



Status of Biofuels Development in California

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Presentation to 4th Annual BBI Biofuels

Workshop & Trade Show Series, *Building an Industry*

A premier biofuels series fostering ethanol and biodiesel developments

Western Region

9-11 October 2007

Portland, Oregon



Overview of Presentation

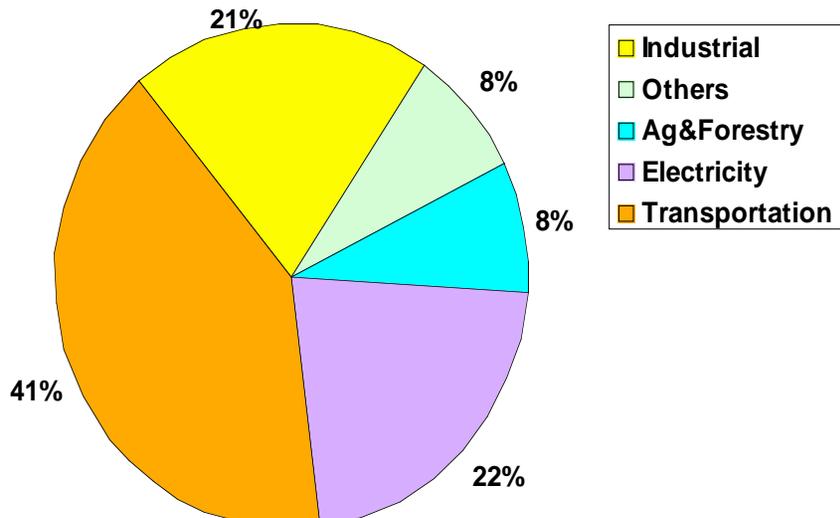
- Policy Initiatives Affecting Biofuels Development
- California's Responds to Global Warming
- A Glimpse of Biofuels Development in California
- Public Interest Energy Research Program
- PIER Biofuels R&D Projects
- Other Biofuels Projects in California
- Final Remarks

Policy Initiatives Affecting Bioenergy

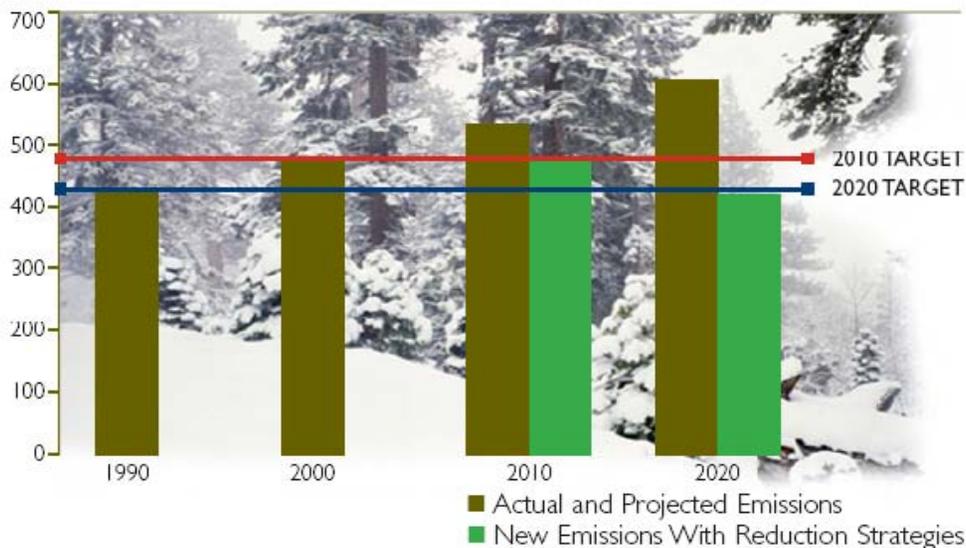


- **Governor's Executive Order S-06-06 –biomass & biofuels, (25 April 2006)**
- **Bioenergy Action Plan (July 13, 2006)**
- **AB 32 – Global Warming Solutions Act, (27 September 2006)**
- **Governor's GHG Reduction Targets (Executive Order S-3-05) (1 June 2005)**
- **Integrated Energy Policy Reports (IEPR) (2003, 2004 update, 2005, 2007)**
- **Energy Action Plan (EAP) I and II (published 2003 and 2005 respectively)**
- **Governor's 2003 / 2004 IEPR response and Ten Point Plan**
- **US 2005 Energy Policy Act**
- **Western Governor's Association (Charter, 2005 Annual Report, 2003 Policy Roadmap)**
- **AB 1493: Vehicular emissions (22 July 2002)**
- **Governor's Executive Order (EO) 2-7-04: Hydrogen highway (20 April 2004)**
- **AB 1007: Alternative fuels (29 September 2005)**
- **SB 1368: GHG emissions from electricity generation (29 September 2006)**
- **EO S-01-07: Low carbon fuel standard (18 January 2007)**
- **Federal: EPACT 2005, Healthy Forest Restoration Act, Farm Bill Title IX, Advanced Energy Initiative, Biofuels Initiative, HR 6, HR 3221, 30x'30, 20 in 10...**
- **USDOE Bioenergy Research Centers, EBI (BP), Chevron, Conoco-Phillips, USDA, USEPA, CEC, CIWMB, ARB...**

California Responds to Global Warming 2000 - 2007



California Carbon Dioxide Emissions by Energy Sectors, 2004
~400 million metric tons carbon dioxide



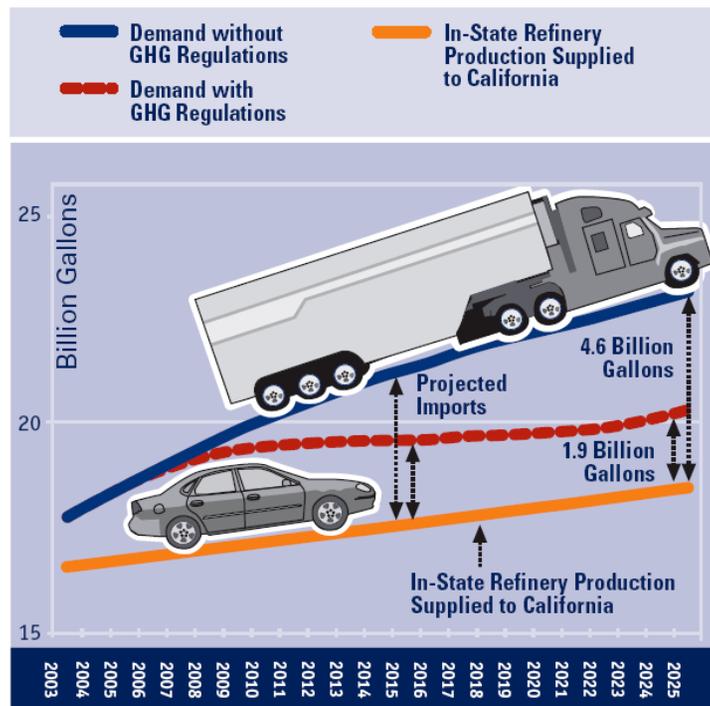
- In 1988 GHG impacts review mandated
- In 2000, the California Greenhouse Gas Registry was established
- In 2002 AB1493 (Pavley) mandates 30% reduction GHG emissions in new light duty vehicles by 2016
- In 2005, AB 1007 requires plan to replace gasoline use with low carbon alternatives.
- **AB 32 – Global Warming Solutions Act of 2006; aggressive goals for 2020**
- **SB 1368 – GHG Emissions standards for IOUs and POU**
- **AB 2021 – Energy Efficiency for POU**
- **AB 2160 – Green Building Acquisition Financing for State Facilities**
- **SB107 – Accelerated RPS Goals – 20% by 2010**
- **SB1 – Renewables Goals for New and Existing Residential and Commercial Structures**
- **AB 2778 – Self-Generation Incentive Program for Fuel Cells and Wind**
- **SB 1250 – PIER and Renewables Incentive Programs Reauthorized**
- In 2007, Governor mandates development of Low Carbon Fuel Standard.

Trends Petroleum and Non-Petroleum Consumption



The 2005 IEPR concluded that California needs to aggressively reduce its dependence on petroleum and introduce more non-petroleum options.

Projected Gasoline and Diesel Demand



Source: California Energy Commission, November 2005, 2005 Integrated Energy Policy Report

Demand for Gasoline and Diesel Fuel

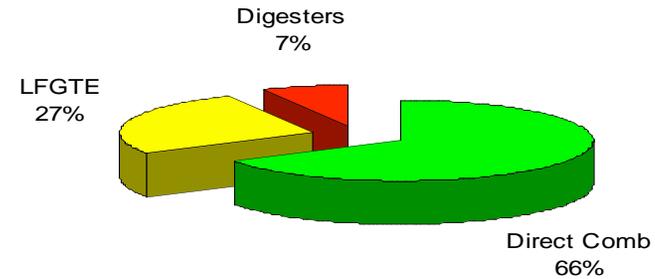
Demand continues, even in the face of record petroleum prices, for several reasons:

- Population growth and more on-road vehicles
- Low per-mile cost of gasoline for the past two decades
- Lack of alternatives to conventional gasoline and diesel fuels
- Consumer preference for larger, less fuel efficient vehicles
- Land use planning that places jobs and housing farther apart without transportation integration
- Lack of mass transit

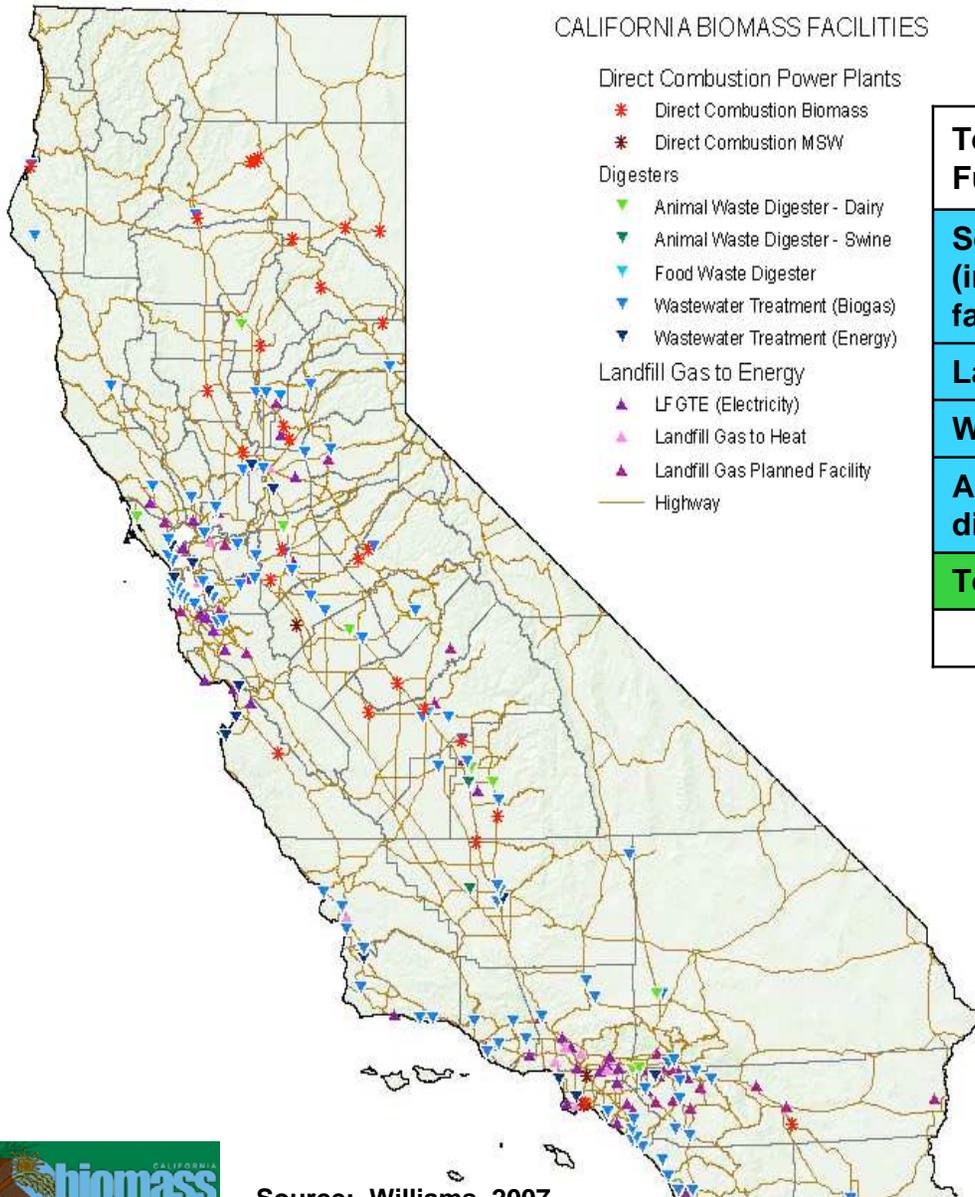
A Glimpse of Bioenergy Development in California



- Biomass Energy Facilities Provide ~1000 MW of Electricity Capacity through
 - Direct Combustion of Forestry, Ag and Urban Biomass
 - Landfill Gas to Energy (LFGTE) Facilities Convert Methane Rich Landfill Gas
 - Wastewater and Dairy Biogas Systems Process Biogas Into Useful Energy
- Biofuels - California consumers over 900 million gallons per year of ethanol and over 43 million gallons of biodiesel fuel.



Current Biomass Power Capacity in California



CALIFORNIA BIOMASS FACILITIES

- Direct Combustion Power Plants
 - * Direct Combustion Biomass
 - * Direct Combustion MSW
- Digesters
 - ▼ Animal Waste Digester - Dairy
 - ▼ Animal Waste Digester - Swine
 - ▼ Food Waste Digester
 - ▼ Wastewater Treatment (Biogas)
 - ▼ Wastewater Treatment (Energy)
- Landfill Gas to Energy
 - ▲ LFGTE (Electricity)
 - ▲ Landfill Gas to Heat
 - ▲ Landfill Gas Planned Facility
- Highway



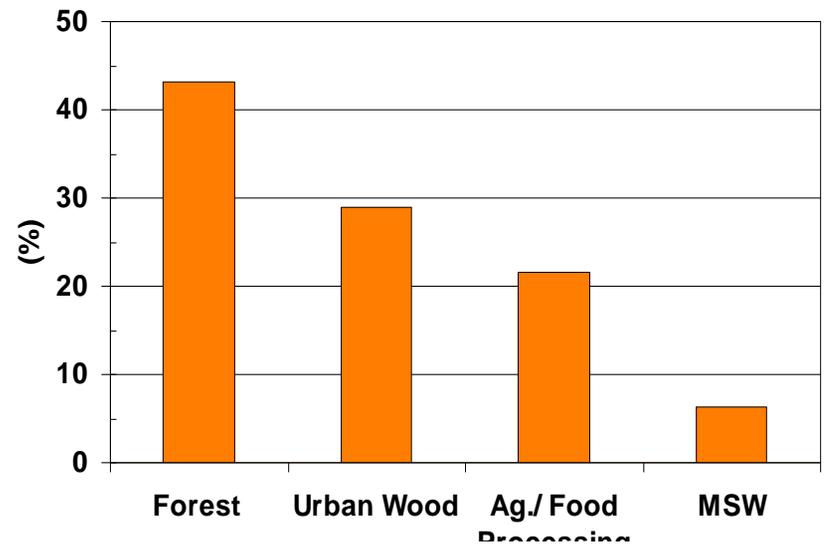
Technology/ Fuel Source	Number of facilities	Gross Capacity (MW)
Solid Fuel Combustion (includes 3 MSW facilities)	30	640
Landfill gas-to-energy	60	275
Wastewater treatment *	20	64
Animal and food waste digester	22	5.7
Totals	132	985

* Suspect - Probably higher



Source: Williams, 2007

Solid Combustion Fuel Sources





Biomass needed to meet goal of a 20% share of the State Renewables Portfolio Standard (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

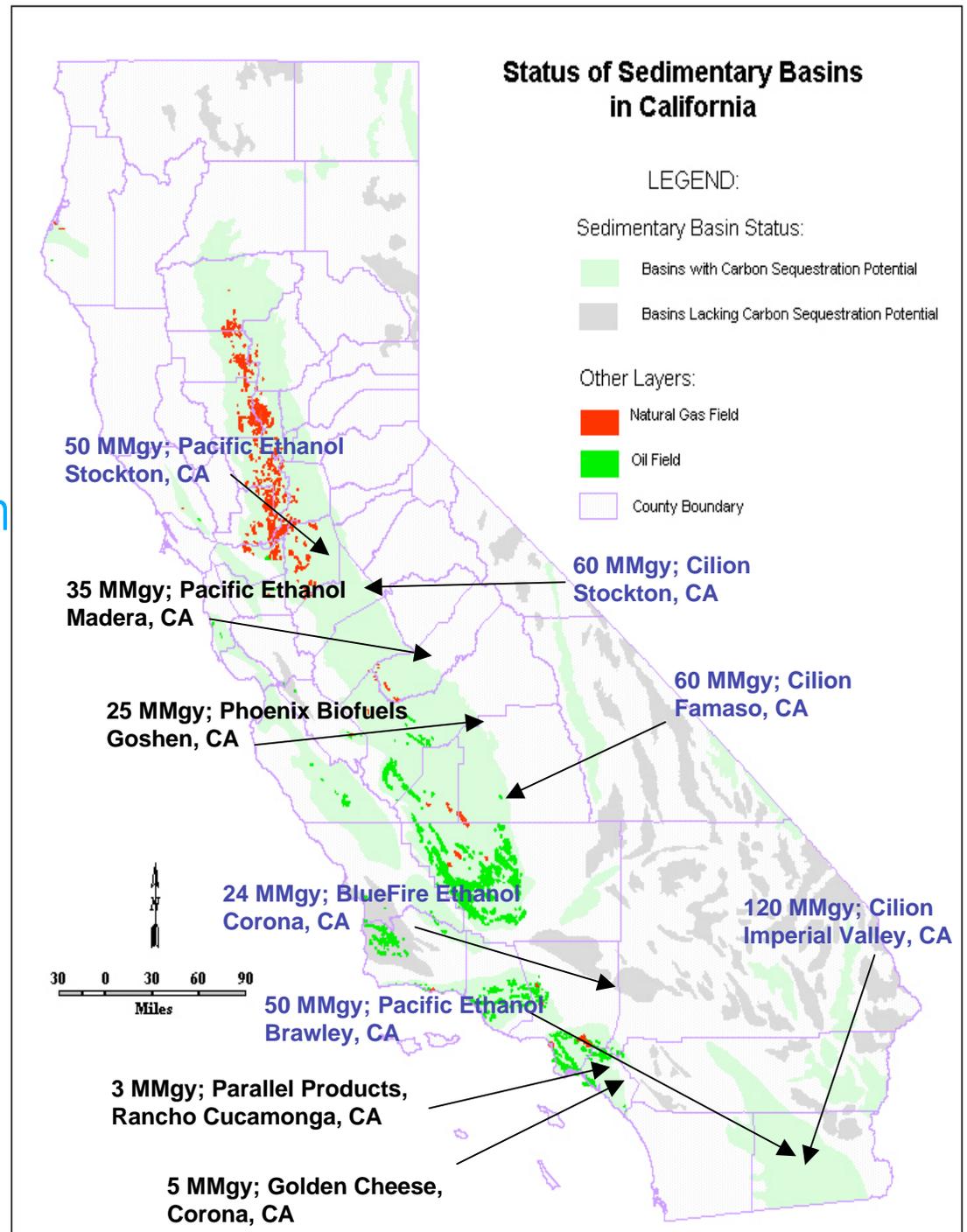
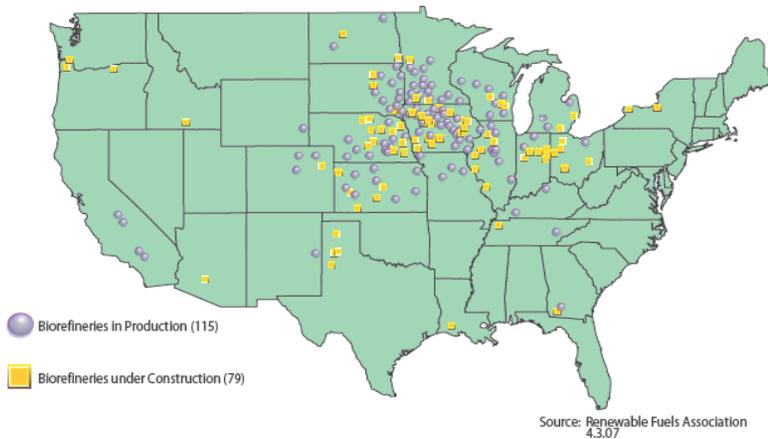
Ethanol Facilities in California

(2006)

- Existing ethanol facilities (68 Million Gallons)

• Proposed plants (364 Million Gallons)

U.S. Ethanol Biorefinery Locations

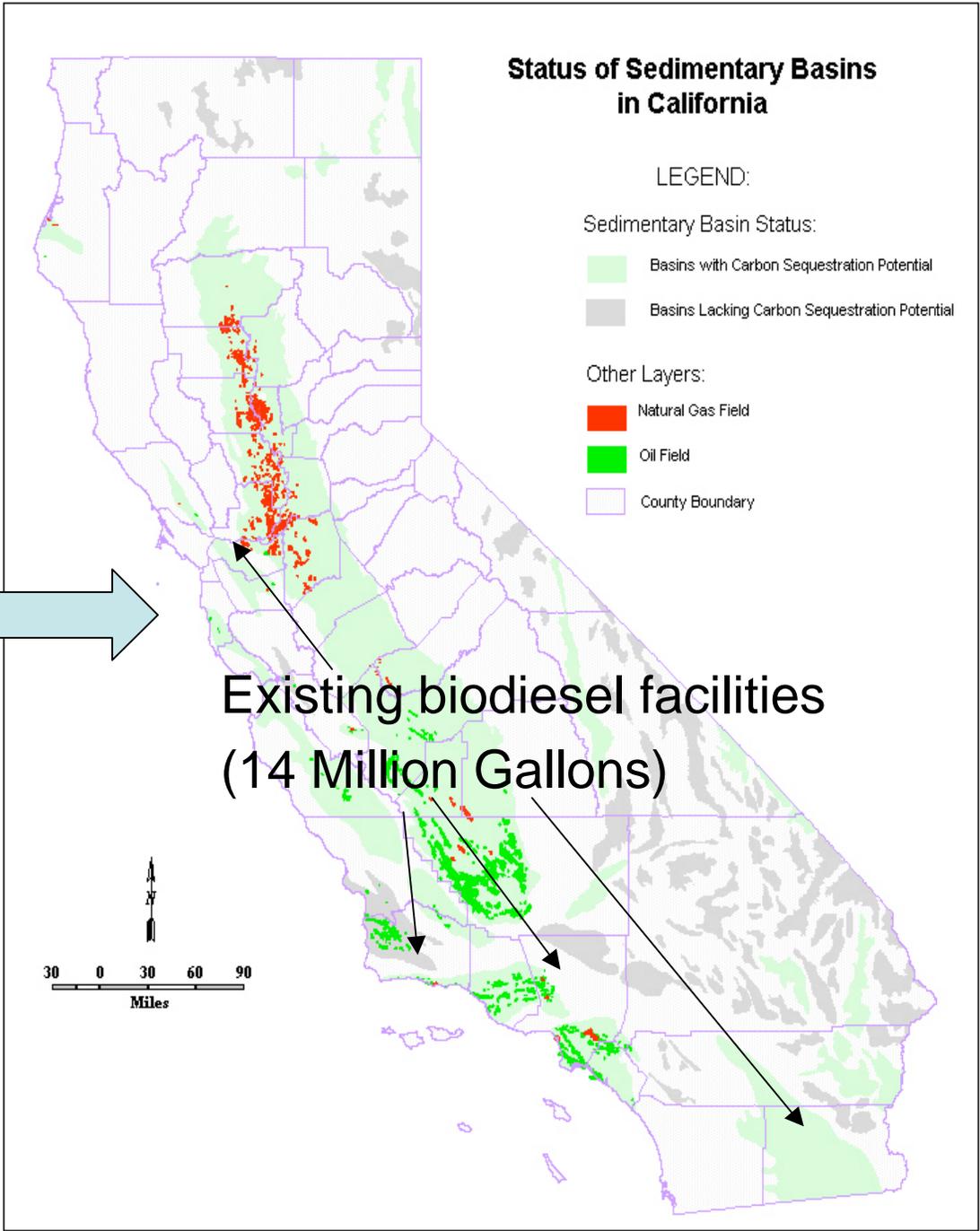
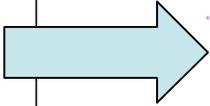




Biodiesel Consumption in California (2006)

43 Million Gallons

Biodiesel imports
(29 Million Gallons)

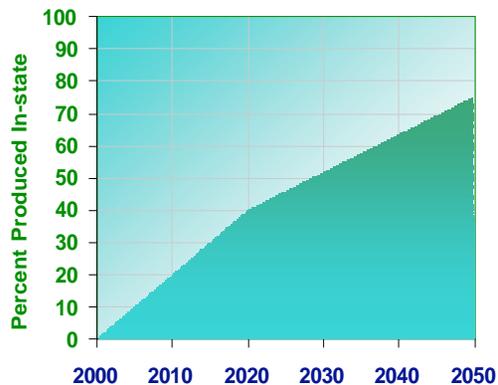
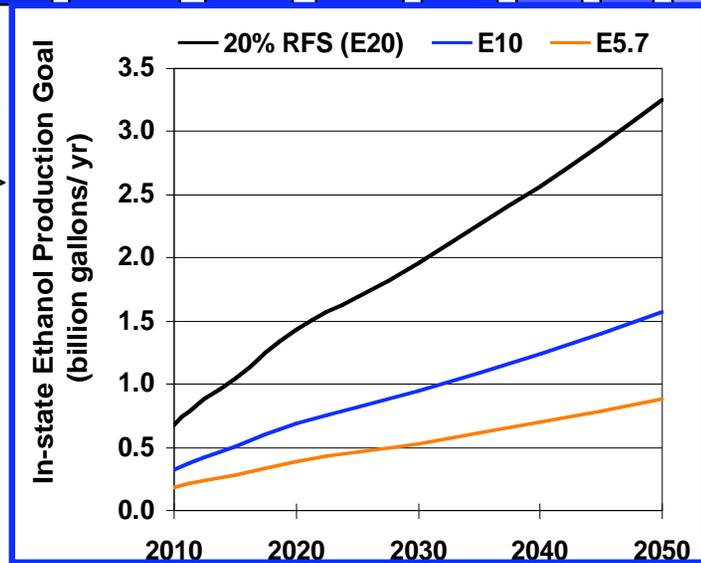


In-state biofuel production goals for blend rate scenarios

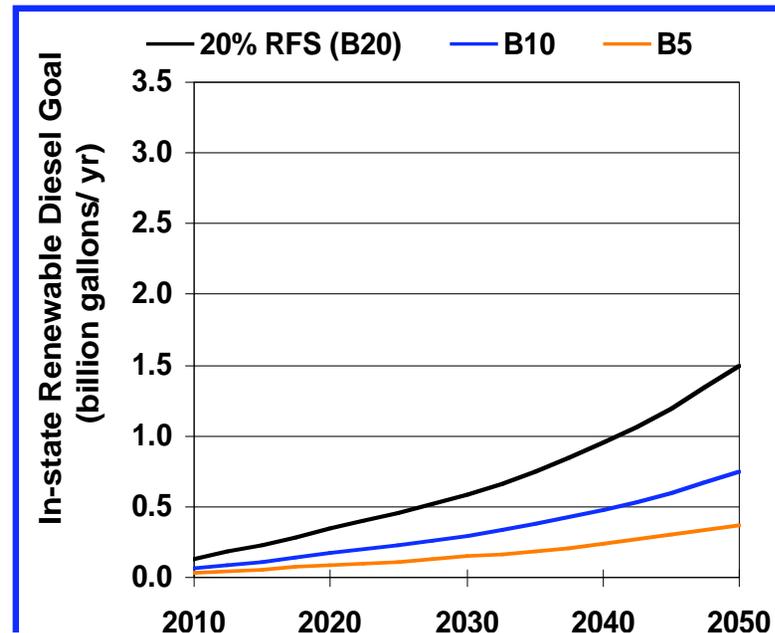


- Assuming projected transportation fuel growth rates and
- Executive Order S-06-06 goals for in-state biofuel production
 - 20% by 2010 (9.3 million GGE)
 - 40% by 2020 (1.6 billion GGE)
 - 75% by 2050 (2 billion GGE)

Ethanol



Renewable Diesel



Source: Williams, 2007

Public Interest Energy Research (PIER) Program



- IOU Ratepayer-funded program launched in 1997
- Addresses electricity, natural gas, and transportation sectors
- ~\$80M annual budget; nearly \$400M in projects
- A leader in no/low-carbon technology and global climate change research programs
 - Efficiency and Demand Response
 - **Renewables**
 - Clean Fossil Fuel Generation – Distributed Generation, Combined Heat & Power
 - **Transportation**
 - Energy Systems Research – Transmission and Distribution, Grid Interconnection
 - Environmental Impacts – Air, Water, Climate, Communities
- **Strong emphasis on collaborations**
 - Avoid duplication/builds on past work/ensures relevance
 - Regular coordination with IOUs via the Emerging Technology Coordinating Council to transition research to the marketplace
 - State Agency Partnerships (DGS/DOF, ARB, T-24,CDF,CAGR,CalEPA, IWMB)
 - Market Partnerships (California builders, Collaborative for High Performance Schools, California Commissioning Collaborative, major equipment manufacturers)
 - Use California Capabilities (Universities, National Laboratories, High Technology Companies)
 - Leverage/complement Federal Investments

SB 1250 Reauthorized PIER in 2006 and Established Solution- Focused Goals



General Goal

- “Develop and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system costs”

Specific Goals

- Develop and help bring to market
 - “Advanced transportation technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers.
 - “Increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers.
 - “Advanced electricity generation technologies that exceed applicable standards to increase reductions in greenhouse gas emissions from electricity generation, and that benefit electric utility customers.
 - “Advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources.”

Biomass RD&D Activities



- Technology Development
 - Direct Combustion/Co-firing Systems
 - Biogas (Landfill Gas, biogas from AD of manures, food waste & waste water)
 - Thermal Gasification and Pyrolysis
 - **Biofuels and Biorefineries**
- Analysis and Planning
 - California Biomass Collaborative Support
 - Biomass Roadmap for biomass development
 - Biomass Resource Assessments
 - Biomass Performance Reporting System
 - Strategic Value Analysis
 - Linking cost competitive biomass resources to electricity system needs while addressing public benefits
- Natural Gas Replacements by Biomass
 - Implement Natural Gas RD&D Program Plan
 - **PIER Transportation RD&D**

California Biomass Roadmap



Vision: Sustainable biomass resources energize a healthy and prosperous California through the environmentally beneficial production and use of renewable energy, biofuels, and bioproducts.

Priority Areas

- Resource access and feedstock markets and supply
- Market expansion, access, and technology deployment
- **Research, development, and demonstration**
- Education, training, and outreach
- Policy, regulations, and statutes

RD&D

- 📁 **Resource Base, Sustainability and Access**
- 📄👤 **Bioscience/Biotechnology**
- 📄👤 **Biomass Conversion**
- 📄👤 **Feedstock Processing**
- 📄👤 **Systems Analysis**
- 🕒👤 **Knowledge/Information Resources**





Biofuels Projects in California

California - Biofuels PIER RD&D

Projects

- Metcalf & Eddy and San Francisco Public Utility Commission: Brown Grease Recovery and Biofuel Production Demonstration (\$995,791.00)
- Renewable Energy Institute International: Demonstration of an Integrated Biofuels and Energy Production System (\$996,093.00)
- Bluefire Ethanol: California Lignocellulosic Biorefinery Project (\$995,938.00)



Summary of Allocations

Alternative Fuel Infrastructure	\$5.4 million
Biofuels Production	\$6.0 million
Plug-in Hybrids	\$5.0 million
Transit Buses	\$2.0 million
Alt Fuel Vehicle Incentives	\$1.5 million
Consumer Education/Outreach	\$1.6 million
Research and Testing	\$3.2 million
Total Funding:	\$24.7 million

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<ftp://ftp.arb.ca.gov/carbis/board/books/2007/052407/07-5-3pres.pdf>
http://www.arb.ca.gov/fuels/altfuels/incentives/052407altfuel_sr.pdf



Summary of Biofuels Production Proposals

- ➡ **Allocated \$5 million**
- ➡ **50 proposals/\$43.0 million requested**
- ➡ **10 recommended proposals**
- ➡ **\$6.0 million recommended funding**
- ➡ **\$68 million match funding**
- ➡ **6 additional proposals identified if funding available: \$5.6 million**

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<ftp://ftp.arb.ca.gov/carbis/board/books/2007/052407/07-5-3pres.pdf>
http://www.arb.ca.gov/fuels/altfuels/incentives/052407altfuel_sr.pdf



Proposals Recommended for Funding

- ☞ **Convert Dairy Waste into Biofuel (Bakersfield)**
 - Crimson/Byogy Group
 - \$650,000
- ☞ **Produce Methane from Dairy Digester to Power Converted Diesel Milk Trucks and Generate Electricity (Tulare County)**
 - Hilarides Dairy
 - \$600,000
- ☞ **Convert Landfill Gas Generated at Bowerman Landfill to Liquefied Natural Gas (LNG) (Orange County)**
 - Prometheus Energy
 - \$640,000

Proposals Recommended for Funding (cont)

- ☞ **Convert Landfill Gas Generated at Altamont Landfill to Liquefied Natural Gas (LNG) (Livermore)**
 - GTI/Waste Management, Inc./Linde BOC
 - \$610,000
- ☞ **10 MM Gallons Per Year Biodiesel Plant (Oakland)**
 - Blue Sky Bio-Fuels
 - \$620,000
- ☞ **MM Gallons Per Year Biodiesel Plant (Pacifica)**
 - Whole Energy Fuels
 - \$620,000

For further details see

<ftp://ftp.arb.ca.gov/carbis/board/books/2007/052407/07-5-3pres.pdf>
http://www.arb.ca.gov/fuels/altfuels/incentives/052407altfuel_sr.pdf

California Integrated Waste Management (CIWMB) Board



CIWMB Approves Funds for Landfill LNG Project:

Study has the potential to produce clean alternative fuel source

GTI receives \$740,000 grant to demonstrate collection of methane gas from decomposing waste materials in landfills and conversion of the methane into liquid natural gas (LNG).

Location:

Altamont Landfill (Alameda County). The demonstration project will produce at least 10,000 gallons of LNG daily, utilize landfill gas that is currently burned off in flare systems and should have all the necessary land use permits.

For further details see:

<http://www.ciwmb.ca.gov/agendas/mtgdocs/2007/06/00022059.doc>

BP Investing on Biofuels

- BP selects UC Berkeley to lead **\$500 million** energy research consortium with partners Lawrence Berkeley National Lab, University of Illinois





UC Davis - Chevron Joint Research Agreement



UCDAVIS



- \$25 million over 5 years
 - Additional \$5 million in-kind from Chevron
- Focus on transportation biofuels

<http://bioenergy.ucdavis.edu>

UCDAVIS



University of California, Davis



The Joint BioEnergy Institute (JBEI), one of three new U.S. Department of Energy (DOE) Bioenergy Research Centers, will receive \$6.7 million in initial funding (FY2007) to begin research on biofuels – liquid fuels derived from the solar energy stored in plant biomass. This funding is in addition to \$125 million DOE plans to invest in JBEI over the next five years, part of a total **\$375 million DOE investment** in biofuels basic research.

JBEI is a partnership between DOE's Lawrence Berkeley National Laboratory (Berkeley Lab), DOE's Sandia National Laboratories, DOE's Lawrence Livermore National Laboratory, the University of California campuses of Berkeley and Davis, and the Carnegie Institution.

For details about JBEI see
<http://jbei.lbl.gov/>

State Alternative Fuel Plan (AB 1007)

- The draft Plan has been released early this month for public comments.
- The Plan presents strategies and actions California must take to increase the use of alternative non-petroleum fuels, in a manner that minimizes costs to California and maximize economic benefits of in-state production.

Public Workshop: Oct 9, 2007

Written Comments Due: Oct 12, 2007

Commission Business Meeting: Oct 31, 2007

http://www.energy.ca.gov/ab1007/notices/2007-10-09_notice_workshop.html



A Low Carbon Fuel Standard for California

Executive Order S-1-07 (Low Carbon Fuel Standard)

A wide range of fuel options (including biofuels) has been discussed in this report. It shows that a 10 percent reduction in carbon intensity of transportation fuels by 2020 as an ambitious goal but attainable.

http://www.energy.ca.gov/low_carbon_fuel_standard/index.html

Final Remarks



California has ambitious goals for biofuel production.

A reasoned and well planned transition to a diversified alternative transportation future using biofuels can be a critical step toward achieving California's goals of improved air quality, reduced petroleum dependence, reduced GHG emissions, and improved energy security.

Achieving the state's policy and environmental goals for biofuels will require substantial investment in RD&D, fueling infrastructure, production facilities, vehicle components, and commercial development of biofuels, and advanced technology vehicles.

Thank You

Grazie Gracias

Merci Dankë

Danke schön Dankschen

Salamat po Khawp khun makh

Danyavad Tack så mycket

Arigato gozaimasu Dank u

Dank u wel Dziakuju

Kamsahamnida

Kiitos Efcharist

Dzieki Terima kasih Labai dekoju