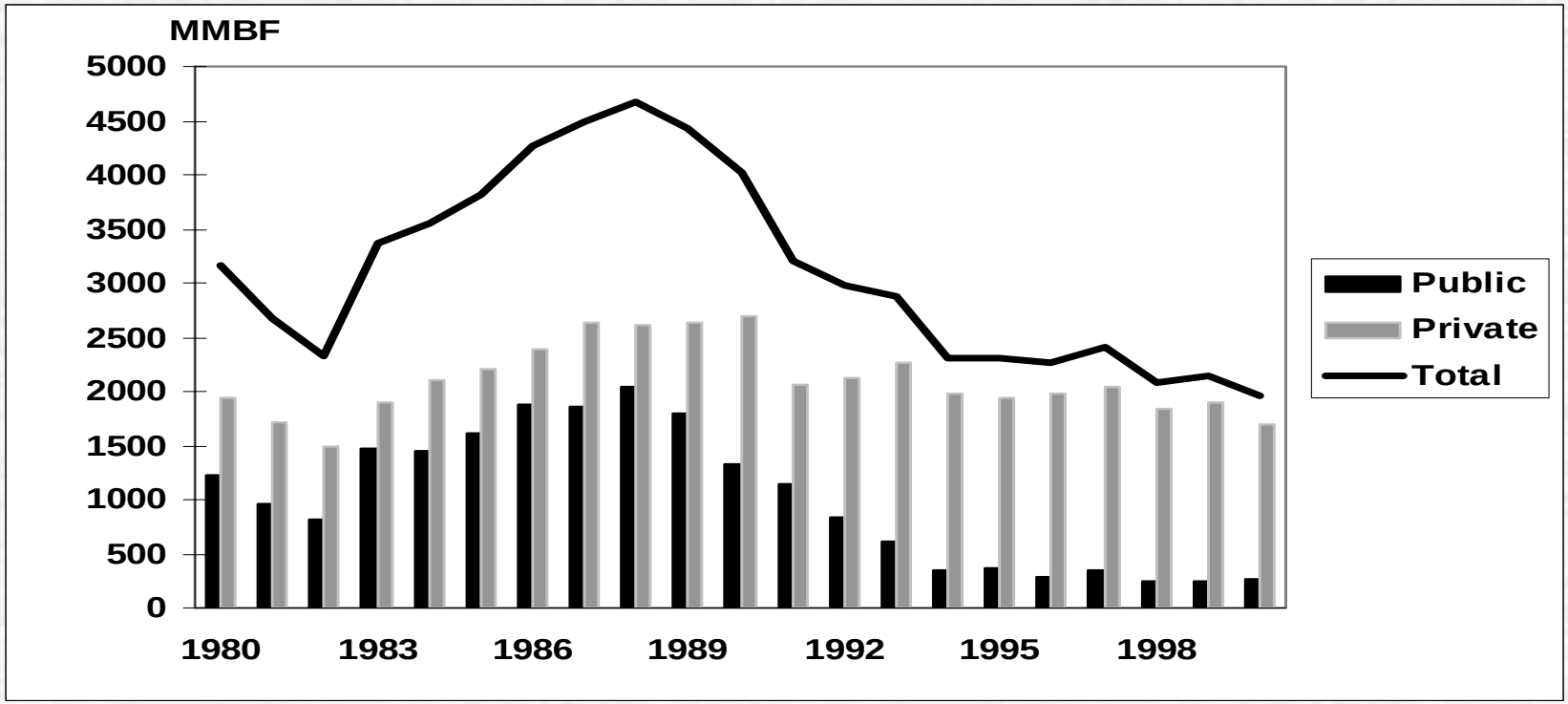
After the Bust

- Utilities provide cash incentives to buy back SO 4 contracts.
- Some plants went down, some curtailed operations.
- Plants that were smaller, less efficient or had poor access to fuel were closed.
- Plants that transitioned into year 11 sought out cheaper fuel sources.
- Electrical utility deregulation loomed large.

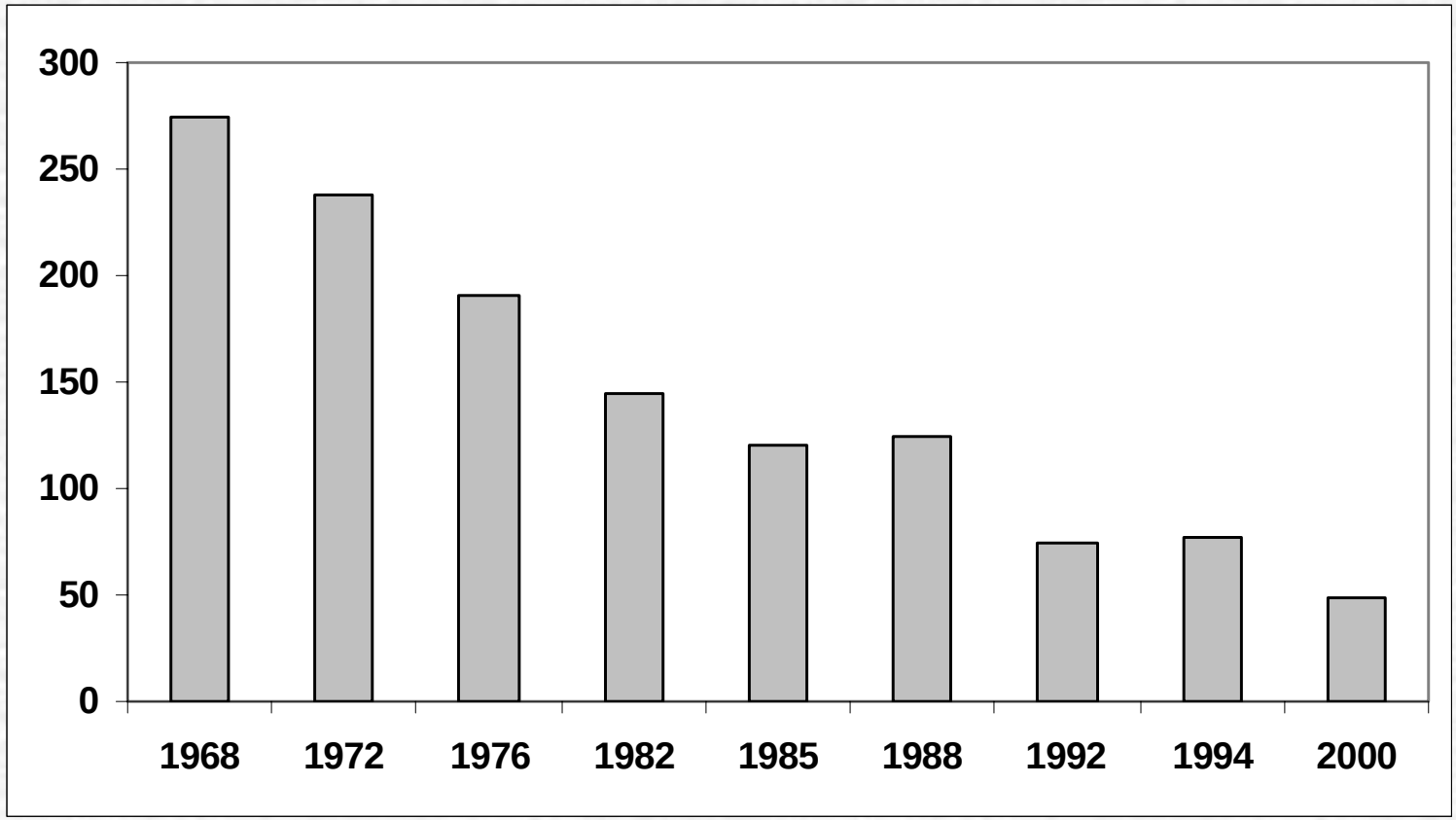
California Experience – Current Situation

- Approximately 30 plants operational.
- Produce almost 650 MW (enough power for about 500,000 homes).
- Consume around 10,000,000 GT/year:
  - forest biomass
  - agricultural biomass
  - urban biomass
- Generate revenue based upon a variety of power purchase agreements – non-PURPA rates – most on a fixed rate of around $.0537/kWh. Term out in June, 2006.

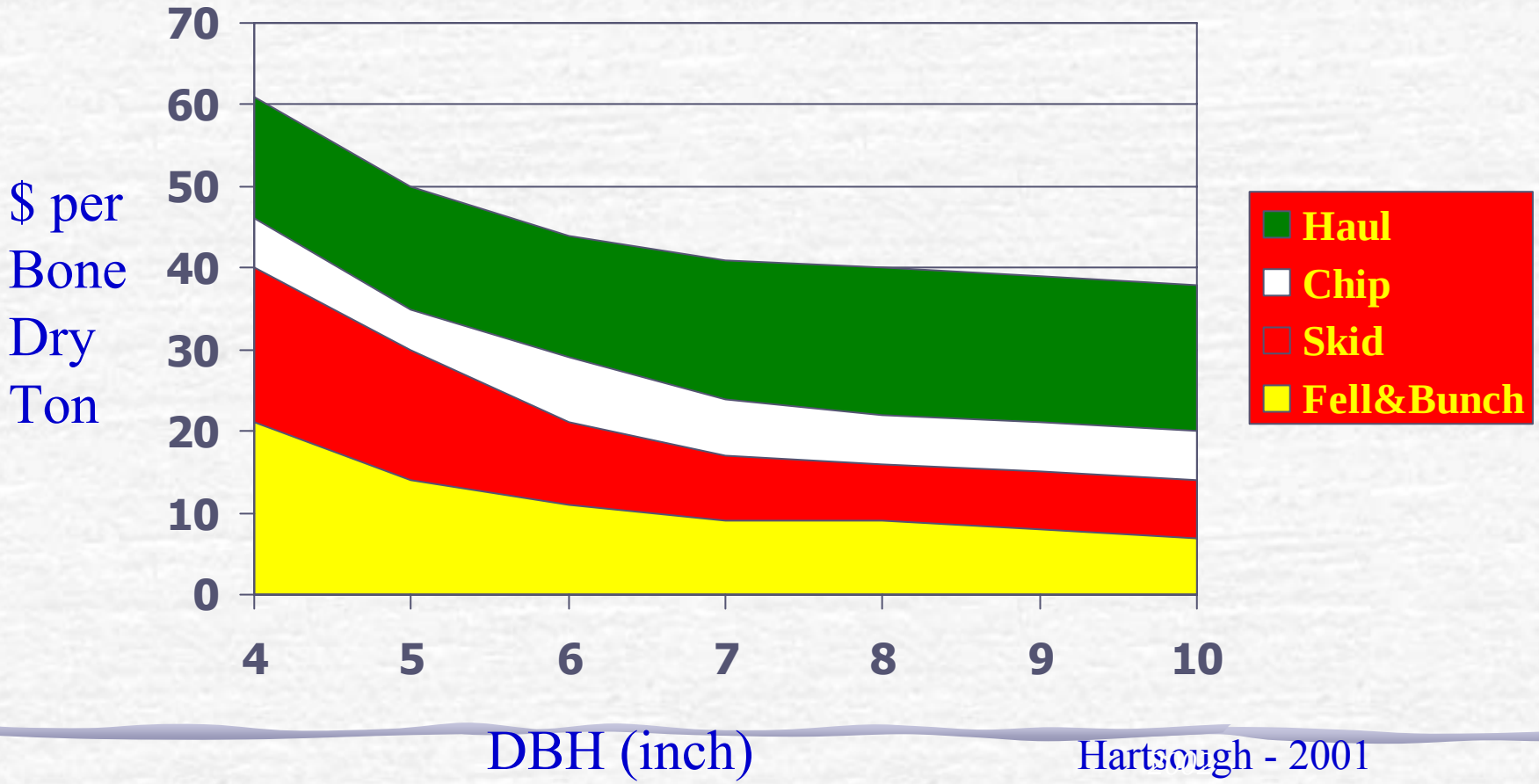
CA Timber Harvest



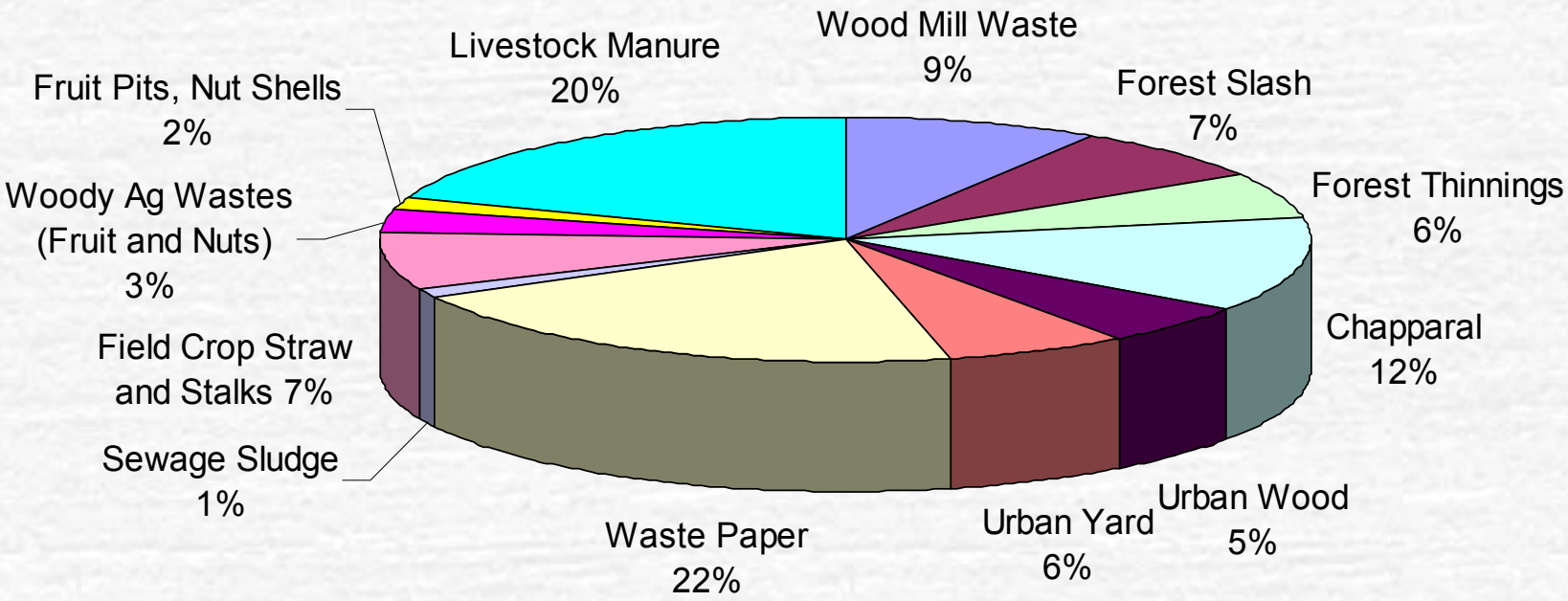
Number of mills in CA



Costs for Chipping Operation



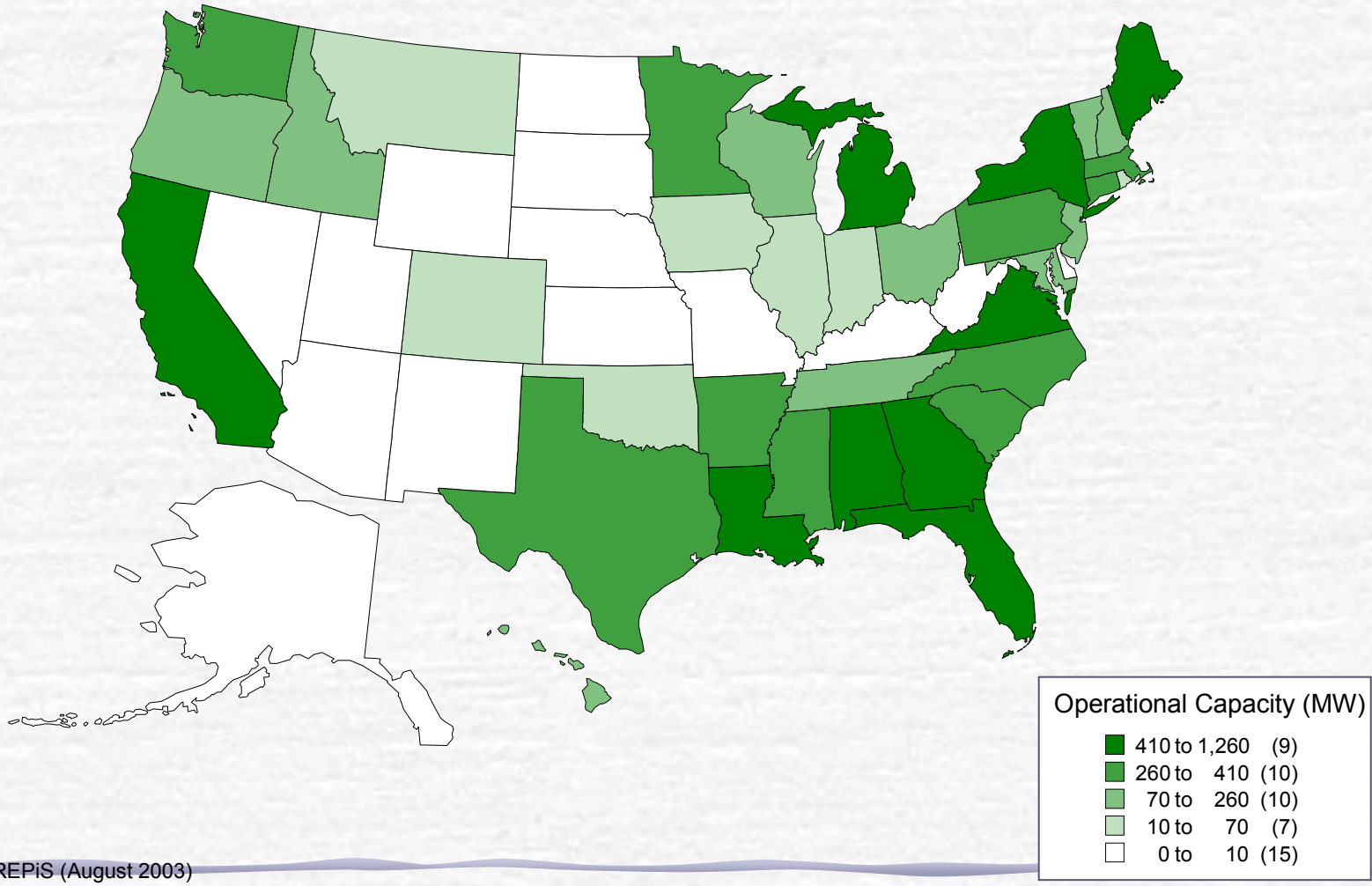
Opportunities for Biomass Utilization in California



Over 100 million GT of biomass are generated each year in California

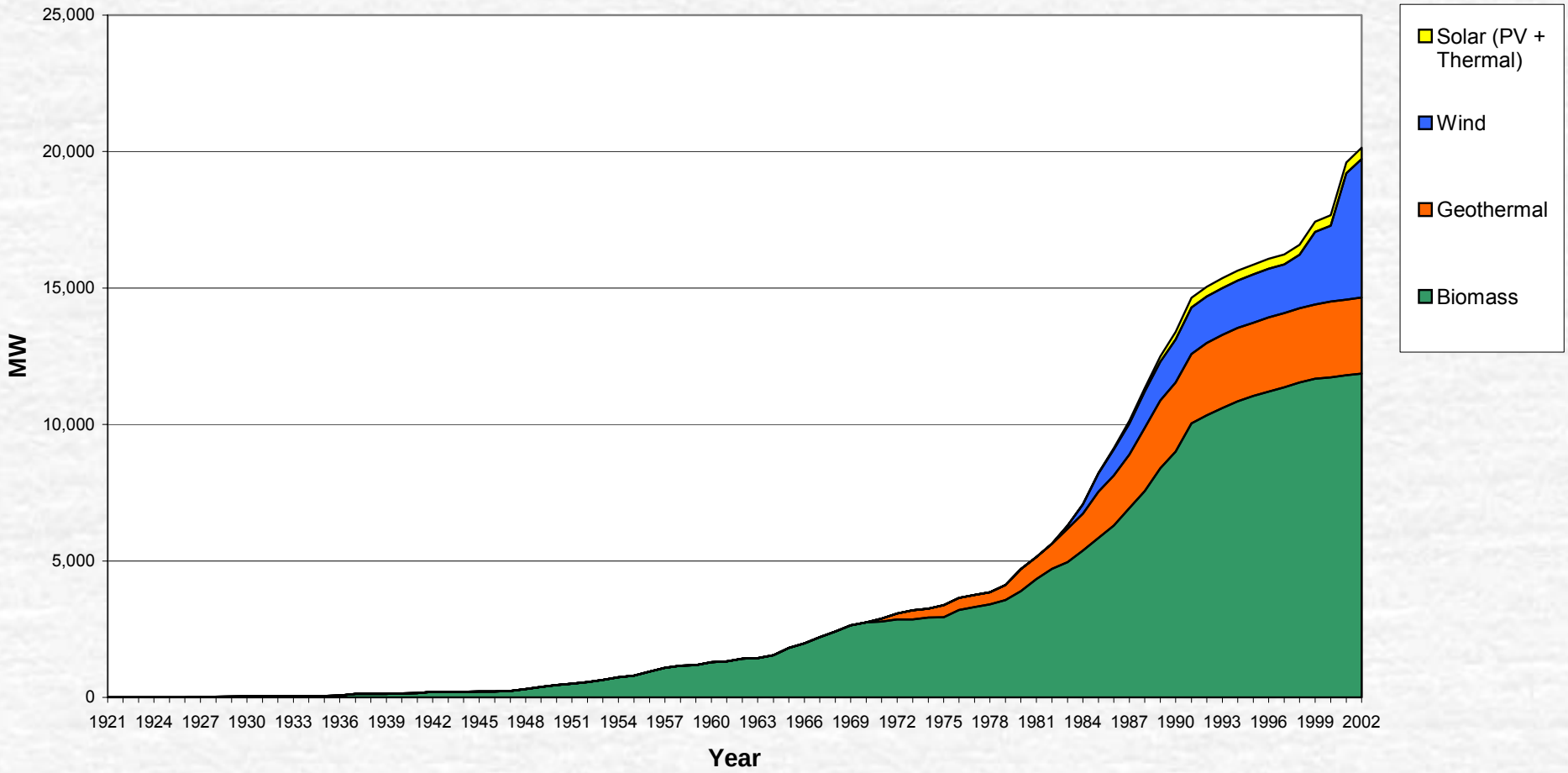
Source: Overview of the Biomass Energy Industry in California. Tiangco, Valentino Ph.D, California Energy Commission, February 19, 2002

Operational Biomass Capacity in the U.S.



Source: REPiS (August 2003)

CUMULATIVE OPERATING CAPACITY
Non-Hydroelectric Renewables
(Source: REPiS - August 2003)



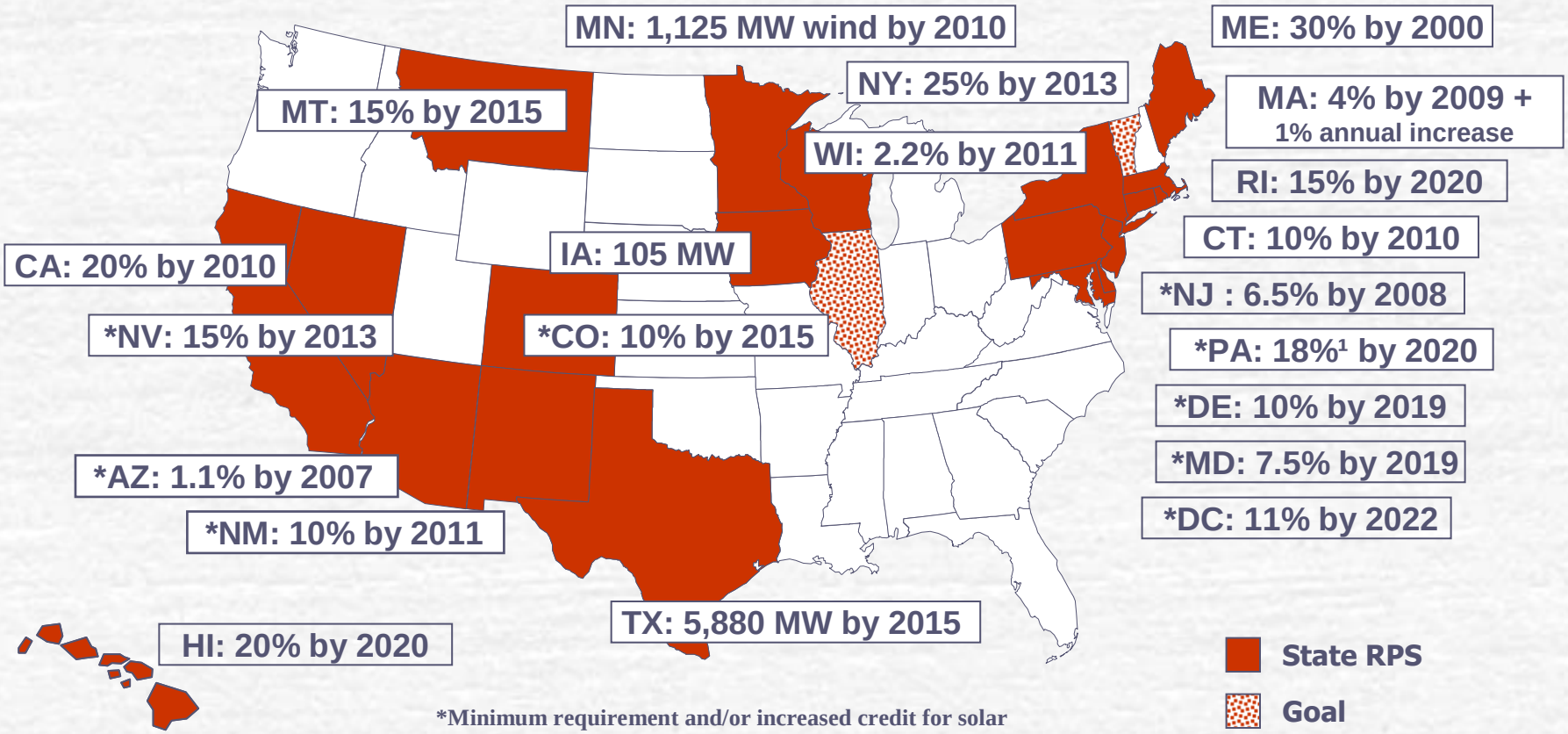
CA Renewable Energy Legislation

- SB 1078 Renewable Energy Portfolio Standard
  - Mandates 20% renewables by 2017 (now 20% by 2010)
- SB 1038 – Funding of Renewable Portfolio Standard and Public Interest Energy Research
  - Funding existing and emerging renewable resource technologies
- AB 58 – Net metering interconnection deadlines
  - Extend net metering terms to installations completed by 9/30/2003

CA Policy Actions – Some Good News

- Renewables Portfolio Standard
  - Imposes minimum renewables content requirement on all suppliers.
    - Can determine quantity of renewables to be supplied
    - Market-based approach
    - Suppliers will seek out lowest-cost resources
    - CA Governor's Executive Order S-06-06

Renewables Portfolio Standards

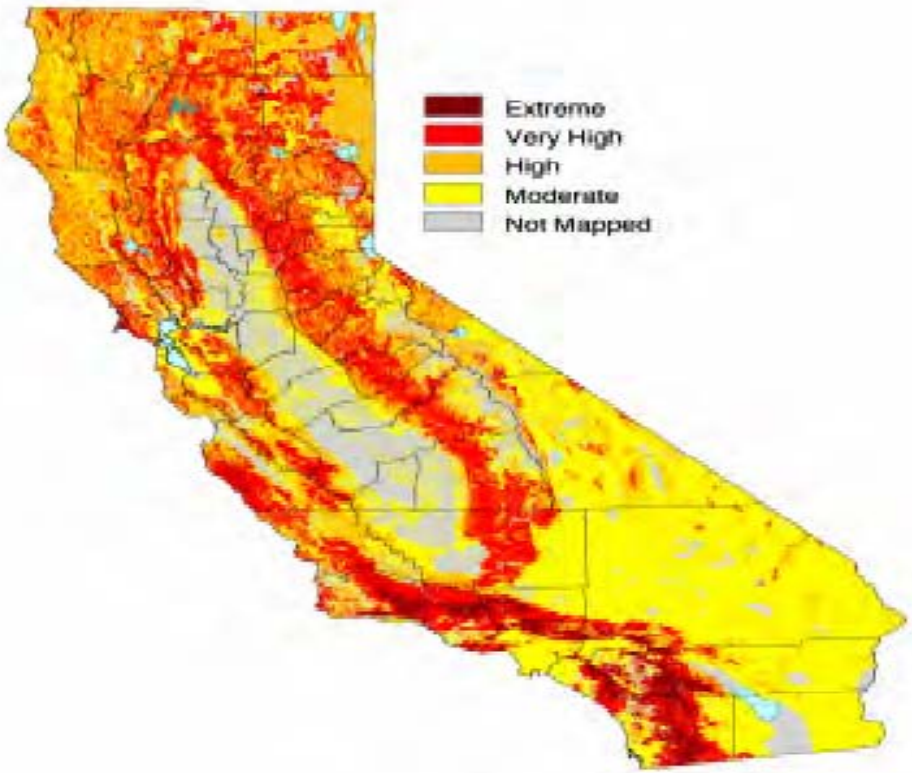


*Minimum requirement and/or increased credit for solar

[1] PA: 8% Tier I, 10% Tier II (includes non-renewable sources)

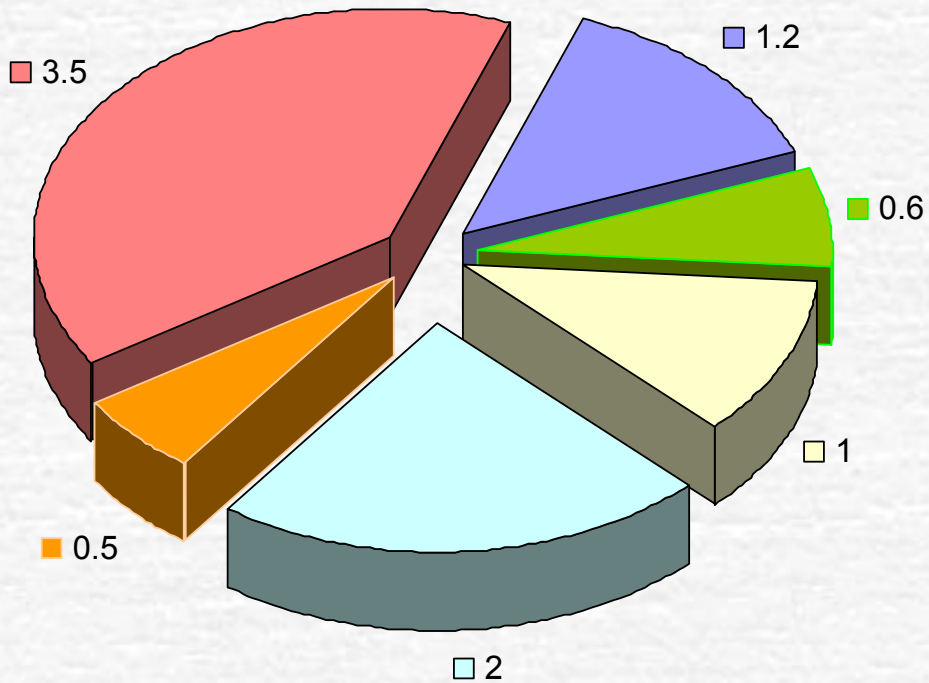
March 2006

Statewide fire threat



Source: FRAP, 2003

Cost Centers from Forest to Bus Bar = 8.8¢/kWh



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

Other utilization Opportunities - Ethanol as an Fuel Additive

- MTBE has been phased out as an oxygenate in re-formulated gasoline.
- Ethanol is selected as primary substitute for MTBE.
- Biomass to ethanol fuels technologies appear promising.

Biomass Project Development - Deal Killer Issues to Consider

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

Community Support

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

Fuel Supply

- Sustainable long term supply located within close proximity (25 to 75 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
  - Quantities that are 2 – 3 times minimum volume for plant operation

Project Economics

- Markets for heat and power
  - Market support justifies capital investment
- Return on investment
  - Minimum ROI of 17%
- Economies of scale
  - Combustion efficiencies
  - Labor and overhead

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

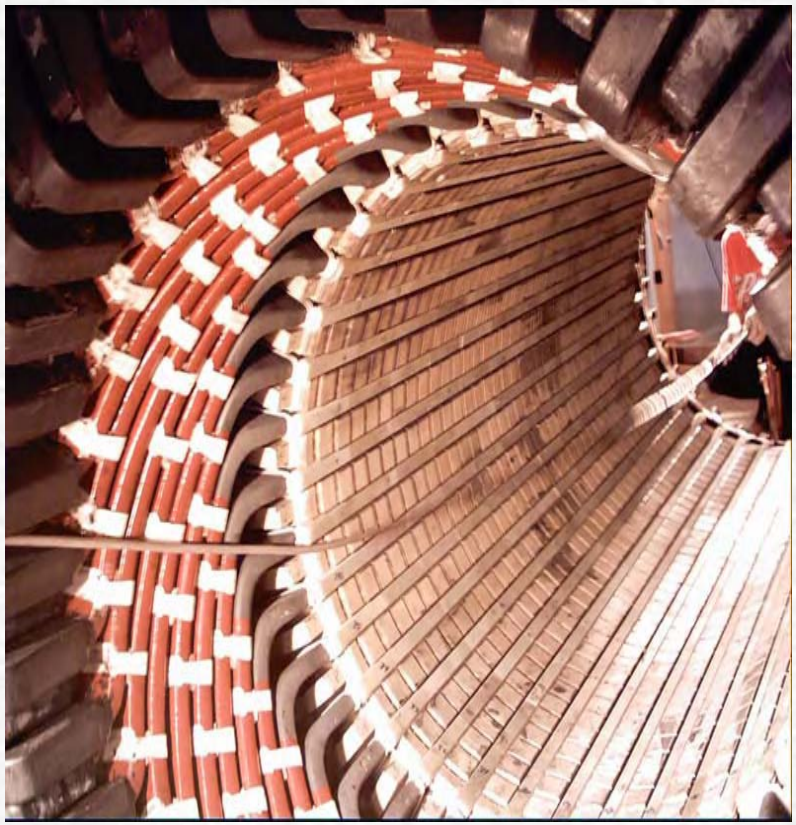
Observations On What Not to Do

- Do not oversell project.
- Do not set scale before assessing fuel resource.
- Expect less than 24 to 36 months for successful project development.

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

Project Development 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

Cone Fire

Contact Information

- Tad Mason, TSS Consultants
- 916.638.8811 ext 112
- *tmason@sbcglobal.net*
- *www. tssconsultants.com*