



California's Bioenergy: Potential and Policy

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Presentation Outline

1. Bioenergy policy drivers
2. Bioenergy potential
3. Example policies and projects

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California Bioenergy Policy Drivers

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Strategic Value of Bioenergy

- California has large, diverse and untapped biomass resources which can support greater use in electric power, fuels and chemicals.
- Biomass is an energy resource capable of achieving state petroleum reduction, climate change, renewable energy and environmental goals.
- Use of biomass for energy production can address California's waste disposal and environmental problems, while creating local jobs.
- Other public benefits include improving forest health and human and animal health, while avoiding catastrophic wildfires.

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California Biomass Energy Policy Drivers

- Governor's Executive Order S-06-06 –biomass & biofuels
- Bioenergy Action Plan
- Governor's GHG Reduction Targets (Executive Order S-3-05)
- Renewables Portfolio Standard
- Low Carbon Fuels Standard
- AB 32 – Global Warming Solutions Act
- U.S. 2005 Energy Policy Act and 2007 Energy Independence and Security Act

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Gov. Schwarzenegger's Executive Order S-06-06

April 2006 order establishes targets to increase in-state production and use of bioenergy, and re-invigorates Bioenergy Inter-Agency Working Group

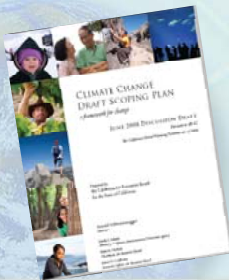


- Biofuels- produce minimum of 20 percent of biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050
- Biomass Electricity- meet a 20 percent target within the established state goals for renewable generation for 2010 and 2020

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AB 32: The Global Warming Solutions Act of 2006

- Signed by Governor Schwarzenegger Sept. 27, 2006
 - Goal of achieving 1990 emissions level by 2020 is the toughest mandatory goal in the nation
 - Establishes pathway for Governor's 2050 goal of 80% below 1990
- California Air Resources Board charged to develop regulations
 - Released Draft "Scoping Plan" in June; Final to be adopted in November
 - Relies on economy-wide, regional Cap-and-Trade system, with various sector-specific regulatory and voluntary programs



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Key Activities and Documents

- Inter-Agency Bioenergy Working Group
 - *Bioenergy Action Plan* (2006) establishes goals, creates and coordinates agency responsibilities
 - California Energy Commission
 - California Air Resources Board
 - California Environmental Protection Agency
 - California Resources Agency
 - Department of Food & Agriculture
 - Department of Forestry & Fire Protection
 - Department of General Services
 - Integrated Waste Management Board
 - Public Utilities Commission
 - Water Resources Control Board
- California Biomass Collaborative
 - Federal, state, and local government
 - Academic and government researchers
 - Private industry
 - NGOs
 - *Roadmap for the Development of Biomass in California* (2007)
 - *California Biomass Resource Assessments* (2005, 2006, 2007, etc.)
 - Technical technology assessments
 - Sustainability analysis and certification




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California Energy

Today Biomass Is Viewed as a Disposal Problem

- Reducing Landfill Capacity
 - About 40 million tons of biomass goes into landfills every year
- Contributing to Air Pollution and Fire Risk
 - Open field burning of crop residues emits more than 100,000 tons of air pollutants annually
 - Wildfires contribute over 1.1 million tons per year at a cost of >\$900 million/year
- Local Concerns
 - California's 1.67 million dairy cows generate odor and health concerns

The slide includes four images illustrating biomass disposal issues: a large pile of trash in a landfill, a field of crop residues being burned, a large wildfire in a forest, and a large dairy farm with many cows.



Total Categorical Bioenergy Potentials in California

Category	Biomass (Million BDT/year)	Energy in Product (Trillion Btu/year)	Total Capacity
Electricity	32	118 (35 TWh)	4,650 MWe
CHP Heat		230	9,050 MWt
Heat	32	350	11,700 MWt
Biochemical Biofuel	32	188	1.5 BGY gasoline equivalent
Thermochemical Biofuel	27*	250	1.7 BGY diesel equivalent
Biomethane	5 + Landfill gas and WWTP	106	106 BCF/y methane
Hydrogen (bio + thermal)	32	305	2.5 Million tons/y

* Tonnage for thermochemical biofuel assumed to be constrained by moisture content

Current California consumption:
 16 billion gallons gasoline + 4 billion gallons diesel = 2,500 Trillion Btu/year direct energy content
 300 TWh/y electrical energy = 1,024 Trillion Btu/year direct energy



Biomass power and capacity needed to meet 20% share of accelerated RPS

	RPS (%)	Renewable power under RPS (GWh/y)	20% Biomass goal (GWh/y)	Biomass capacity required above current 2005 (MW- 0.85 cap. Factor)
2010	20	58,575	11,700	575
2020	33	109,400	21,875	1,975
2050	33	136,500	27,300	2,670



Biofuel Goals



Instate biofuel production goals for several blend rate scenarios (million gallons per year)

Year	Ethanol			Biodiesel			
	E5.7	E10	E20	B2	B5	B10	B20
2010	183	325	675	13	32	65	130
2020	390	700	1430	35	85	170	345
2050	900	1,570	3,250	150	375	750	1,490



Active Policies and Projects

Preliminary Recommendation

AB 32 Scoping Plan: Recommended Measures

Table 2: Recommended Greenhouse Gas Reduction Measures

Recommended Reduction Strategies	Sector	2020 Reductions (MMT CO ₂ E)
The Role of State Government	Various	1-2 ¹⁷
California Cap-and-Trade Program Linked to WCI: Emissions cap of 365 MMT CO ₂ E covering electricity, transportation, residential/commercial and industrial sources by 2020. Shaded reductions contribute to achieving the cap.		
California Light-Duty Vehicle GHG Standards	Transportation	31.7
Energy Efficiency	Electricity & Commercial and Residential	26.4
Renewables Portfolio Standard (33% by 2020)	Electricity	21.2
Low Carbon Fuel Standard	Transportation	16.5
High Global Warming Potential Gas Measures	High GWP	16.2
Sustainable Forests	Forests	5
Water Sector Measures	Water	4.8 ¹⁸
Vehicle Efficiency Measures	Transportation	4.8
Goods Movement	Transportation	3.7
Heavy/Medium Duty Vehicles	Transportation	2.5
Million Solar Roofs (Existing Program Target)	Electricity	2.1
Local Government Actions and Regional GHG Targets	Land Use and Local Government	2
High Speed Rail	Transportation	1
Landfill Methane Control	Recycling & Waste	1
Methane Capture at Large Dairies	Agriculture	1 ¹⁹
Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	Industrial	TBD
Additional Emissions Reduction from Capped Sectors		35.2
	Total Reductions	169

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Preliminary Recommendation

Scoping Plan Bioenergy Proposals

- 33% RPS by 2020, applied to all utilities
 - Electricity from direct combustion, landfill-, dairy-, and wastewater-biogas qualify
- Low Carbon Fuels Standard
 - 10% reduction in transportation fuel GHG-intensity by 2020
 - Will likely require ultra-low GHGs advanced biofuels
- Encourage use of forest biomass for energy generation
 - Including mill waste, thinnings, and fuel treatment
- Manure-to-biogas digesters
 - Voluntary program with possibility of future mandatory program
- Increase wastewater treatment biogas energy production
- Increase landfill methane capture
 - Mandatory capture and improved systems at all landfills with ≥ 400,000 tons waste-in-place

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R&D Projects

California Energy Commission

Forest Residue

Contractor: Hatch Pacific/SPT/C (S&B) / Community Power Corporation

Goals:

- Conduct technology demonstration project at a 15 MW biomass gasifier using forest residue

Status:

- 15 MW unit installed & connected to the grid & being tested
- All power is sold back to Pacific Coast
- ARJ will collect first energy information for S&B&C
- Capable waste thermal energy for heating the office building
- Emissions: NO_x 30.1 ppm (ppb) @ 3 % CO₂, CO = 2.1 ppm, THC = 4.1 ppm

Contractor: Community Power Corporation

Goals:

- Design, develop and demonstrate a 30 MW power-to-gas plant (combined gas and power) using forest residue
- Improve and commercialize the biomass energy conversion technologies and reduce environmental risk and cost at California's refinery

Status:

- 30 MW gasifier and other components are being designed
- The gasifier system will be field tested starting July 2007




California Energy Commission

Landfill Projects

RESEARCH: MJ&E atmospheric energy conversion system, for NCA California - Yuba County, Landfill

Contractor: M&E Engineering

Goals:

- System efficiency of 10% (netting of PFC)
- System life minimum of 30 years (2 ppm)

Status:

- Prototype is built and being tested using landfill gas
- High calorific / thermal efficiency = 30%
- NO_x Emissions = less than 2 ppm @ (1%, 2%)

RESEARCH: Biomethane for a Microturbine - Butte/Butte Landfill

Contractor: BCS Engineers

Goals:

- Reduce consumption of a 200 kw microturbine for 50000 kWh/year
- Reduce CO₂ = 10 MWh/year

Status:

- The microturbine has operated for one year
- High efficiency, reduced maintenance and emissions cost
- Final Results are being followed




California Energy Commission

Inland Empire Utility Agency (IEUA) Centralized Digester

Goals:

- Successful demonstration of cost-effective European centralized digester
- Ability to co-process food wastes and dairy manure
- Use lean burn engine to generate 1.5 MW of electricity

Project Site:

- Chino Basin (IEUA site)

Status:

- Design is completed
- Under construction




California Energy Commission

Dairy Power Production Program

- California is home to about 1.67 million milking cows - 18% of US milking cows
- CA dairies produce more than 27 billion pounds of milk, 1.25 billion pounds of cheese and generate \$3 billion in annual sales
- Represent a significant bioenergy resource
- Engine generators at 18 CA dairies

Dairy Name	Engine Generator Capacity (KW)	Engine Model
Strawn (Castellanos)	75	Volvo/Deere 3400
Castellanos	150	Caterpillar 3400
Castellanos	200	Caterpillar 3412/15
Blair/De	225/4	Caterpillar 3400
Lourenco	130	Caterpillar 3400
Estroff/De	180	Caterpillar 3400
Kreft/De	130/2	Caterpillar 3400
Mason-Kreft	180	Caterpillar 3400
Van Overwing	130	Caterpillar 3400
Blue	850	Volvo/Deere 5720



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- California Energy Commission Biomass Program
<http://www.energy.ca.gov/biomass/index.html>
- ARB Climate Change Web Site:
www.arb.ca.gov/cc/cc.htm

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