Biomass Context

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Outline

- What are biomass energy feedstocks
- Biomass power development history in California
- Biomass terms and definitions
- Energy production in California and Humboldt
- Biomass benefits and challenges
- Biomass policy efforts

What is biomass?

- Woody materials
- Non-hazardous

✓ Mill residues- chips, bark, mill ends

✓ Forest sources- slash, small diameter materials,

- Agriculture- pits, shells, prunings
- Urban wood waste- construction wood, yard trimmings

Biomass thinning

BEFORE

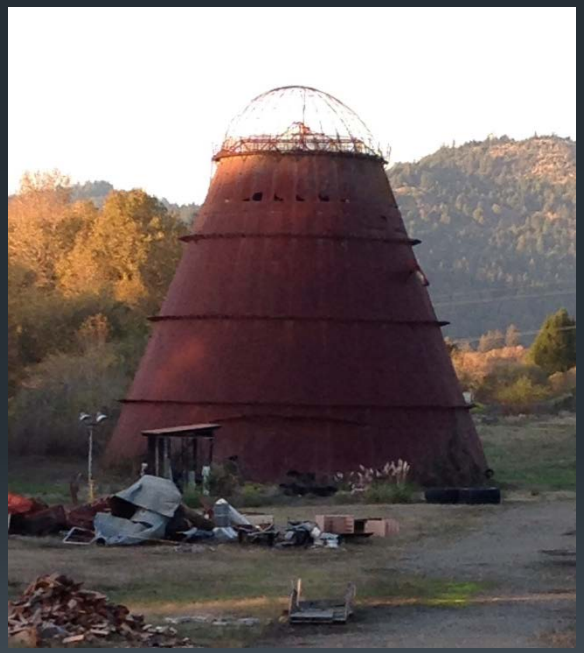
AFTER

Biomass terms and definitions

- 1 MW (1,000 kW) is enough power for 750 to 1,000 homes.
- Biomass fuel is purchased primarily on a bone dry ton (BDT) basis.
- 10 MW biomass power plant consumes 10 BDT/hr.
- Biomass power facilities are designed to operate 24/7 and deliver baseload power.
- ~4.9 jobs per MW
- Utilities purchase the power using long-term Power Purchase Agreements (PPAs).
- Investor owned utilities (IOU) include PG&E.
- Biopower facilities can have heat and power, or just power

CA biomass power history

- Public Utilities Regulatory Policy Act (Federal) of 1978 for domestic, renewable energy
  - Market response – 50+ new biopower plants (approx. 800 MW of generation capacity).
  - Co-generation was an early goal for many sawmills
- Currently ~25 operating plants (~550 MW of capacity), down from 66 plants
- New CA Renewable Portfolio Standard –50% renewables by 2030



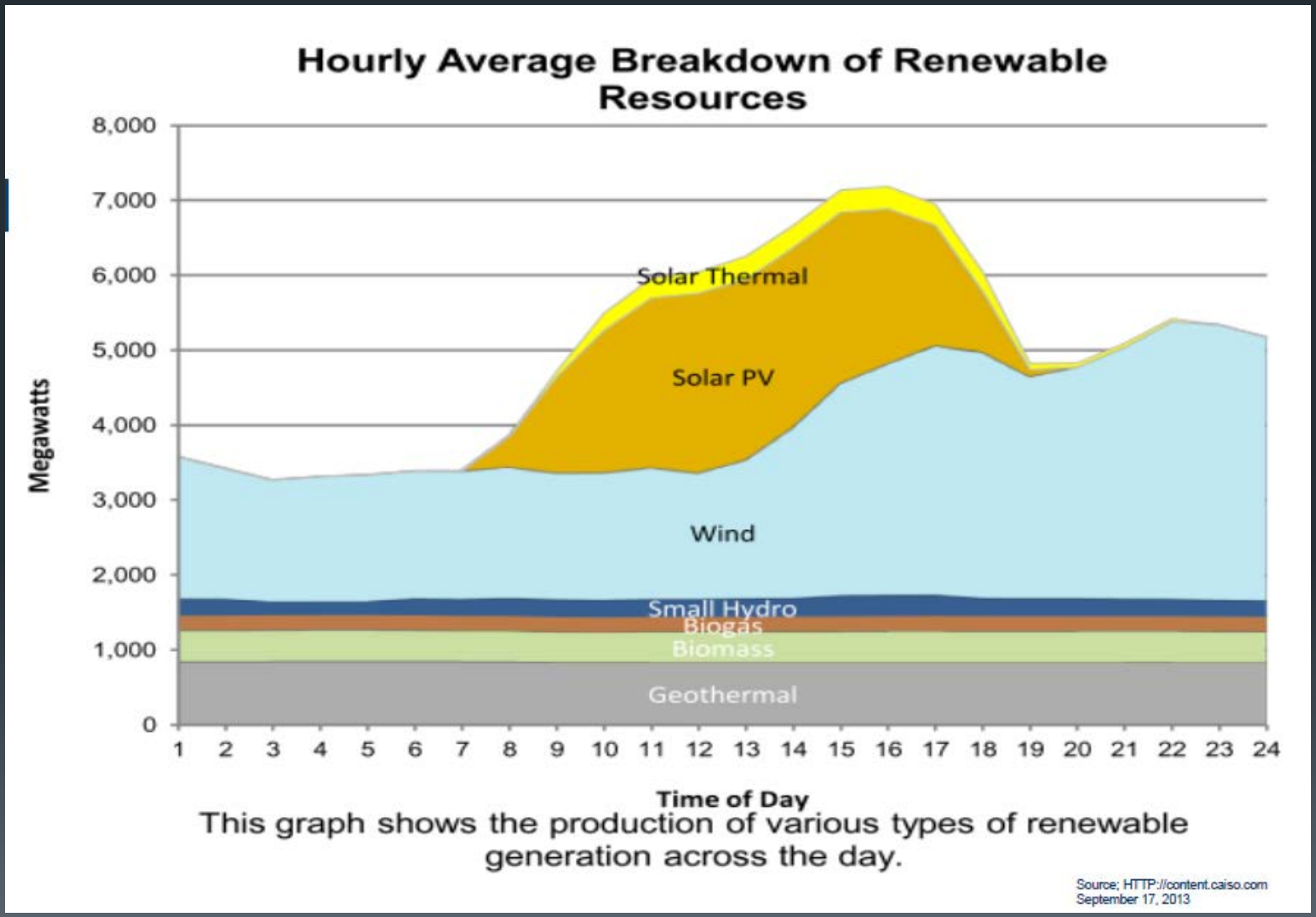
Historic “teepee” burner of wood waste, Carlotta, CA

California energy generation 2014

Fuel Type	Percent of California In-State Generation	Percent California Total Power Mix
Coal	1%	6%
Large Hydro	7%	6%
Natural Gas	61%	45%
Nuclear	9%	9%
Oil	0%	0%
Other	0%	0%
Renewables	23%	20%
Biomass	3%	3%
Geothermal	6%	4%
Small Hydro	1%	1%
Solar	5%	4%
Wind	7%	8%
Unspecified Sources of Power	N/A	15%
Total	100%	100%

Source: California Energy Almanac http://energyalmanac.ca.gov/electricity/total_system_power.html

Biomass is base-load energy

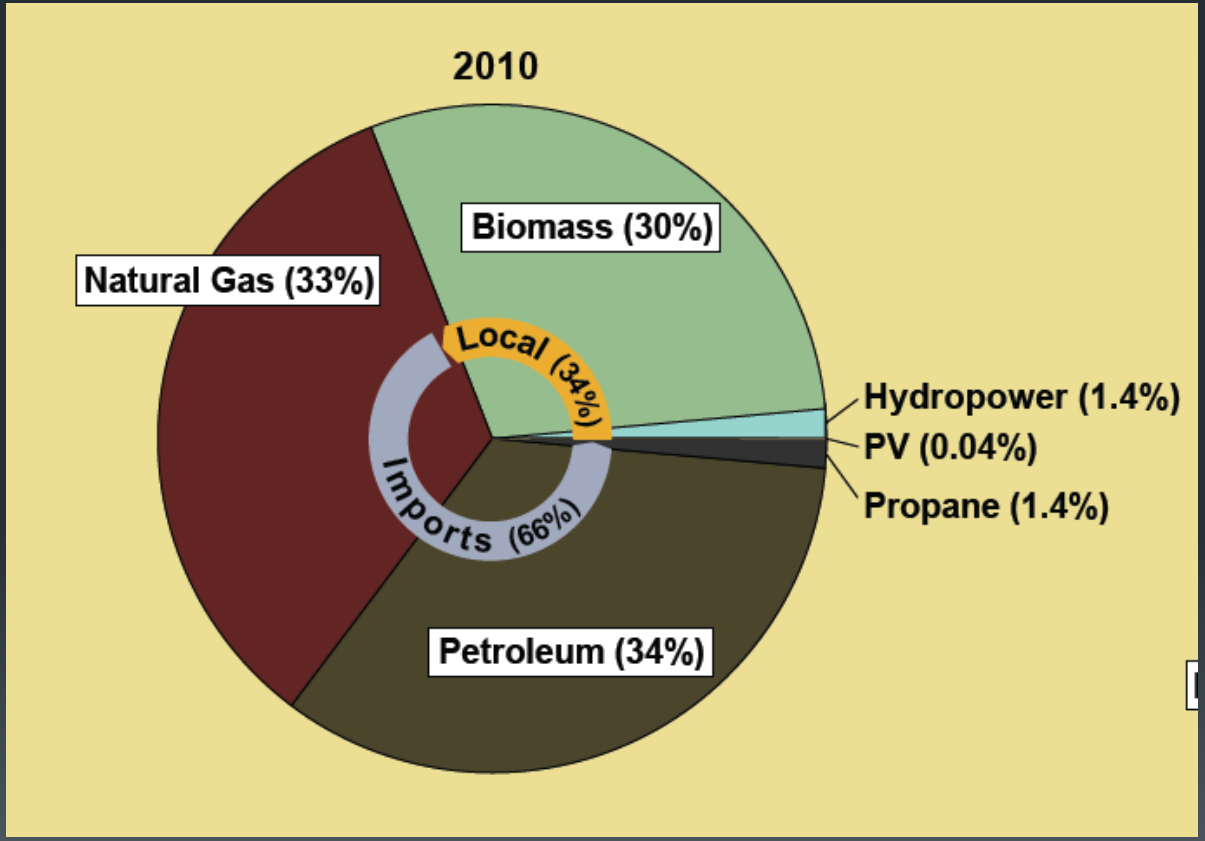


This graph shows the production of various types of renewable generation across the day.

Source; HTTP://content.caiso.com
September 17, 2013

What does energy and fuel does Humboldt produce and use?

- ~30% of energy from biomass
- 1.4% hydropower
- 0.04% solar



Source: RePower Humboldt, Redwood Coast Energy Authority

National data on biomass emissions

Emissions by type of Combustion in pounds emitted per ton of Woody Biomass consumed

	PM- 2.5 (lb/ton)	No_x (lb/ton)	CO (lb/ton)	VOC (lb/ton)	CO_2 (lb/ton)
Industrial (dry fuel) [1]	0.7 – 6.5	8.8	10.8	0.31	3120
Residential Stove [2]	6 - 23	2 - 14	46 - 160	10 - 44	~ 2800
Prescribed Burn [3]	12 - 34	6	167	19.0	~ 2700
Wildfire [3]	~ 30	4	140	12 - 24	~ 2600

Black carbon is more damaging than CO_2 or methane

Sources:
1. US EPA. AP42, Fifth Edition, Volume 1, Chapter 1
2. McDonald et. al. 2000. Environmental Science and Technology (34:2080-2091)
3. USDA Forest Service, various reports

Comparison of biomass, coal, and natural gas

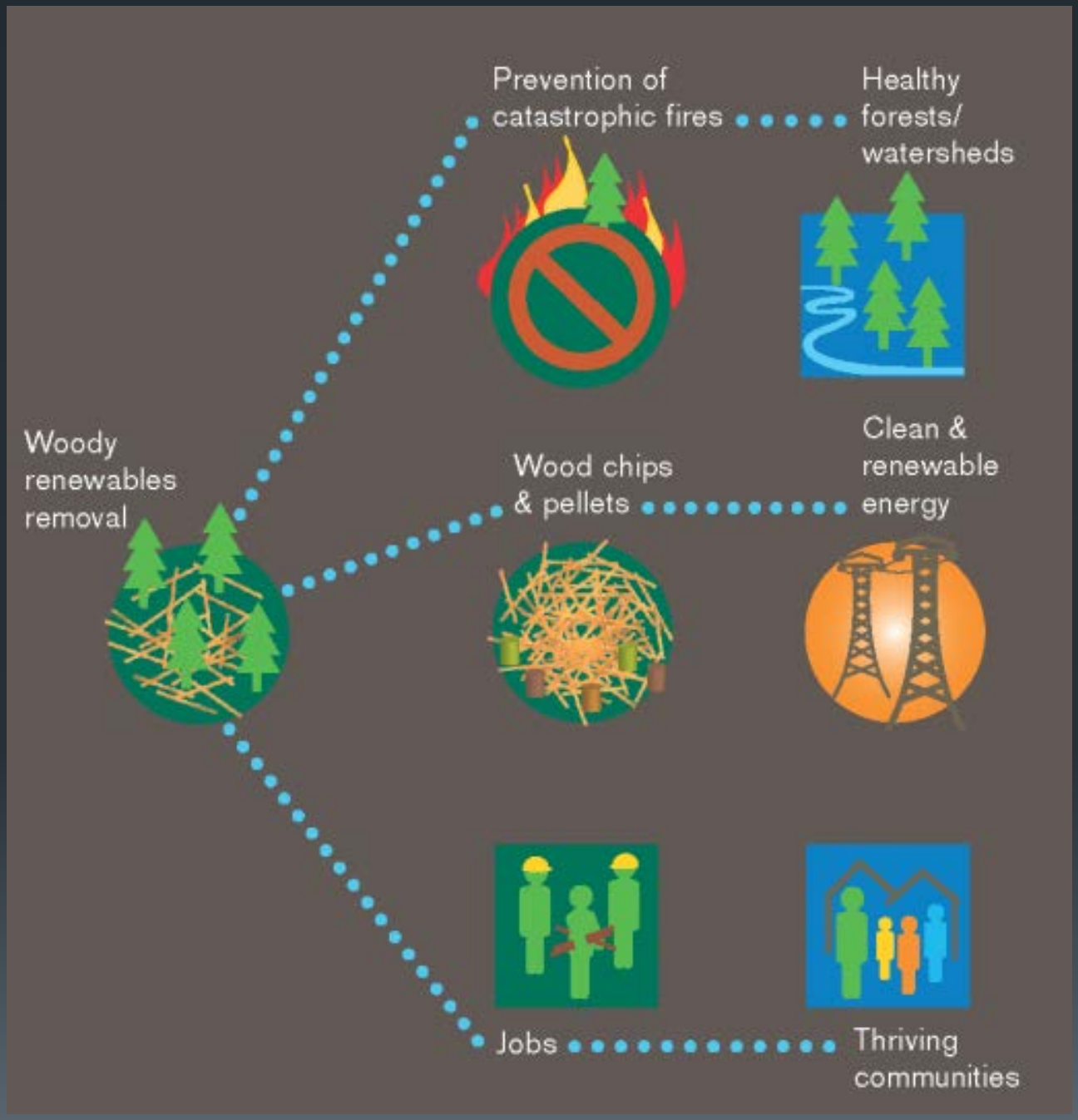
Environmental Impact

Air Emissions	Coal Fueled Boiler (lb/Million Btu)	Biomass Fueled Boiler (lb/Million Btu)	Natural Gas Boiler (lb/Million Btu)
CO	0.02 – 0.67	0.60	0.058
CO_2 fossil	178 - 231	0	117.6
CO_2 non fossil	0	195.0	0
NO_x	0.27 – 1.15	0.22 – 0.49	0.031 – 0.27
SO_x	1.3	0.025	0.0005
VOC	0.002 – 0.048	0.017	0.005
Methane	0.002	0.021	0.002
Particulates	0.37 – 2.4	0.05 – 0.56	0.007

Source: US EPA. AP42, Fifth Edition, Volume 1, Chapter 1

Biomass benefits

- Delivers distributed, baseload generation
- Promotes healthy forests and defensible communities
- Reduces emissions from wildfires or burn piles
- Reduces greenhouse gas emissions
- Utilizes an abundant local product. ~5 jobs per MW (33MW x 5= 165 jobs)
- It's renewable



Graphic courtesy of the Sierra Institute for Community and the Environment

California challenges

- 50% of the power agreements are expiring in 2016
- More expensive than natural gas
- Limited subsidies

Humboldt challenges

- 1 of 3 power plants in Humboldt are idle
- The plants provide essential infrastructure to process saw mill residues
- Plants provide a large economic benefit to the County
- Competitive disadvantage for wood manufacturing investment in the north coast if biomass infrastructure is reduced
- Forest health projects limited, more pile burning, less fuel reduction

Policy efforts for 2016

- Renewable Portfolio Standard (RPS) to increase the amount of renewables in CA's energy production to 50% by 2030
- SB 1122- recent CA legislation to encourage small distributed < 3MW facility development for up to 50 MWs statewide
- SB 590- a recent failed CA price subsidy
- Governor's October 2015 proclamation
  - Contract extensions where PPAs are expiring, and new RAM offerings for new contracts
  - Only for areas that meet high forest hazard zones
  - Tree mortality task force- bioenergy workgroup
- Community choice aggregation (CCA), a local energy procurement option

Additional resources

- UC Division of Ag and Natural Resources http://ucanr.edu/sites/WoodyBiomass/
- CA Biomass Energy Alliance http://www.calbiomass.org/
- Bioenergy Association of California http://www.bioenergyca.org/
- CA Biomass Collaborative http://biomass.ucdavis.edu/about/
- New California Agriculture, vol 69, issue 3 http://californiaagriculture.ucanr.edu/issue.cfm?volume=69&issue=3