

Renewable Energy Potential from California Agriculture

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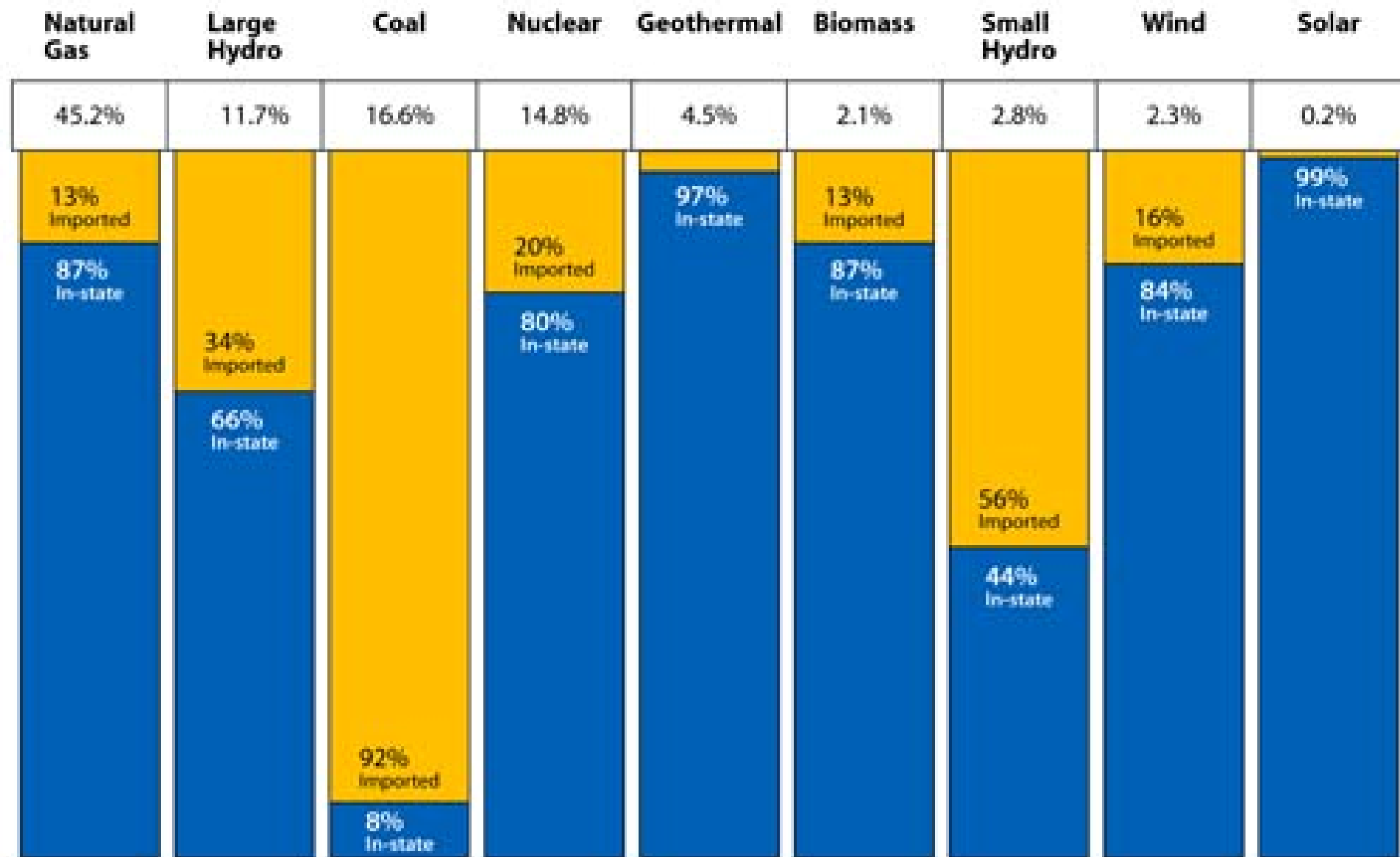
Presentation

- Motivation for study
- Methods
- Results
- Opportunities

Motivation

- Increased interest in agricultural sources of renewable electricity
 - Wind
 - Solar
 - Biomass
- Multiple policies provide incentives at state/national level for renewable energy

California's Electricity Mix – 2007



Source: California Energy Commission, *Gross System Power Report 2007*

CA Renewable Sources 2007

Fuel Type	
Renewables	11.9%
Biomass	2.1%
Geothermal	4.5%
Small Hydro	2.8%
Solar {1}	0.2%
Wind	2.3%

Methods

- Review current data on energy use/projections
- Literature Review of Existing Studies
- Estimate Potential from Agricultural Sources, variety of calculations of acreage, crops, technical capacity

Renewable Electricity Resources

- Wind
- Solar
- Biomass

California Solar Potential

**17 million MW statewide, or
16% of 2006 demand**

Current Production:

- 400 MW, mostly small scale
- .05% of electricity demand

Potential from Agriculture

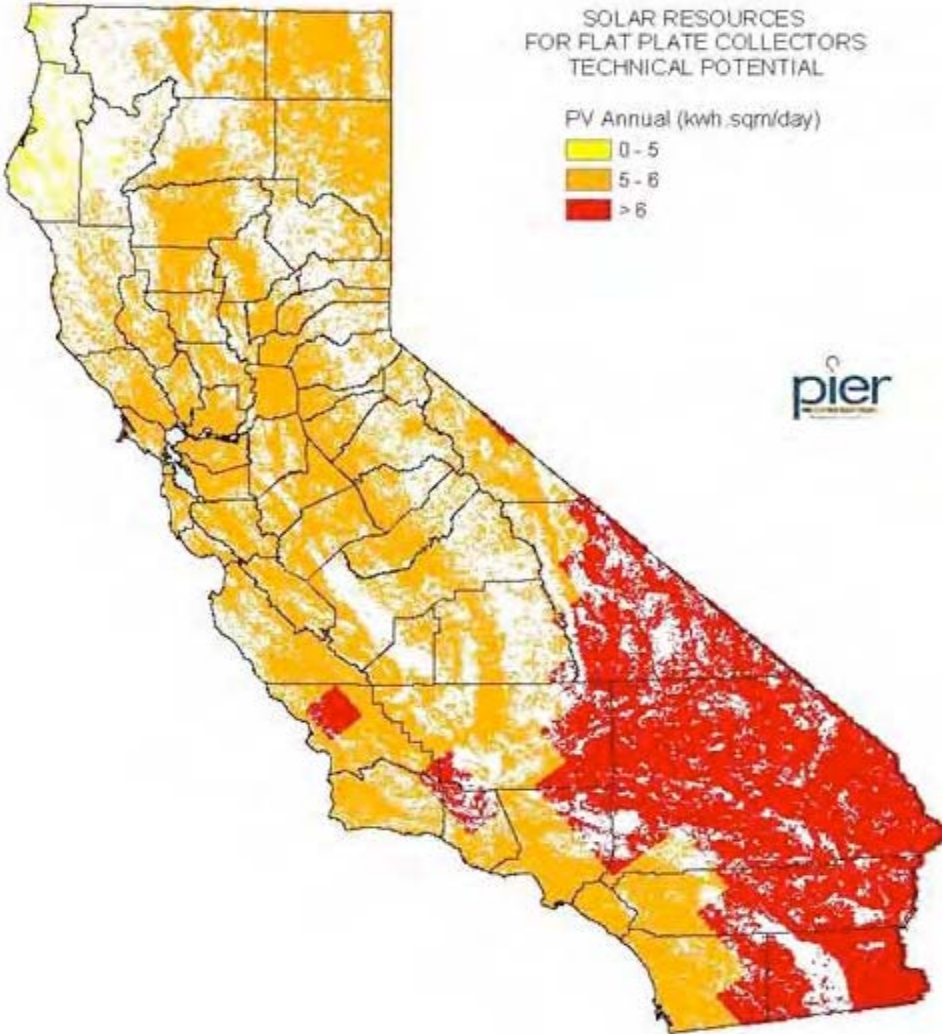
- 1,300 MW
- Up to 5% of electricity demand

SOLAR RESOURCES
FOR FLAT PLATE COLLECTORS
TECHNICAL POTENTIAL

PV Annual (kwh.sqrm/day)



pier



Solar example:



Cline Vineyards Solar Panels – 50,000 sq. foot roof
411 kW production at peak

Saves \$92,000 per year

Incentives

Federal Tax Credit:

30% offset

CA Go Solar Initiative

Up to 50% rebate and/or
production incentive

Net Metering

Wind Energy Potential....

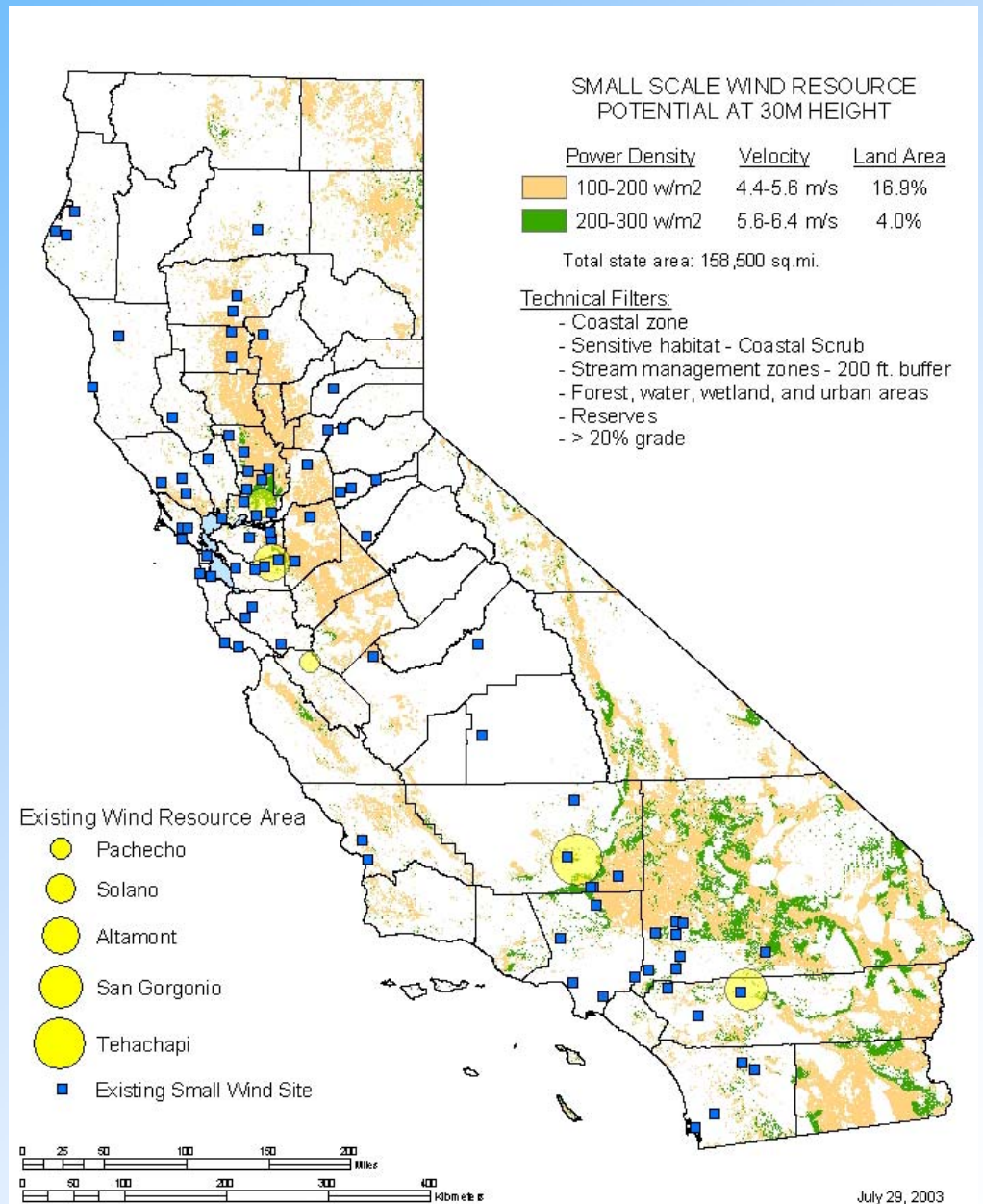
THE TOP TWENTY STATES for Wind Energy Potential
as measured by annual energy potential in the billions of kWh, factoring in environmental and land use exclusions for wind class of 3 and higher.

	B kWh/Yr		B kWh/Yr
North Dakota	1,210	11. Colorado	481
Texas	1,190	12. New Mexico	435
Kansas	1,070	13. Idaho	73
South Dakota	1,030	14. Michigan	65
Montana	1,020	15. New York	62
Nebraska	868	16. Illinois	61
Wyoming	747	17. California	59
Oklahoma	725	18. Wisconsin	58
Minnesota	657	19. Maine	56
Iowa	551	20. Missouri	52

Source: An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States, Pacific Northwest Laboratory, August 1991. PNL-7789

California Wind Map

Small Wind Potential in California, 30 meters



Source: National Renewable Energy Lab

Wind Energy

Current Production

2,439 MW

1.8% of total electricity

Potential from Agriculture

**Small scale – 51 MW on
1.8 million acres**

**Large scale on farmland
5000 MW?**



San Giorgio Pass, Palm Springs

Photo: Wordpress.org

Examples of Utility Scale Projects in California

Encouraged by:

**Renewable Portfolio
Standard**

Federal Tax Credit



Tehachapi Pass, Route 58

Small Wind Examples



Small Wind Turbines are encouraged by

- Net Metering
- State Rebate/Loan Programs
- USDA REAP Funds



Biomass

- 48% - Animal waste
- 45% - Plant material
- 0.8% - Food processing

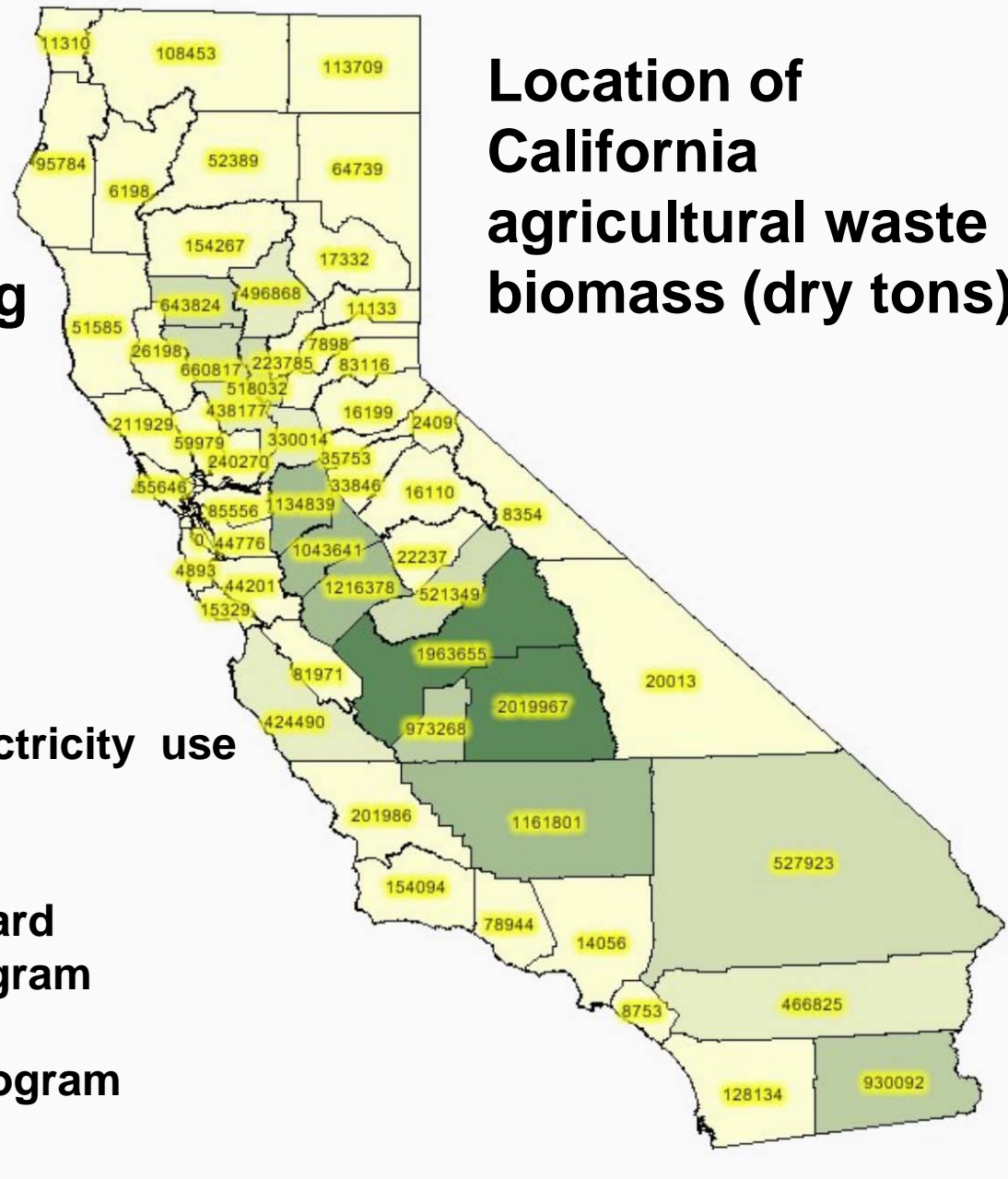
Current use:
.018% of electricity

Potential:
•880 MW
•2% of California's current electricity use

Encouraged by:

- Renewable Portfolio Standard
- Emerging Renewables Program
- Net metering
- Dairy Power Production Program
- USDA REAP

Location of
California
agricultural waste
biomass (dry tons)



California Renewable Energy Policies for Electricity

- Net metering – up to 50 kW
 - Allows consumers to “run meter backwards”; get retail credit for energy production; co-metering up to 1 MW
- Emerging Renewables Program
 - Rebate for various technologies, up to \$2.50 per Watt up to 7.5 kW; \$1.50 for 7.5 - 30kW
- Self Generation Incentive Program
 - \$1.50/W up to 1 MW (30 kW is min. size)

More state incentives....

- Go Solar Initiative

100 kW or less: up to \$2.50 per watt rebate
(about 50% of cost)

Larger than 100 kW – up to \$.39 per watt of
production in the first 5 years

Current Federal Policies Supporting Renewable Energy

- **Production Tax Credit for Utility Scale Wind**
 - 1.9 cents/kWh for 10 years
 - Only accrues to corporate entities (C- and S-corps, LLCs)
 - Extended through Dec 31, 2008
 - Makes wind energy investment attractive to corporations
- **Federal Tax Credit for Solar**
 - 30%, no cap on size for commercial; \$2000 residential
- **2002 Farm Bill**
 - \$32 million in 2008 to cost-share renewable energy production for farms and rural small businesses

2008 Farm Bill Funds

- Of the nearly \$68 million granted since 2003
 - 45% has gone to three states:
 - Minnesota (20%)
 - Iowa (13%)
 - Wisconsin (11%)
 - 41% has gone to large-scale wind projects
 - California has earned \$1.7 million on 10 projects
- States with favorable renewable policies seem more likely to apply for and receive these funds
 - but not CA!

Bottom line...

Significant opportunities and incentives for renewable electricity sources in agriculture

Opportunities for agriculture to increase implementation and leverage incentive funds to use solar/wind/biomass

Questions?

Full report available at:

www.cissc.calpoly.edu/research

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