CALIFORNIA
ENERGY
COMMISSION

2009 PROGRESS TO PLAN
BIOENERGY ACTION PLAN FOR CALIFORNIA

Prepared for the Bioenergy Interagency Working Group:

Air Resources Board
California Energy Commission
California Environmental Protection Agency
California Resources Agency
California Department of Food and Agriculture
Department of Forestry and Fire Protection
Department of General Services
Integrated Waste Management Board
Public Utilities Commission
Water Resources Control Board

STAFF REPORT

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Arnold Schwarzenegger, *Governor*

CALIFORNIA ENERGY COMMISSION

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Abstract

In 2005, Governor Schwarzenegger expressed support for the public-private California Biomass Collaborative and directed the Interagency Bioenergy Working Group to develop an integrated and comprehensive state policy on the use of biomass for electricity generation and natural gas and petroleum consumption. In 2006, the Governor issued Executive Order S-06-06, establishing targets for the use and production of biofuels and biopower and directing state agencies to work together to advance biomass programs in California. The Interagency Bioenergy Working Group assembled a plan that provides specific actions and timelines that agencies agreed to take to implement the Executive Order. This report serves as the second Progress to Plan.

Keywords: Interagency Bioenergy Working Group, California Energy Commission, Bioenergy Action Plan, Progress to Plan, biofuel, biopower

Executive Summary

The 2009 Bioenergy Action Progress to Plan addresses the State of California's progress in developing a coordinated state government approach to bioenergy issues and responds to Executive Order S-06-06 that established biomass productions and use targets for California.

The 2006 Action Plan identified 63 action items for various state agencies (Attachment 1). Despite better coordination within state agencies, progress towards meeting California's ambitious bioenergy goals has been slow, and in some cases, the state is losing ground.

Without major initiatives to make legislative and regulatory changes, and state and federal financial incentives and policies that recognize the benefits of using "waste" material for energy, California will fall far short of the goals outlined when Governor Schwarzenegger signed Executive Order S-06-06 which stated:

- For biomass used for electricity, the state shall meet a 20 percent target within the established state goals for renewable generation for 2010 and 2020.
- For biofuels, the state shall produce a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050.

The action items of the 2006 *Bioenergy Action Plan* remain important and California state government continues to:

- Coordinate research, development, demonstration, and commercialization efforts with federal and state agencies.
- Align existing state regulatory requirements to encourage production and use of California's biomass resources.
- Promote California as a market leader in technology innovation and market development.
- Encourage market entry for new applications of bioenergy, including electricity, biogas, and biofuels.
- Maximize the contributions of bioenergy toward achieving multiple state policy goals of petroleum reduction, addressing climate change, renewable energy, and environmental protection.

This is the Second Progress to Plan update of the 2006 Bioenergy Action Plan

CHAPTER 1: Introduction

The Interagency Bioenergy Working Group assembled a plan that provides specific actions and timelines that agencies agreed are necessary to implement the Executive Order. This Second Progress to Plan developed by the California Energy Commission presents the status, barriers, and recommendations of biopower and biofuel development using biomass in California. The status of biopower and biofuel are summarized in Chapters 2 and 4, respectively, and the barriers and recommendations to the development of each are summarized in Chapters 3 and 5. Chapter 6 includes conclusions drawn from Chapters 2 to 5.

CHAPTER 2: Status of California's Biopower Development

California consumed 306,577 gigawatt hours (GWh) of electricity in 2008 with about 64 percent generated from fossil fuel including natural gas and coal, 14 percent from nuclear, 11 percent from large hydroelectric, and 11 percent from renewable resources (Table 1).

Table 1: 2008 Total System Power (GWh)

Fuel Type	In-State	Northwest Imports	Southwest Imports	Total System Power
Coal	**3,977**	**8,581**	**43,271**	**55,829**
Large Hydro	**21,040**	**9,334**	**3,359**	**33,733**
Natural Gas	**122,216**	**2,939**	**15,060**	**140,215**
Nuclear	**32,482**	**747**	**11,039**	**44,268**
Renewables	**28,804**	**2,344**	**1,384**	**32,532**
Biomass	5,720	654	3	6,377
Geothermal	12,907	0	755	13,662
Small Hydro	3,729	674	13	4,416
Solar	724	0	22	746
Wind	5,724	1,016	591	7,331
Total	**208,519**	**23,945**	**74,113**	**306,577**

Source: California Energy Commission

The 2006 *Bioenergy Action Plan* follows the Governor's Executive Order for in-state electricity production using biomass resources, and has a target of producing 20 percent of the state Renewables Portfolio Standard (RPS) goals for renewable generation by 2010 and 2020. The RPS obligates investor-owned utilities (IOUs), energy service providers (ESPs) and community choice aggregators (CCAs) to procure an additional 1 percent of retail sales per year from eligible renewable sources until 20 percent is reached, no later than 2010. For 2020, an accelerated RPS goal of 33 percent has been established.

California generates over 80 million bone dry tons (BDT) of biomass annually. [1] Of the total biomass generated each year, 28.5 million BDT come from solid fuel biomass including forest thinnings, slash, shrub, and mill residues, agricultural crop residues, and recovered municipal solid waste (MSW); 19.2 million BDT come from MSW that is currently disposed of in landfills; and 4.5 million BDT come from livestock manures, sewage sludge, and food processing wastes.

1 Bone dry means completely dry and without any trace of moisture.

The remaining 27.8 million BDT are not technically feasible to collect and use in producing renewable electricity, fuels, or biobased products.[2]

In 2008, California generated approximately 20 percent of its renewable electricity from biomass fuels, including:

- Solid fuel biomass (including mill and agricultural residues, forest slash and thinnings, urban wood wastes, and recovered MSW[3]).
- Unrecovered MSW. [4]
- Landfill gas from the existing wastes in place.
- Digester gas generated from anaerobic digestion of
    - Sewage sludge
    - Livestock manure
    - Agricultural and industry wastes or wastewaters.

Since 2002, electricity generated from biomass fuels decreased from 6,192 GWh to 5,724 GWh in 2008 while the state's total electricity generation and demand has increased.[5] Meeting California's 20 percent RPS goal and the 2010 biopower targets would require an additional 6,562 GWh biopower generation annually assuming that total electricity consumption in 2010 will remain the same as in 2008 at 307,141 GWh.

California's biopower generation was about 943 megawatts (MW) in 2008; 60 percent of existing biopower generation comes from solid fuel biomass, 28 percent from landfill gas, 7 percent from digester gas, and 4 percent from unrecovered MSW (Figure 1).

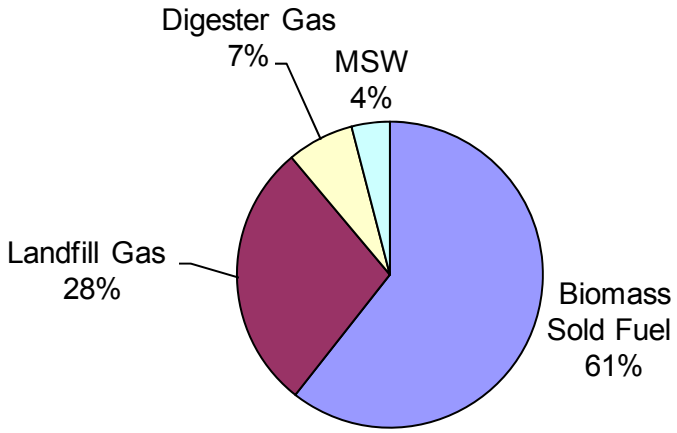
2 California Biomass Collaborative. 2005. *Biomass in California: Challenge, Opportunities, and Potential for Sustainable Management and Development. Prepared for the California Energy Commission*. http://biomass.ucdavis.edu/materials/reports%20and%20publications/2005/2005_Biomass_in_California.pdf.

3 Recovered MSW includes the portion of the MSW that is currently recycled, composted, or transformed into energy.

4 Unrecovered MSW includes the portion of the MSW that is currently landfilled.

5 Daryl Metz presentation at the 2009 Integrated Energy Policy Report staff workshop on Research Development and Demonstration of Advanced Generation Technologies, "California Generation Portfolio," California Energy Commission, August 10, 2009.

Figure 1. California Biopower Mix (943 MW), 2008



Data Source: California Biomass Collaborative

Table 2 shows the total number of biomass solid fuel facilities constructed during the 1980s, 1990s, and 2000s; number of currently operating facilities built during the 1980s or before, 1990s, and 2000s; and electric power capacity for the facilities constructed to date and currently operating. Although 60 percent of California's biopower generation comes from solid-fuel biomass, over half of the total biomass solid fuel biopower plants constructed to date are idle, dismantled, or converted to natural gas power plants. Only one new facility has been constructed since 2000. The total generating capacity from solid fuel biomass has decreased from 958 MW in the 1990s to 667 MW today. Assuming that 19.6 million BDT solid fuel biomass (not including 8.9 million BDT/yr recovered MSW) is available to be converted into electricity, a potential of 2,754 MW could be added based on existing biomass solid fuel resources.[6]

While only one new facility has been constructed since 2001, three idled biomass plants have restarted commercial operations and received financial assistance from the Energy Commission's Existing Renewable Facilities Program. Also, an idled coal facility and two operational coal facilities are undergoing full and partial fuel switches to biomass, respectively. The idled coal facility will restart commercial operations as a biomass generator in the third quarter of 2010, and the operational facilities are firing with at least 10 percent biomass, with plans for higher biomass fuel usage in 2010 and 2011.

6 With an average of 8000 Btu/lb heating value and a 13,000 Btu/kWh of conversion efficiency.

Table 2: California Biomass Solid Fuel Biopower Plants Developed

Year of Construction	# of Total Facilities Constructed	# of Facilities Currently Operating	MW Capacity of Total Facilities Constructed	MW Capacity of Facilities Currently Operating
1980s or before	53	22	759	474
1990s	13	7	199	179
2000s	1	1	36	14
Total	67	30	994	667

Data source: Dr. Gregory Morris, Future Resources Associates, Berkeley, CA

Table 3 shows the development of biopower plants using MSW in California during the last 30 years. Three MSW incineration plants were constructed in the 1980s with a total power generation capacity of 70 MW. No new MSW power plants have been constructed since 1990. Assuming that 19.2 million BDT MSW that is currently disposed of in landfills will be used for electricity production, a potential of 2,192 MW power could be generated.[7] All three MSW incineration power plants constructed during the 1980s remain operating to date and are profitable, even though only one can claim renewable energy credit under the existing renewable energy definition.

Table 3: California MSW Incineration Power Plants

Year of Construction	# of Total Facilities Constructed	# of Facilities Currently Operating	MW Capacity of Total Facilities Constructed	MW Capacity of Facilities Currently Operating
1980s or before	3	3	70	70
1990s	0	0	0	0
2000s	0	0	0	0
Total	3	3	70	70

Data Source: California Energy Commission

Table 4 shows the landfill gas to electricity biopower plants development in California during the last 30 years. There were 118 landfill gas to electricity (LFGTE) facilities constructed with 90 operating today. The total power generation capacity of the 90 facilities is about 309 MW.

7 With an average of 6500 Btu/lb heating value and a 13,000 Btu/kWh of conversion efficiency.

Table 4: California Landfill Gas to Electricity Biopower Plants [8]

Year of Construction	# of Total Facilities Constructed	# of Facilities Currently Operating	MW Capacity of Total Facilities Constructed	MW Capacity of Facilities Currently Operating
1980s or before	43	24	170	127
1990s	24	19	84	72
2000s	51	47	126	110
Total	118	90	380	309

Data Source: US EPA Landfill Methane Outreach Program

During the 2000s, only one new facility was constructed using solid fuel biomass and no new facilities constructed using MSW; however, 47 new LFGTE facilities were added during that time. The total power generation capacity from the 47 LFGTE facilities is about 110 MW. Technologies used to convert landfill gas to electricity include internal combustion (IC) engine, gas turbine, microturbine, and others (Table 5). Locations of the 47 LFGTE facilities developed during the 2000s are shown in Figure 2.

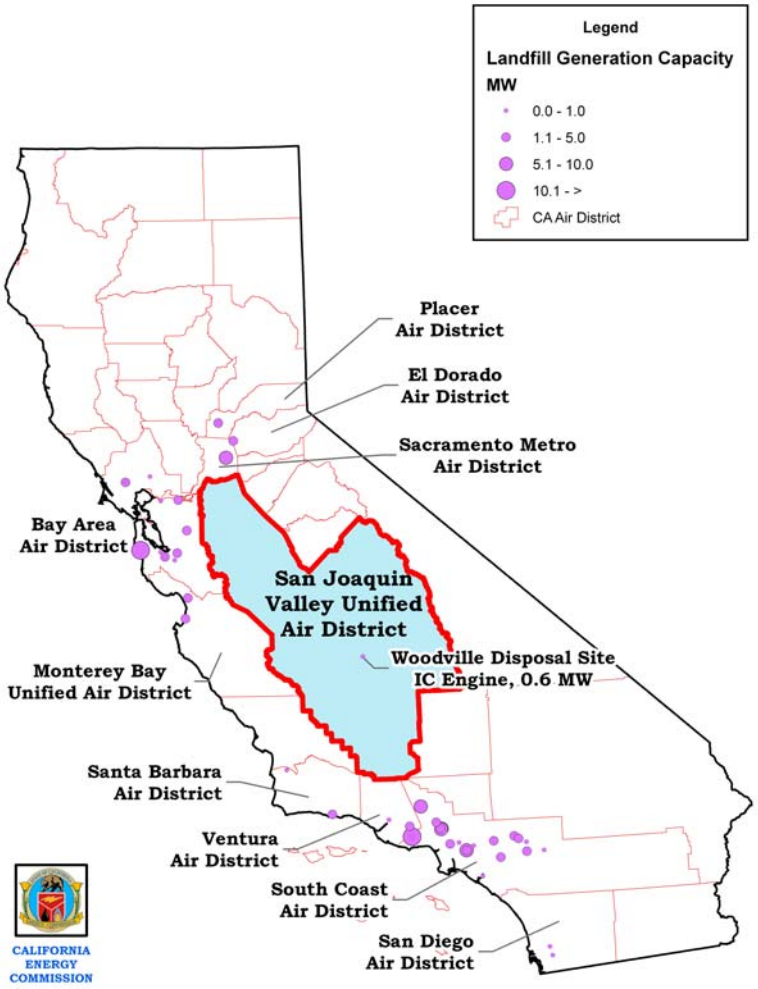
Table 5. California Technologies Used for Landfill Gas to Electricity Since 2000

Technologies	# of Facilities	MW Power Generation
IC Engine	25	78
Gas Turbine	3	20
Microturbine	12	6
Co-generation	4	6
Alternative fuel or direct thermal	3	NA
Total	47	110

Data Source: US EPA Landfill Methane Outreach Program.

8 US EPA Landfill Methane Outreach Program. http://www.epa.gov/lmop/proj/index.htm

Figure 2: California Landfill Gas to Electricity Facilities Developed During 2000s



Digester gas generated from anaerobic digestion of sewage sludge, livestock manure, and agricultural and industry wastes contributed about 7 percent of California's total biopower generation in 2008. Almost all of the biopower generated from digester gas is produced from anaerobic digestion of sewage sludge at domestic wastewater treatment plants. California has 242 sewage wastewater treatment plants, 74 of which have installed anaerobic digesters. The total biopower generation from the 74 plants is about 66 MW.[9]

Table 6 shows the development of biopower plants using livestock manure in California during the last 30 years.

9 Database provided by Lauren Fondahl, US EPA Region 9.

Table 6: California Livestock Manure Biogas Power Plants

Year of Construction	# of Total Facilities Constructed	# of Facilities Currently Operating	MW Capacity of Total Facilities Constructed	MW Capacity of Facilities Currently Operating
1980s or before	18	1	NA	0.03
1990s	0	0	0	0.00
2000s	18	4/5	3.8	0.90
Total	36	10	3.8	0.93

Data Source: California Energy Commission

The tax incentives of the late 1970s and early 1980s encouraged the construction of 18 livestock manure digester systems. To date, only one of the 18 digester facilities built during the 1980s or before remains in operation. Poor engineering design, lack of understanding by the system developers, excessive initial investment, and poor equipment selection with resulting high maintenance cost are the primary reasons for the closure of the 17 livestock manure digester systems developed during the 1980s and earlier.[10]

Senate Bill 5X (Sher, Chapter 7, Statutes of 2001) earmarked $10 million of the approximately $709 million available under the legislation for grants that "encourage the development of manure methane power production projects and reduce air and water pollutions on California dairies." About $3.4 million was awarded to 10 dairy digesters in 2001, and $2.6 million dollars was awarded to an additional eight dairy biogas projects (including one refurbished digester built during the 1980s) in 2006. Nine of the 10 digesters awarded in 2001 became operational by 2005 with a generating capacity of 2.5 MW. However, by the end of 2008, seven of these nine operational projects were shut down. Temporary air permits were issued to the projects awarded in 2006—three of them are operating, and the remaining five are under construction. The locations of the 18 dairy digesters developed during the 2000s are shown in Figure 3.

The Self-Generation Incentive Program (SGIP), initiated in 2001, is also part of the actions taken by the Legislature to address peak electricity demand problems. Assembly Bill 970 (Ducheny, Chapter 329, Statutes of 2000) directed the California Public Utilities Commission (CPUC), in consultation with the California Independent System Operator (California ISO) and the Energy Commission, to reduce demand for electricity and reduce load during peak periods. The same legislation required the CPUC to consider incentives for load control and distributed generation to enhance reliability with "differential incentives for renewable or super-clean distributed generation resources." The CPUC issued Decision 01-03-073 on March 27, 2001, outlining the provisions of a distribution generation incentive program known as the SGIP.[11] The results of electricity delivered by the SGIP for biopower facilities are shown in Table 7. As of December

10 Mark A. Moser. 1997. *Resource Potential and Barriers Facing the Development of Anaerobic Digestion of Animal Waste in California*. CEC P500-97-B100.

11 *CPUC Self-Generation Incentive Program – Eight-Year Impact Evaluation Revised Final Report*. July 2009. Prepared by Itron, Inc.

31, 2008, $601 million in incentives has been paid to 1,268 complete projects, which delivered 718,000 MWh in 2008. Electricity delivered from biopower facilities funded under the SGIP represents about 9 percent of the total.

Figure 3: California Dairy Biogas Digesters Developed During 2000s

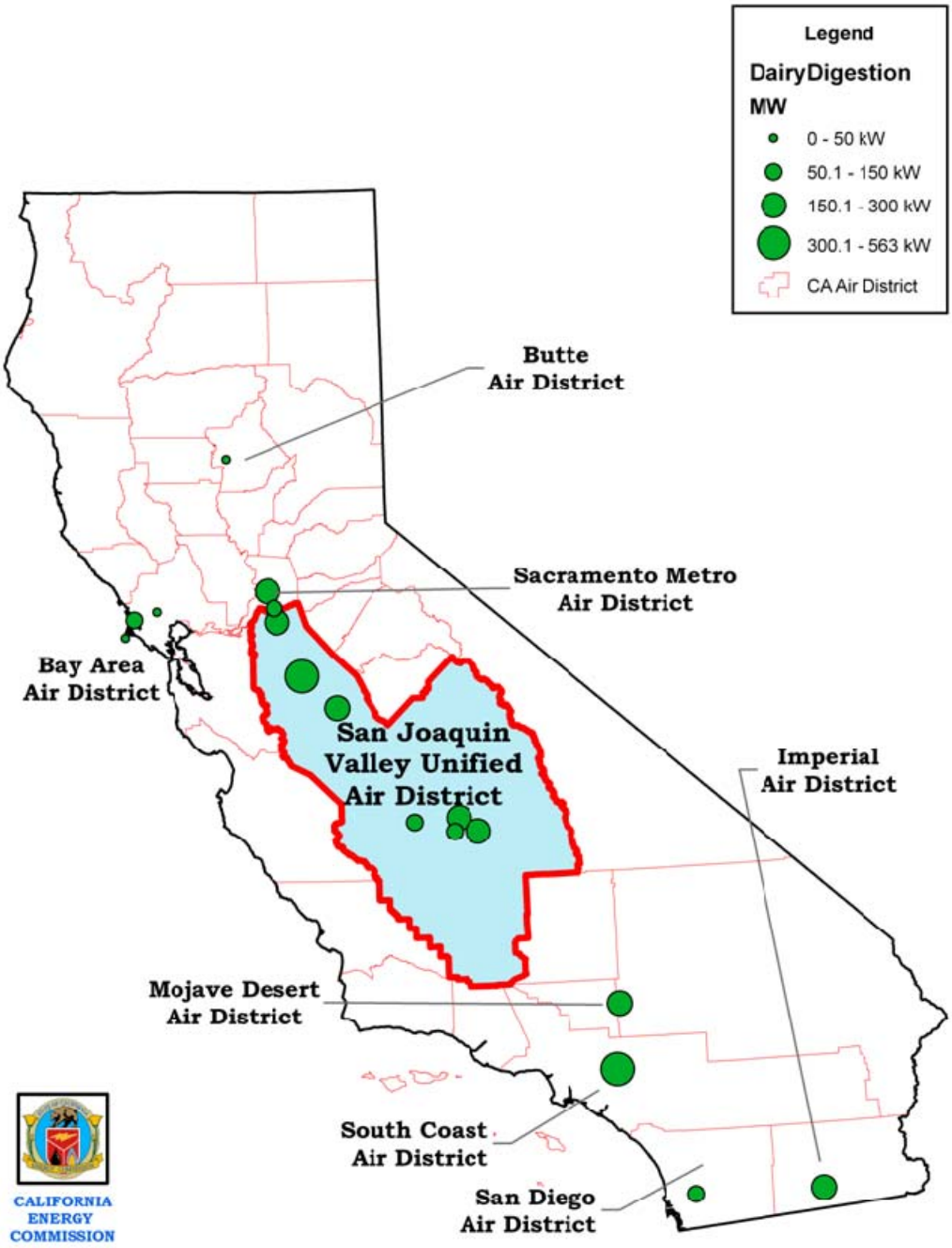


Table 7: Summary of SGIP Electricity Delivered by Biopower Facilities in 2008

Biopower Technologies	MWh	Annual Capacity Factor
Fuel Cell	12,572	0.612*
IC Engine	47,848	0.211*
Microturbine	6,863	0.487*
Total	67,283	

* Indicated confidence lever is better than 70 percent.
Data Source: *CPUC Self-Generation Incentive Program – Eight-Year Impact Evaluation Revised Final Report*. July, 2009. Prepared by Itron, Inc.

CHAPTER 3: Barriers and Recommendations to California's Biopower Development

On April 21, 2009, the Energy Commission held a workshop on biopower in California as part of the 2009 Integrated Energy Policy Report proceeding. Several speakers identified major issues currently facing biopower, including air quality permitting, financial constraints, project financing difficulties, challenges with injecting landfill gas into nature gas pipelines, and barriers to the development of municipal solid waste gasification facilities.

Air Quality Permitting

The main obstacle to developing new biopower facilities in California is obtaining local air permits. In the San Joaquin air basin, the Energy Commission sponsored five new dairy digester projects using internal combustion (IC) engines at rated capacities of 500 kW or less to meet the dairies' electricity needs and, with approved power purchase agreements, to sell excess electricity to the local utilities. Because the air basin is an extreme non-attainment area, the San Joaquin Air Quality Management District imposed strict nitrogen oxide (NOx) requirements on these generators, requiring the most advanced emission control systems. The dairies, facing severe distress from low milk prices, balked at these substantially increased costs and could not agree to the conditions of the permit. Several meetings with the district, the dairymen, the California Environmental Protection Agency, the California Air Resources Board, the local air districts, and other stakeholders resulted in conditional agreement on permits.[12]

Regulating air quality pollutants by annual emissions (tons pollutant /yr) rather than by unit emissions (tons pollutant/kWh) can lead to missed opportunities and prohibit large facility development for biopower. For example, the Lopez Canyon Landfill in Los Angeles had 25 MW of available landfill gas resource; however, that facility could only obtain an air permit for 6 MW. The remaining gas must be flared.

In addition to NOx permitting issues, new solid-fuel biomass projects located in the South Coast Air Quality Management District face the added challenge of obtaining permits to emit particulate matter. A 25 MW solid-fuel biomass project required permits for about 90 pounds per day[13] of PM-10 emission offsets or emission reduction credits.[14] At a cost of about $350,000

12 April 10, 2009, letter from the Western United Dairymen to Governor Arnold Schwarzenegger. This can be downloaded from the Energy Commission's website at http://www.energy.ca.gov/2009_energypolicy/documents/2009-04-21_workshop/comments/Letter_from_Western_United_Dairymen_to_the_Governor_04-10-09_TN-51189.pdf.

13 California Air Resources Board, facility details for Burney Mountain Power, available at http://www.arb.ca.gov/app/emsinv/facinfo/facdet.php?co_=45&ab_=SV&facid_=42&dis_=SHA&dbyr=2007&dd=

per pound per day[15] or $31.5 million for the PM-10 permit, this requirement could make new biomass projects in this part of the state financially unviable.

Financial Situation for Biomass Facilities

About 60 percent of California's biopower generation comes from solid-fuel biomass facilities that were operational before 1996. Since 1998, the Energy Commission has provided production incentives for these facilities; however, these production incentives will expire in 2011. Representatives of the biomass facilities receiving incentives have informed staff that they face difficulties keeping their facilities on-line. For example, many of the existing biomass facilities are nearly 30 years old and face financially challenging maintenance issues. Also, facilities managers report that while plenty of biomass feedstocks are available, they are having difficulty procuring affordable biomass sources.[16] Most of these facilities sell their power under fixed price qualified facility (QF) contracts with an average annual energy price under $66 per MWh. The facilities report that their fuel costs alone can range between $20 and $60 per MWh, with transportation contributing most of the cost.

Project Financing

In recent years, the Energy Commission and other agencies have funded several bioenergy projects with research and demonstration grants to take advantage of the state's diversity of biomass resources through research and demonstration programs. While these projects demonstrate that biomass to electricity could have widespread applications, the costs are still high compared with conventional sources of electricity. Using biopower for distributed generation could offset some of the costs, but reliable, durable, and consistent performance of these generators are necessary to give investors confidence that this system will have adequate payback.

Using biogas to generate electricity faces challenging financial hurdles related to the need to acquire expensive pollution control equipment unless less reliable microturbines are used. The

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14 PM-10 refers to particles with a diameter of 10 micrometers or less; definition found at: http://epa.gov/airtrends/aqtrnd95/pm10.html

15 South Coast Air Quality Management District, September 24, 2009, "PM-10 Market Conditions and Offset Availability in SCAQMD," presentation by Mohsen Nazemi, available at http://www.energy.ca.gov/2009_energypolicy/documents/2009-09-24_workshop/presentations/06_SCAQMD-Nazemi_Market_Conditions_and_Offset_Availability-092409_Final.pdf

16 According to research by the U.S. Forest Service aimed at studying forest management scenarios and at estimating the cost of extracting biomass fuels from the forest, which was presented by Mark Nechodom, Ph.D. of the U.S. Forest Service, treatment and transportation of biomass fuels costs $68 per bone dry ton while plant operators could only afford to pay $8.20 per bone dry ton to get an acceptable return.

alternative to using biogas for electricity generation is to inject the gas directly into the natural gas pipeline. Pipeline injection of biogas such as that produced by dairy cows or wastewater sewage sludge in anaerobic digesters is eligible for the Renewables Portfolio Standard. However, it is very costly to clean the biogas to the level needed to meet rigorous fuel standards set by the gas utilities. In addition, the location of injection points for the gas into the pipeline may require costly extensions to the digesters and gas clean up facility.[17] Also, these biogas injection projects cannot claim federal production tax credits because the credits apply only to the generating facility that uses the gas.[18]

Additionally, other project developers have reported that interconnection and metering fees are costly and that feed-in tariffs cannot help with these costs because they only apply once the project is generating.[19] Developers of solid-fuel biomass facilities have also had difficulty obtaining affordable supplies of biomass fuels.[20]

Injection of Landfill Gas Into the Natural Gas Pipelines

Assembly Bill 4037 (Hayden, Chapter 932, Statutes of 1988), effectively precludes using California landfill gas in gas pipelines, although utilities can purchase out-of-state landfill gas without restrictions. The statute added Section 25421(a) to the California Health and Safety Code, which states that "no gas producer shall knowingly sell, supply, or transport landfill gas to a gas corporation, and no gas corporation shall knowingly purchase landfill gas, if that gas contains vinyl chloride in a concentration that exceeds the operative no significant risk level set forth in Article 7 (commencing with Section 12701) of Chapter 3 of Division 2 of Title 22 of the California Code of Regulations." If a pipeline operator allows the injection of landfill gas into the pipeline, there is a twice monthly measuring requirement. If vinyl chloride is present, both the landfill gas developer and the pipeline operator face a $2,500 penalty per day for each violation. This requirement has resulted in the refusal by in-state pipeline operators to accept purchases of landfill gas produced in-state for injection into the pipeline. Landfill gas injected into the pipeline from out-of-state sources is not restricted under the code. Sacramento Municipal Utility District (SMUD) recently published a press release stating that it has a 15-year contract to purchase landfill gas produced in Texas.[21]

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17 Pg. 138, *Transcript for Tuesday, April 21, 2009 Workshop on Biopower in California*. Allen Dusault, Sustainable Conservation.

18 Pg. 163, *Transcript for Tuesday, April 21, 2009 Workshop on Biopower in California*. Bill Nelson, Sempra Generation.

19 Pg. 2-3 Comments filed by Paul Fukumoto of FlexEnergy, LLC.

20 Pg. 4. Comments filed by Jesus Arredondo of Buena Vista Biomass Power.

21 *SMUD to Purchase Green Gas from Texas*. SMUD press release. http://www.smud.org/en/news/Documents/09archive/texas-gas-4-15-09.pdf

Municipal Solid Waste Gasification Conversion

Although MSW gasification conversion is RPS eligible, the stringent definition of "gasification conversion"[22] effectively prohibits the use of these technologies for RPS compliance. To date, no MSW gasification facility has met this definition, particularly the requirement that the MSW gasification conversion occur without using air or oxygen except ambient air to maintain temperature control.[23]

Most Western Electricity Coordinating Council (WECC) states do not explicitly allow MSW to be used for RPS compliance. California's RPS allows MSW that has undergone gasification or been converted to biodiesel to be used for RPS compliance, but combustion of solid unconverted MSW is not eligible (with the limited exception of facilities located in Stanislaus County and operational before Sept. 26, 1996). Similarly, Arizona allows only gasified MSW to be used for RPS compliance but does not specifically permit combustion of solid MSW. Nevada is the only WECC state to specifically allow unlimited or unrestricted combustion of solid MSW and gasified MSW to be used for RPS compliance. All other WECC states do not identify any form of MSW as eligible for RPS compliance.

As the space available for landfills becomes more limited in California, renewable energy developers have expressed interest in MSW gasification and are seeking clarification of rules for RPS eligibility of MSW conversion.

Recommendations to Support California's Biopower Development

- The 2006 *Bioenergy Action Plan* should be updated to address existing barriers described in this report and identify potential solutions to solve the barriers to meeting the Governor's goal to meet 20 percent of renewable energy goals with electricity generated from biomass. While the *Bioenergy Action Plan* successfully addressed a number of important tasks, further action is needed to meet the goals of the Governor's Executive Order for biopower and biofuels.
- Given the state's aggressive renewable energy targets and the need for additional renewable energy to meet those targets, the 2009 IEPR recommended that the Energy Commission and the California Integrated Waste Management Board should review

22 Public Resources Code Section 25741.

23 April 21, 2009, IEPR workshop comments by Phoenix Energy: "There is no way you can do this without the presence of oxygen. Limited oxygen, yes, but if you follow the definition to the letter of the law, it can't be done.", transcript p. 74, see [http://www.energy.ca.gov/2009_energypolicy/documents/2009-04-21_workshop/2009-04-21_TRANSCRIPT.PDF].

emerging technologies to gasify MSW that most closely meet the intent of current RPS eligibility requirements as well as environmental considerations and, if appropriate, suggest modifications to applicable state statutes to allow such technologies to be RPS-eligible.

- The Energy Commission should explore options to ensure that existing biomass facilities continue to operate, including continuation of the Existing Renewable Facilities Program, subsidizing biomass feedstocks, or developing a feed-in tariff for existing biomass facilities.
- The state should expend the efforts to encourage biomass co-digestion, biopower and biofuel co-generation technologies to maximize the use of California's abundant biomass, solve waste disposal problems, and reduce catastrophic wildfires.
- Local air pollution districts should be encouraged to become involved in the Interagency Biomass Working Group since they have key regulatory authority over biomass projects. Furthering the dialogue between air districts, the state's energy agencies, the Governor, and the Legislature can result in innovative solutions to reduce air pollution while enabling California to meet its air quality and biomass energy goals.
- A long-term program should be established to validate and track critical research results and data achieved to date for bioenergy technologies, fund research on integrated bioenergy system design and operation, and support bioenergy education, research, and training programs established under colleges, universities, and other institutions to ensure that well-trained and qualified human resources are available for the bioenergy industry development

CHAPTER 4: Status of California's Biofuel Development

The *Bioenergy Action Plan* calls for in-state transportation fuel production using biomass resources and has a target of producing a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050.

Near term biofuel production for California will most likely be ethanol, biodiesel, and biomethane either as compressed natural gas (CNG) or liquefied natural gas (LNG). Currently, about 1 billion gallons of ethanol is consumed in California each year as a transportation fuel. Nearly all of this is used as a blendstock for California Reformulated Gasoline, which is blended at the E-6 (six percent) level. About one million gallons is used annually at the E-85 blend level.

California has seven biorefineries. Five convert corn grain to ethanol, and two convert cheese and beverage wastes to ethanol. The total production capacity of the seven biorefineries is about 250 million gallons per year (MGPY). As of December 2009, four of the five modern corn grain ethanol biorefineries are off-line due to adverse market conditions.[24] As a result, nearly all of the 1 billion gallons of ethanol used each year in California is imported from large Midwest ethanol producers. The ratio of existing ethanol generation to consumption in California is 55 million gallons/960 million gallons or 5.7 percent.

Biodiesel is the second most widely used biofuel in California. About 50 million gallons were consumed in California in 2009, primarily at the B5 blend level. California has 11 biodiesel plants with a combined production capacity of 87 MGPY. Due to biodiesel's inability to compete with petroleum-based diesel prices, however, six of these plants are idle and the remainder will likely produce less than 25 MGPY. California's biodiesel plants currently use yellow grease as their lowest-cost feedstock but also use more expensive and abundant soybean, palm, and a variety of plant and animal byproducts for biodiesel production. [25] As of September 2009, the ratio of biodiesel generation/consumption was 6 million gallons/50 million gallons or 12 percent.

In addition to ethanol and biodiesel used for transportation, in 2008, California used about 150 million therms of natural gas for CNG or LNG vehicles, and 828 GWh of electricity for plug-in hybrid electric vehicles (PHEVs) in California in 2008. There are also 190 hydrogen-powered vehicles on the road in California.[26] However, it is unclear how much of these alternative

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24 All five of the large biorefineries were idle for most of 2009. Calgren recently restarted production at its 52.5 MGPY facility at Pixley, California. Staff presentation by Jim McKinney at the AB 118 Investment Plan Biofuels Workshop, September 14 and 15, Sacramento, California.

25 Jim McKinney's presentation at the AB 118 Investment Plan Biofuels Workshop, "Status of Biofuel Production Facilities in California," California Energy Commission, September 14 and 15, 2009.

26 *2009 Integrated Energy Policy Report*, California Energy Commission, CEC-100-2009-003-CTD.

transportation fuels are derived from renewable resources. If these fuels become major alternative transportation fuels and are largely imported from out of state using imported renewables, there will be additional instate biofuel production requirements needed to meet the biofuel target.

California developed two ethanol plants during the 1980s that converted beverage and cheese wastes or wastewater to ethanol with annual production capacity of 8.5 million gallons (Table 8). No new ethanol facilities were built during the 1990s. When Methyl Tertiary Butyl Ether was phased out to meet the US EPA's Clean Air Act, five new ethanol plants were developed during the 2000s to replace 5.7 volume percent of the total gasoline consumed in the state. All five ethanol plants built during the 2000s used corn brought in by rail from the Midwest as the predominant feedstock; however, as of December 2009, only one of the five corn grain-to-ethanol biorefineries continues in operation. In addition to the corn ethanol plants sitting idle, the Golden Cheese Plant, built in 1985, was permanently closed after more than two decades in operation.

According to a recent study, the five modern California corn ethanol biorefineries produced ethanol with a carbon intensity value of 80.7 grams of CO_2–equivalent per megajoule (gCO_2-eq/MJ), which is about 20 percent lower than imported Midwest corn ethanol at 99.4 gCO_2-eq/MJ).[27] This lower carbon intensity is due to using natural gas for process energy (rather than a Midwestern mix of coal and natural gas), a higher process efficiency, and the distribution of "wet grains" for dairies and cattle feedlots, rather than drying the distiller grains.

Table 8: California Ethanol Plants

Year of Construction	# of Total Facilities Constructed	# of Facilities Currently Operating	Million gal/yr Capacity of Total Facilities Constructed	Million gal/yr Capacity of Facilities Currently Operating	Feedstock Used
1980s	2	1	8.5	5	Beverage and cheese wastes
1990s	0	0	0	0	
2000s	5	0	239	0	Corn
Total	7	1	247.5	5	

Data source: California Energy Commission[28]

Several advanced sugar ethanol projects in California are in the planning and early development phase. These facilities would use sugar cane, sweet sorghum, or sugar beets as feedstocks and produce very low carbon intensity fuels (80 to 90 percent reduction) using

27 "Detailed Modified California GREET Pathway for Corn Ethanol," ARB Staff Draft Report, February 22, 2009.

28 Presentation by Jim McKinney at the AB 118 Investment Plan Biofuels Workshop, "Status of Biofuel Production Facilities in California," California Energy Commission, September 14 and 15, 2009.

conventional fermentation and distillation process technologies. These projects would use fully integrated, complimentary technologies to produce ethanol, electricity, building materials, beverages, fertilizer, or soil amendment and other value-added products.

The Energy Commission has also funded several pilot or full-scale demonstration projects for coproduction of ethanol and electricity that uses ligno-cellulosic biomass including forest residues, rice straw, and recovered MSW and yard wastes. These projects are the Sacramento Ethanol Partners Arkenol Ethanol, Collins Pine/BC International/Ogden, Gridley, and Bluefire Ethanol. To date, technologies converting ligno-cellulosic biomass to ethanol have not passed the most important test—demonstration in a commercially viable facility; however, biomass-to-biofuel conversion technology commercialization continues to progress.

Biomethane, a renewable form of natural gas, is not currently used in large quantities in transportation but has shown potential as a transportation biofuel in California. The most likely sources of biomethane will be dairies, landfills, wastewater treatment facilities, and agricultural food processing facilities. While technologies upgrading biogas to biomethane exist, they still must demonstrate financial and economical feasibility. Renewable hydrogen has also been cited as a source of renewable fuel but is currently produced in very small amounts in California using solar energy as its energy source. Hydrogen production is a very energy-intensive process, and it is difficult to harness enough renewable energy to produce in large quantities; however, if the technology becomes commercialized, renewable hydrogen could potentially provide numerous environmental benefits coupled with a stable fuel source that can be derived from many feedstocks.

For ethanol to meet the *Bioenergy Action Plan*'s instate biofuel production goal for 2010, the state should consider restarting its largely idle in-state production capacity to add 145 MGPY. To meet the 2020 target, the state will need to add an additional 500 MGPY of new ethanol production capacity. Furthermore, several state and federal policy drivers will lead to increased use of biofuels in California. Policies that have become key influential factors in the use of biofuels in California include revisions to the Energy Independence and Security Act (EISA), the Federal Renewable Fuel Standard (RFS2), California's Low-Carbon Fuel Standard[29] (LCFS), and California's shift from E-6 ethanol blend level to E-10 in 2010. The shift to E-10 alone will increase consumption of ethanol to about 1.5 billion gallons per year, while California's "fair share" of the 36 billion gallons of advanced biofuels specified nationally in the RFS2 will be 3 billion gallons per year in 2022. These policies will work together to increase the amount of biofuel consumption in California, and the increases will have to be accounted for when calculating in-state biofuel production requirements.

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29 Air Resources Board staff estimates that up to 30 new biorefineries will be needed in California to help achieve the 10 percent carbon intensity reduction targets in the Low-Carbon Fuel Standard. Advanced biofuels are projected to account from 60 to 89 percent of the total carbon reductions from transportation fuels by 2020. California Air Resources Board, *Proposed Regulation to Implement the Low-Carbon Fuel Standard: Initial Statement of Reasons*, March 5, 2009.

For biodiesel to meet the *Bioenergy Action Plan*'s in-state biofuel production goal for 2010, the state may need to consider restarting its largely idle in-state biodiesel production capacity to add 4 MGPY. The state will need to add an additional 44 MGPY of new biodiesel capacity to meet the 2020 biofuel production goal. It is assumed that the biodiesel consumption in 2020 will remain the same as it is in 2009 at 50 MGPY.

CHAPTER 5: Barriers and Recommendations to California's Biofuel Development

Factors inhibiting biofuel development include feedstock supply versus viable technology, fundamental mass and energy balance data using fully integrated process, fossil fuel competition, cost of biomass collection and processing and unrealized net social, economical, and environmental benefit, current credit crisis, and adequate government policy.

Feedstock Supply versus Viable Technology

Ethanol can be produced from either ligno-cellulosic or starch/sugar type of biomass feedstocks. California has substantial biomass resources of waste streams from the agricultural, municipal, and forest sectors that are available for use as feedstocks for advanced biofuels with low carbon intensity values. California's agricultural and municipal waste streams provide a technical potential of 17 million bone dry tons per year (MBDT/yr), with an additional 14.2 MBDT/yr available through forest residues. However, over 95 percent of the biomass produced in California is the ligno-cellulosic type of feedstock. To date, technologies converting ligno-cellulosic biomass to ethanol have not yet passed the most important test—demonstration in a commercially viable facility. However, as evidenced by information presented by energy developers, and at the AB 118 Investment Plan workshops, as well as recent American Recovery and Reinvestment Act awards, commercial viability may be fast approaching. Should the ligno-cellulosic ethanol technology become developed to commercialization, about 1.9 billion gasoline gallon equivalent ethanol could potentially be produced using the existing available biomass feedstocks in California.

Technologies available for ligno-cellulosic ethanol include separate hydrolysis/fermentation (SHF), simultaneous saccharification/fermentation (SSF), simultaneous saccharification/co-fermentation (SSCF), consolidated bioprocessing (CBP), and gasification and fermentation or catalytic synthesis (GF/CS). Significant challenges remain and need to be overcome. The challenges for SSF, SSCF, and CBP, and GF/CS technologies are listed below.

- Dilute and Strong Acid Hydrolysis (SHF)
  - The need to regenerate acids.
  - Formation of inorganic waste streams.
  - High operational temperatures and pressures.
  - The corrosiveness of the pretreatment.
  - High water consumption: 28-54 gallon water/ gallon ligno-cellulose ethanol produced versus 15 gallon water/gallon corn ethanol produced.
- SSF, SSCF, and CBP
  - Effective enzymes to separate lignin from cellulose and hemi-cellulose.
  - Effective enzymes to simultaneously hydrolyze cellulose and hemi-cellulose into simple C5 and C6 sugars.

- GF/CS
  - Feedstock homogeneity (moisture and composition).
  - Capital cost.
  - Tar formation.
  - Syngas cleanup.

Fundamental Mass and Energy Balance Data Using Fully Integrated Systems

Mass and energy balance data for an integrated system at both laboratory and pilot scales are critical to determine system net energy requirement, conversion efficiency, and technical and economical feasibilities before it is commercialized. To date, complete mass and energy balance data using lingo-cellulosic biomass to produce ethanol with a fully integrated system are lacking at all scales including laboratory. Existing partial process data are based on plant capacity at 1 ton/day or less.[30] These have posed serious risk when investing large scale or so called commercialized facilities in the past.

Fossil Fuel Competition

Organization of the Petroleum Exporting Countries (OPEC) and oil industry actions are not predictable. While oil prices are expected to increase over time, increase or decrease of flow from existing reserves can always decrease or increase oil market prices at any time. [31]

Cost of Feedstock Collection and Processing, and Unrealized Net Social, Economical, and Environmental Benefits

California's existing available biomass, in general, is generated from waste streams. The cost per unit of fuel in terms of $/million BTU for biomass is often higher than it is for fossil fuel due to the cost needed to collect and process biomass before it is ready as a feedstock for energy production. However, using in-state biomass resources for renewable energy generation will help solve waste disposal problems, reduce potential wildfires, reduce dependency on fossil fuels, and protect the environment and public health by reducing air, water, and soil pollution. Such net benefits have not been fully quantified and realized when biomass feedstock is competing with fossil fuel for energy production.

30 J.R. Hettenhaus, R. Wooley and A. Wiselogel. 2000. *Biomass Commerzialization Prospects in the Next 2-5 Years*. National Renewable Energy Laboratory.

31 J.R. Hettenhaus, R. Wooley and A. Wiselogel. 2000. *Biomass Commerzialization Prospects in the Next 2-5 Years*. National Renewable Energy Laboratory.

Current Credit Crisis

The biofuels industry has taken a hit due to the severe downturn of the economy. Construction on a number of biofuel projects has ceased due to companies' inability to secure financing. In today's economically risk-adverse climate, financial institutions are not funding unique bioufuel infrastructure projects, which all pose uncertain risks. Lack of capital and debt financing is impeding biofuel plant development and upgrades at existing plants. If capital and debt financing were readily available, California's existing and planned biofuel plants could move forward to use instate biomass wastes and other alternative feedstock.

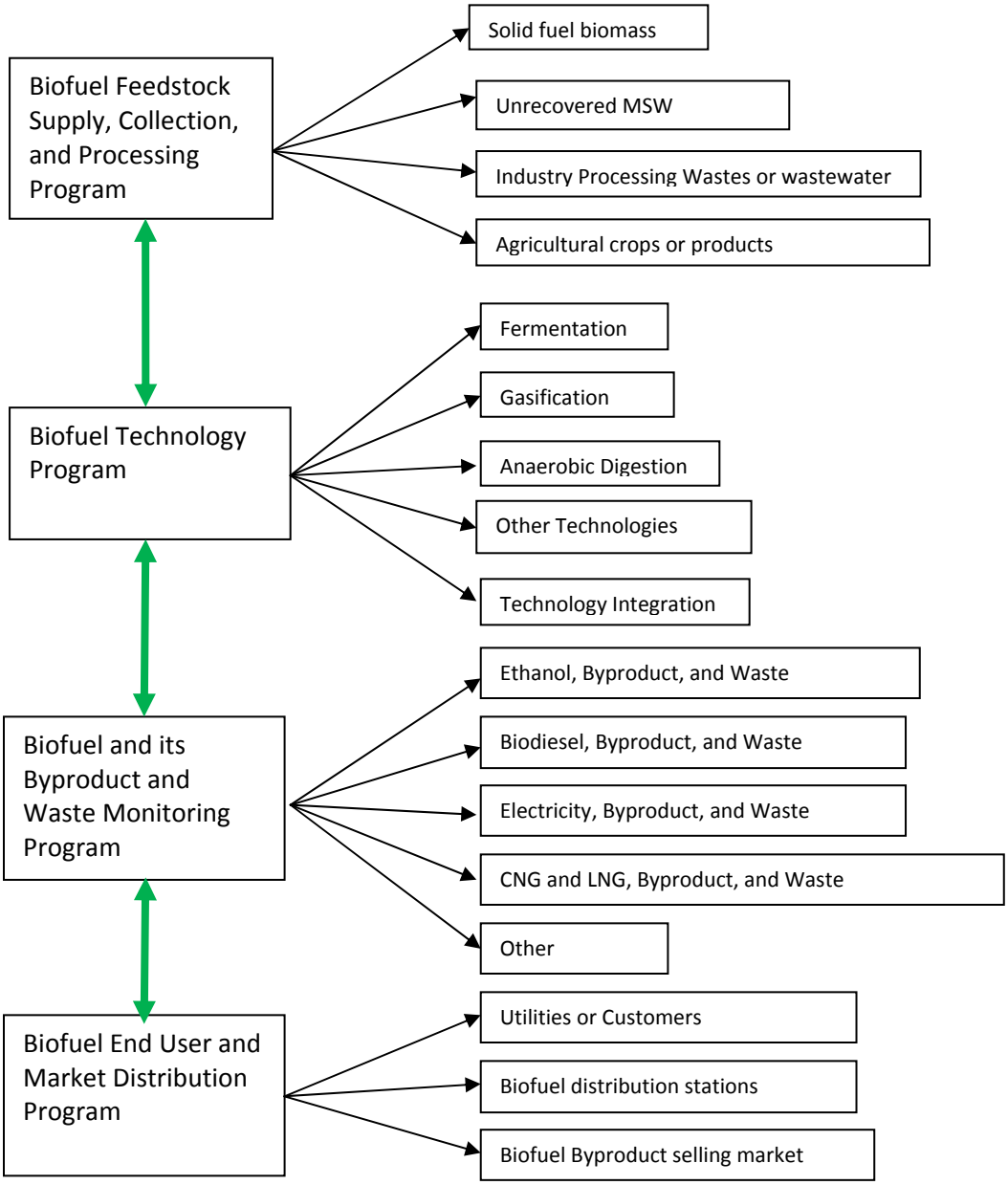
Adequate Government Policy

The federal and state environmental policies are fragmented and sometimes conflicting. Adequate and validated environmental data often do not yet exist when pollutant emission standards are established even for existing industry operation. For example, as of October 1, 2007, California's agricultural operations are required to meet the U.S. Environmental Protection Agency's Clean Air Act (CAA) Title V regulations although it is still unclear if the regulations are based on sufficient research data to adequately identify and quantify agricultural source emissions. To meet the new CAA requirements, many agricultural operations will face challenges to obtain sufficient funds to add waste treatment facilities.

Recommendations to Support California's Biofuel Development

- Establish multiple but well connected chain programs to use in state biomass resources for biofuel development in California. These multiple and chain programs include Biofuel Feedstock Supply, Collection, and Processing, Biofuel Technology, Biofuel and its Byproduct and Waste Monitoring, and Biofuel End-User and Market Distribution as shown in Figure 4.

Figure 4: Biofuel Multiple Program Connection



Source: California Energy Commission

- Establish comprehensive policies and incentives targeting usage of in-state biomass resources with consideration of the multiple program connections and barriers presented.
- Establish multiple but well-connected performance and environmental standards based on best available technology using in-state biomass resources.
- Create short-term grants to help all cities in California establish a long-term business plan on bioenergy development using existing available feedstock and viable technologies and at the same time solve urgent problems such as waste disposal.
- Create long-term, zero-interest loans and grants to help the biofuel industry invest capital equipment and ease the financing process based on the business plan developed.
- Work with utilities and stakeholders to create a fair bioenergy market price that reflects the cost of biomass feedstock collection and processing and unrealized net social, economical, and environmental benefits.
- Establish long-term monitoring programs for biofuel/bioenergy and its byproducts produced and distributed into the market.
- Establish long-term grants to support bioenergy education, research, and training programs established under colleges, universities, and other institutions to ensure that well-trained and qualified human resources are available for the bioenergy industry development.
- Validate and track critical research results and data achieved to date for bioenergy technologies.
- Encourage research on integrated system design and operation from feedstock collection to energy production and waste handling at both laboratory and pilot scales prior to full-scale or so-called commercialized facilities being demonstrated.
- Provide incentives to successful technology demonstrations using integrated systems to attract real private investment to make the projects both economically and financially feasible.

CHAPTER 6: Conclusions

- The development of both biopower and biofuel production using biomass has been slow and is unlikely to meet the Governor's Executive Order bioenergy targets in 2010. Meeting both California's 20 percent RPS goal and the 2010 biopower targets would require an annual addition of 6,562 GWh electricity with the assumption that total electricity consumption in 2010 will remain the same as it is in 2008 at 307,141 GWh. Meeting California's 20 percent biofuel target by 2010 would require an annual addition of 141 million gallons per year (MGPY) of combined ethanol and biodiesel production.
- California generates about 80 million bone dry tons (BDT) biomass annually. Managing this amount of biomass presents clear opportunities and challenges when increasing attention on biomass use is driven by renewable energy, economic, environmental, social, and market considerations. These considerations include meeting RPS and Renewable Fuel Standard (RFS)2 goals, low carbon fuel standards, and bioenergy targets; reducing severity and risk of wildfire; improving forest health and watershed protection and air and water quality; reclaiming greenhouse gas emissions; developing municipal resources; reducing dependency on imported energy sources; developing new economic opportunities for agriculture and other industries; improving electric power quality and support to the power grid from distributed electricity generation; creating jobs; and revitalizing the economies of many agricultural and rural communities.[32]
- Of the total biomass generated in California, about 43 million BDT/yr, including 19.6 million BDT/yr solid fuel biomass, 19.2 million BDT/yr municipal solid waste (MSW) landfills, and 4.5 million BDT/yr livestock manure, sewage sludge, and food processing wastes, can be used for energy production. If all 43 million BDT/yr biomass sources were used for energy production using existing viable technologies, a total of 5,000 MW biopower and 200 million gallons of biofuel could be added to California's energy system. It is assumed that 41 million BDT/yr biomass generated from solid fuel biomass, MSW landfills, sewage sludge, and livestock manure will be used for electricity generation, and 2 million BDT/yr of biomass generated from existing agricultural food processing facilities will be used for ethanol production.
- Policies have been the key driver for bioenergy development in California. Massive development of biopower plants using biomass solids fuel was driven by the federal Public Utilities Regulatory Policy Act, established in 1978, which allowed utilities to create standard-offer contracts for power purchases from independent generators during 1980s. These contracts enabled the development of approximately 1,000 MW of biopower

32 California Biomass Collaborative. 2005. *Biomass in California: Challenge, Opportunities, and Potential for Sustainable Management and Development*. Prepared for the California Energy Commission. Http://biomass.ucdavis.edu/materials/reports%20and%20publications/2005/2005_Biomass_in_California.pdf

capacities using solid fuel biomass in California by 2000. However, policies have changed. When state and federal incentives expire, it is questionable whether these systems can afford to operate due to high operational costs when incentives are no longer available. Also, the limitation on maximum incentive size discourages large biomass facility development in California.

- The Energy Commission should collaborate with partner agencies and stakeholders to develop policy changes and support legislation that address regulatory hurdles and price uncertainty for biopower and biofuel in California.
- The state should continue to coordinate the efforts to maximize the use of California's abundant waste stream, including agricultural waste, municipal solid waste, and forest waste to produce energy, solve waste disposal problems, and reduce catastrophic wildfires.
- State agencies, utilities, and stakeholders should work together to create long-term programs to help finance biopower and biofuel projects that can provide immediate greenhouse gas (GHG) emission reduction benefits and a bridge to the introduction of sustainable fuels that will reduce fossil fuel dependency and result in deeper GHG emission reductions in the future.
- A long-term grant program should be established to validate and track critical research results and data achieved to date for bioenergy technologies, fund research on integrated bioenergy system design and operation, and support bioenergy education, research, and training programs established under colleges, universities, and other institutions to ensure that well-trained and qualified human resources are available for the bioenergy industry development.

ATTACHMENT1: Action Items From the *2006 Bioenergy Action Plan* California Energy Commission, December 22, 2009

Bioenergy Action Items	Actions Taken
Multi-Agency Collaboration Responsibilities	
1. *The Governor has entrusted the Working Group with the responsibility for carrying out his bioenergy policy objectives and meeting the state's targets. The Working Group, chaired by the Energy Commission, will continue to meet as its member agencies carry out their individual and joint responsibilities. These meetings will provide consistent public forum for the interested stakeholders and members of the public to keep track of the progress being made throughout state government.*	Chair of the Working Group, California Energy Commission Commissioner Jim Boyd leads the Working Group to accomplish the sustainable development of biomass in California. Working Group meeting was held on December 21, 2009. Established a Bioenergy Coordination Group at the Energy Commission. Energy Commission Coordinator: Mike LeaonWorking Group Liaison: Sarah Michael
2. *As directed by the Governor, the Energy Commission will coordinate with the Working Group on the use of state funds and on securing federal funding that support strategic research, development, and demonstration (RD&D) projects including efforts to:*	

Bioenergy Action Items	Actions Taken
a. *Prove the commercial readiness of biofuels production and advanced biomass conversion technologies including cellulosic feed stocks derived from forestry, agriculture, and urban wastes; gasification; pyrolysis; biomass-to-liquids; and landfill gas to energy systems;*	Through the PIER Program – 2 biofuels projects are being funded; 1) SFPUC is conduction a project to convert fats, oil, and grease (FOG) to biodiesel, 2) REII is conducting an integration of biofuel and biopower project using rice straw, rice hulls and wood. In addition, six biopower projects are also being funded. On December 15, 2009, California Energy Cmmission conducted a workshop to discuss three grant solicitations to be funded by the Alternative and Renewable Fuel and Vehicle Program. The three solicitations include: **1. Biomethane Production (available funding is $21.5 million):** The Energy Commission is seeking to fund projects that involve the design, construction and operation of biomethane production facilities. The intent of this solicitation is to encourage the development of a new industry in California to produce a transportation fuel that is one of the most effective greenhouse gas reduction strategies, and that can significantly reduce petroleum fuel demand, stimulate economic development, and reduce environmental impacts associated with the state's major waste sources. The Energy Commission reserves the right to increase this total amount to $26 million without issuing a new solicitation. **2. Alternative and Renewable Fuel Infrastructure (available funding is $13.8 million):** The Energy Commission is seeking to fund projects that develop infrastructure necessary to store, distribute and dispense the following transportation fuels:

Bioenergy Action Items	Actions Taken
	• Electricity • E-85 • Biomass-based diesel • Natural gas The intent of this solicitation is to upgrade public and private infrastructure investments, expand the network of public-access and fleet fueling stations and charging sites based on the population of existing and anticipated vehicles, and put in place infrastructure that will ultimately be needed to accommodate transportation fuels with very low greenhouse gas emissions. The Energy Commission reserves the right to increase this total amount to $17 million without issuing a new solicitation. **3. Medium- and Heavy-Duty Advanced Vehicle Technology (available funding is $9.5 million):** The Energy Commission is seeking to fund projects that develop the commercialization of advanced medium- and heavy-duty vehicle technologies. The intent of this solicitation is to provide funding to advance the state-of-the-art in medium- and heavy-duty vehicles to significantly reduce the demand for petroleum fuels and greenhouse gas emissions in this critical market sector. The Energy Commission reserves the right to increase this total amount to $12 million without issuing a new solicitation.
b. Develop up to four afforestation (replanting trees) and	No action yet.

Bioenergy Action Items	Actions Taken
carbon sequestration pilot and demonstration projects in California of sufficient size to supply 3 to 5 megawatts of biomass-fueled electricity to an electricity gasification plant or bio-refinery;	
c. *Identify the highest value use and market potential for forest fuel, harvest residues, and other small wood forest products as a potential source of energy, fuel, chemicals;*	No action yet.
d. *Demonstrate new cropping systems and biomass handling, storage, and distribution; and*	No action yet.
e. *Implement at least three field demonstrations of the most efficient biomass harvesting systems for small forest material.*	CDFFP is doing something with UCD and John Deere.
3. *The Working Group and its member agencies will also collaborate at the state, regional, and national levels through various interagency and coalition venues to develop strategic alliances to accelerate deployment of bioenergy production and use technologies in California. Examples include:*	
a. *The 25/25 coalition is a broad-based, non-partisan group of stakeholders advocating increased use of renewable energy, supporting a national goal of meeting 25 percent of our domestic energy needs with renewable resources by 2025; and*	CDFA is actively involved in the 25/25 coalition being led by Secretary of CDFA.
b. *The "Wildland Biomass for Electric Power" project that is addressing life-cycle costing for forestry projects, which is currently underway through the Public Interest Energy Research (PIER) Program in collaboration with the U. S. Forest Service.*	LCA Report for forestry has been drafted.

Bioenergy Action Items	Actions Taken
4. *The Working Group will create and implement a communications plan to disseminate information about the benefits of bioenergy to the general public and to policy makers.*	No specific action taken yet.
5. *The Working Group will explore new avenues for financing new project development, including investigation of existing state bonding authority such as the California Consumer Power and Finance Authority, which may be applicable to bioenergy projects.*	No action yet.

Bioenergy Action Items	Actions Taken
The Energy Commission Responsibilities	
a. *Report on progress in implementing the state policy objectives, biomass production and use targets, and actions detailed in this plan in the biennial Integrated Energy Policy Report and Joint Energy Action Plan.*	Reported the Progress to Plan of the *Bioenergy Action Plan* at *2007 IEPR*. Updates have been included in the *2008 and 2009 IEPR*.
b. *Complete a comprehensive "road map" to guide future research, development, and demonstration activities through the California Biomass Collaborative by June 2006.*	Revision is underway by CBC staff to include priority ranking for actions in the roadmap. Conducted public workshops about this roadmap in 2007.
c. *Prepare the State Alternative Fuels Plan, as required by AB 1007, by the end of 2006 that, among other things, will identify actions and incentives to increase the production and use of biofuels and to develop an extensive and convenient E-85 network in new and retrofitted service stations in California.*	Completed the State Alternative Fuels Plan http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF Now implementing AB 118 that directs the California Energy Commission to develop the **Alternative and Renewable Fuel and Vehicle Technology Program** http://www.energy.ca.gov/proceedings/2008-ALT-1/index.html

Bioenergy Action Items	Actions Taken
Legislative Options	
The Working Group has identified the following two topics for possible legislative action during the 2006 session: 1. *Amend existing law to revise existing technology definitions and establish new ones, where needed. In particular, review the definitions of gasification, transformation, fermentation, pyrolysis, and manufacturing. Such statutory clarification would enable the use of biomass residues through combustion or non-combustion technology.* 2. *Amend existing law to provide incentives to local jurisdictions for energy production activities.*	The Energy Commission and CalRecyle are overseeing the bills to revise the definitions. No action taken by the Legislature in 2006. AB 222 (2009) is pending before the Senate Environmental Quality Committee and is supported by the Schwarzenegger Administration. Among other things, AB 222 would allow new non-incineration technologies to be used in the production of renewable biofuels and electricity from biogenic material diverted from California's landfills. No action yet.
The Working Group also has identified the following that may be potential topics for legislation in the future, but for which additional evaluation is needed before determining the suitability of a legislative remedy: 1. *Establish a California renewable fuels standard based on fuel content that could include a minimum average of 10 percent renewable content in gasoline and a 5 percent non-petroleum diesel fuel standard.*	On April 23, 2009, the Air Resources Board adopted a regulation that will implement Governor Schwarzenegger's Low-Carbon Fuel Standard calling for the reduction of greenhouse gas emissions from California's transportation fuels by 10 percent by 2020. http://www.arb.ca.gov/newsrel/nr042309b.htm

Bioenergy Action Items	Actions Taken
2. *Recommend a package of tax incentives to encourage use of biomass, biofuels and other bio-based products. (e.g., production tax credits, fuel excise taxes based on energy content, gas tax exemptions.*	Federal tax incentives for new plants were included in the federal stimulus legislation; Congress passed a one-year extension of the Production Tax Credit for existing biomass facilities.
3. *Establish broad-based funding mechanisms that recognize the unique benefits of bioenergy, including but not limited to, use of existing state bonding authority, state investment tax credits for new and emerging technologies.*	No action yet.
4. *Evaluate alternative sources of revenue, including but not limited to surcharges on trash collection, landfill tipping fees and other sources, to provide stable funding for grant and incentive programs research activities for biomass-to-energy production from landfill-bound residuals.*	No action yet.
5. *Establish a system of carbon credits, consistent with broader state policy on greenhouse gas reduction.*	No action yet.
6. *Encourage coordinated permitting and mediation of environmental impacts and mitigation at the project level.*	A coordinated permitting guidance manual has been drafted and is awaiting approval by CalEPA.

California Air Resources Board ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. *As the Governor urged in the Executive Order, enable the most flexible possible use of biofuels, through its Rulemaking to Update the Predictive Model and Specifications for Reformulated Gasoline, while preserving the full environmental benefits of California's Reformulated Gasoline Programs, as required by Health and Safety Code section 43013.1 by January 31, 2007.*	RFG3 amendments approved by the Board June 14, 2007, allowing the blend wall to be as high as E10.
b. *Complete the Rulemaking for presentation to the Board by January 31, 2007. As part of the rulemaking, reflect the emissions performance of current and future vehicle fleets and incorporate available data on the emissions impact of fuel properties.*	RFG3 amendments approved by the Board June 14, 2007. Amendments incorporated vehicle fleet updates.
c. *As data becomes available on the impacts of fuel specifications on the current and future vehicle fleets, review and update motor vehicle fuel specifications as appropriate. In reviewing the specifications, consider the emissions performance, fuel supply consequences, potential greenhouse gas reduction benefits, and cost issues surrounding ethanol blends, particularly E6, E10, and E8, for gasoline by January 31, 2007, and for diesel by December 31, 2008.*	RFG3 amendments approved by the Board June 14, 2007 updated the motor vehicle fuel specifications for ethanol blends from E0 through E10. The Low-Carbon Fuel Standard (LCFS) requires reductions of greenhouse gas emissions from gasoline and diesel used as a transportation fuel. See below for diesel plans.
d. *Consider adoption of fuel specifications for motor vehicle fuels, such as B2, B5, B20, and B100 by January 31, 2007.*	Currently, B1-B5, B6-B20 and B100 are subject to regulation by the Division of Measurement Standards under ASTM specifications approved in 2008. ARB staff is midway through a multimedia evaluation of motor-vehicle biodiesel and renewable diesel fuel pursuant to Health & Safety Code Section

Bioenergy Action Items	Actions Taken
	43830.8, which is scheduled to be completed by end of October 2009. This multimedia evaluation is being conducted in anticipation of a proposed rulemaking to establish new motor vehicle fuel specifications for biodiesel/renewable diesel by early 2010.
e. Evaluate the greenhouse gas reductions benefits of biofuels and biomass production and use, and report back to the Working Group on recommended options to encourage their use, in close cooperation with the other members of the Working Group, by June 30, 2007.	Done as part of the Low-Carbon Fuel Standard which was approved by the Board in April 2009. Results of the evaluation can be found in the LCFS staff report.
f. Evaluate the suitability of using available regulatory levers to encourage the establishment of E-85 stations in California by June 30, 2007.	There are several sources of funding available for E85 infrastructure and several regulations that will increase the need for the infrastructure: AFIP funding of $5 million for E85 stations and AB118 monies to build infrastructure. Federal RFS mandates large volumes of biofuels, which in turn will increase the use of E85. LCFS that in coming scenarios, will require a larger E85 fuel pool.
g. Complete a peer-reviewed study of the emissions performance, costs, and benefits of using biofuels and biofuel blends, using a multi-media approach by July 31, 2008.	The LCFS estimated the emissions performance, costs, and benefits of biofuel and biofuel blends. The staff report was peer reviewed by four independent researchers.
h. Consider adoption of regulations by June 30, 2008 that require all gasoline-powered vehicles sold in the state to meet the state's	RFG 3 amendments relating to E85 vehicles and their requirements to meet all of the state's emission standards for

Bioenergy Action Items	Actions Taken
emission standards using gasoline blended with up to 10 percent ethanol and consider a requirement increasing the percentage of E85-compatible vehicle sold in the state	gasoline vehicles was approved by the Board in June 2007. The California Energy Commission recently projected a population of 4.2 million FFVs in California in 2020. Many of the new cars/light trucks offered by U.S. manufacturers are expected to be FFVs after 2012.
i. *Consider adoption of regulations by June 30, 2008, requiring heavy-duty diesel engine manufacturers to warrantee heavy-duty diesel engines using California diesel and B2, B5 and B 20 meeting the California specifications indicated in "d" above.*	Consideration of whether to require engine manufacturers to warranty their heavy-duty engines for use with biodiesel is expected to be part of the proposed rulemaking noted in response to Question d. Because that process is still in the multimedia evaluation stage, no decision has been made yet with regard to warranties for in-use engines and fleets.
j. *Examine the air pollutant emissions performance of biofuels and biomass in stationary sources and recommend appropriate emissions performance standards and mitigation for emissions remaining after the application of controls.*	As part of the LCFS, ARB staff committed to prepare a "best practices" document to guide districts that have regulatory authority over stationary sources.

California Integrated Waste Management Board ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. *Identify and quantify the amount of material currently being landfilled and assess the potential for its conversion to biofuels and other bio-based products by December 31, 2006.*	Completed; Needs update.
b. *Establish goals for 2010 and beyond for the use of landfill-bound residuals to be used for bioenergy production by December 31, 2006.*	Completed.
c. *Identify state and private revenue sources of grant and incentive program research activities related to bioenergy production from landfill-bound residuals by December 31, 2006.*	Completed.
d. *Identify and quantify the potential of using landfill gas as a biofuel by December 31, 2006.*	Completed.

STATE WATER BOARD ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. *Identify clear and consistent procedures that are used to protect water quality from the harvesting of biomass and the operation of biomass facilities.*	In November 2009, the Central Valley Regional Water Board (RWB) obtained a $742,000 contract to develop a Programmatic Environmental Impact Report (PEIR) for anaerobic manure digestion and co-digestion facilities located at dairies and other sites. The RWB plans to use the PEIR to support adoption of a General Waste Discharge Requirements (WDR) Order for such digesters. Having a General WDR Order should significantly reduce permitting time for such facilities in the Central Valley.
b. *Conduct prompt reviews of planning documents, environmental documents prepared under the California Environmental Quality Act (CEQA), and monitoring proposals for biomass harvesting and biomass facilities.*	This is an ongoing activity. The SWB's Executive Director has requested all RWBs to provide SWB staff with information on all new permitting of biomass/bioenergy facilities so that progress in issuing permits can be tracked.
c. *Work in cooperation with the Department of Forestry and Department of Food and Agriculture to ensure that adequate criteria for water protection and water quality are put in place on agriculture and forest lands in California.*	This is an ongoing activity. In cooperation with DoF and CDFA, the SWB and RWB have developed regulatory water quality programs for irrigated agriculture and forest practices. Staff is working with DoF and CDFA to clarify and simplify the program.

SWB representatives on the Bioenergy Interagency Working Group (BIAWG) have noted that certain BIAWG participants can take proactive steps to promote an increase in the number of energy production facilities that use biomass as a feedstock. Regulatory agencies such as the Water Boards can support those efforts by expediently reviewing environmental documents and processing permits. Planning and tracking efforts are needed to ensure that objectives in the work plan are achieved.

The SWB representatives have also noted the need for a website that identifies proposed biomass / bioenergy facilities and tracks their progress to operational status. The website should be linked to sites that provide information on biomass / bioenergy including available grants and ongoing studies. Hopefully, resources can be found to develop the website.

STATE FOOD AND AGRICULTURE ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. *Report on the existing market potential for the sustainable production and use of agricultural crops and residues as a source of electricity, fuel, chemicals, and other valuable co-products by June 30, 2007.*	Nothing specific to report, but the California State Food and Agriculture (CDFA) has worked with the Biomass Collaborative and 25x25.
b. *Develop a plan to determine how to gain better access to agricultural and forestry biomass resources, including regulatory and technology development needs, in cooperation with the Department of Forestry and Fire Protection by December 31, 2006.*	
c. *Identify "biomass management zones" in key agricultural areas of California, in coordination with the Department of Forestry and the California Biomass Collaborative by June 30, 2007.*	CDFA has made progress in concept, but have not quantified. CDFA is working on a Western Governor's Association study on the use of sugar cane in Imperial County to generate energy for desal and will add information when completed by month's end.
d. *Evaluate the potential for regional manure management centers as potential sites for dairy bio-digesters in the San Joaquin Valley and at other suitable locations, in cooperation with the Energy Commission by June 30, 2007.*	Defer to the Energy Commission. CDFA has a report from CalPoly-SLO, but it is now dated and does not meet CDFA's needs. CDFA has a staff person working on fuel cells to address the NOx issue.
e. *Evaluate the potential for biomass technologies to address animal disposal and animal health concerns associated with emerging animal diseases by June 30, 2007.*	CDFA can report on meeting with BioRefinex on their technology.

Bioenergy Action Items	Actions Taken
f. Work with the Public Utilities Commission to facilitate the sales and distribution of on-farm produced power.	
g. Develop and implement a strategy by December 31, 2006, to support bioenergy production and use under provisions of the existing federal Farm Bill and to improve those opportunities as the Farm Bill is rewritten for 2007.	Title IX of the farm bill was much enhanced due to Secretary Kawamura's leadership on behalf the Governor to represent the state's interest in the Farm Bill's formulation. 25X25 and others were also instrumental. The purpose of this action was accomplished; now need to work to develop projects for CA.

DEPARTMENT OF FORESTRY AND FIRE PROTECTION ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. Identify "biomass management zones" in key forest and range areas of California, based on known resource, contribution to the maintenance of forest health, and reduction in large high-intensity wildfires by December 31, 2007.	Task has been delegated to the Biomass Collaborative. This is due in December 2009.
b. Determine and update geographic areas in the Urban Interface most in need of fuel reduction by December 31, 2007.	Nearing Completion – Final refinements will be completed by December 31, 2008.
c. Work with ARB and local air districts to evaluate the air quality impacts of wildfire emissions before and after fuel hazard reduction and provide intial findings by December 31, 2008.	Ongoing meetings with ARB.
d. Build upon the existing California Climate Action Registry protocols and continue development of additional protocols for the forest management and resource conservation and production and use of long-lived wood products by December 31, 2008.	Contracted to CCAR. Protocols to be completed in November.
e. Identify actions that can be taken by the Board of Forestry to encourage biomass production and use by December 31, 2006.	Continuing to work on this.
f. Work with the Department of General Services to install at least three combined heat and power units, using new technologies, at Forestry Conservation Camps at sites located along the California coast, in the Sierra Nevada range, and in the southern area of California by December 31, 2010.	Feasibility study ongoing.

Bioenergy Action Items	Actions Taken
g. Along with Board of Forestry and Fire Protection, collaborate in further development of long-term harvest contracts or agreements with the Federal Land Management Agencies with California land holdings, in close coordination with the U.S. Forest Service, Bureau of Land Management, and the Bureau of Indian Affairs. This effort would begin by July 31, 2006.	Ongoing with progress in Tahoe and El Dorado Forests.

The State Department of General Services ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
a. Develop an annual statewide vehicle asset plan by December 31, 2006, that, through the Statewide Equipment Council: *a. Includes flexible fuel vehicles in the state's vehicle procurement program.* *b. Requires state vehicle contracts to be based on a Life Cycle Cost Analysis method.* *c. Requires state agencies (for light-duty, non-public safety applications, and other applications as practical) to purchase flexible-fuel vehicles capable of operating on renewable and alternative fuels, increasing to 50 percent of total new vehicles purchased by 2010.*	
b. Develop criteria, establish funding priorities, and identify potential revenue sources by December 31, 2006, to facilitate the incorporation of renewable energy into new state buildings and major renovations where feasible. Where feasible means capable of being accomplished in a successful manner within a reasonable period of time, taking into account life-cycle costing analysis, and the environmental, social, and technological factors. Feasibility shall not be based solely on cost considerations (excerpted from Government Code 14710(c).	
c. Recommend criteria by December 31, 2006 for use by the Department of Finance for the review and approval of funding for renewable and alternative energy projects. These criteria shall include a Life Cycle Cost Analysis methodology. Where projects cannot be justified solely on the basis of a Life Cycle Cost Analysis, policy justifications shall be articulated by the Governor.	

Bioenergy Action Items	Actions Taken
d. *Work with the Department of Forestry and Fire Protection to install at least three combined heat and power units, using new technologies, at Forestry Conservation Camps at sites located along the California coast, in the Sierra Nevada range, and in the Southern California by 2010.*	

California Public Utilities Commission ACTION ITEMS

December 22, 2009

Bioenergy Action Items	Actions Taken
As requested by the Governor, the California Public Utilities Commission will develop policies and establish mechanisms that would encourage increased future development and sustainable use of biomass and other renewable resources by the state's investor-owned utilities. Specific actions in 2006-2007 may include:	
a. *Jointly investigating with the Energy Commission ways to simplify and streamline the RPS process to ensure that biomass and other renewable generation meets RPS goals.*	
b. *Reviewing and streamlining interconnection requirements to remove potential barriers to biopower development.*	Aspects of both biogas and electric interconnection rules have undergone review at the CPUC. Recent activities include: 1) Gas Interconnection; resolution G-3420, approved on 9/18/08, dismissed SDG&E's and SoCalGas' interconnection subsidy because it was filed by advice letter. The resolution states the utilities should file their proposal via a formal application. There may be additional action taken to address potential barriers to interconnection through a more thorough examination of the issues at the Commission potentially triggered by a future application. 2) Electric Interconnection; Biogenerators may choose Rule 21 interconnection by net metering or by selling to the utility as a qualifying facility (QF) at avoided cost. Rule 21 Working Group may consider whether QFs that sell their entire output at other than avoided cost rates (i.e. feed-in tariff rates) may also use a Rule 21 interconnection. Currently, FERC interconnection applies.

Bioenergy Action Items	Actions Taken
c. *Allowing investor-owned utilities to continue offering net metering for biopower facilities and support legislation to increase net metering caps.*	Net metering for biogas digesters is codified in PUCode Section 2827.9. There has not been legislation in this session to increase the statewide net metering cap.
d. *Assessing the costs and benefits of providing specific exemptions to allow biomass facilities to wheel power directly to a farm and to consolidate net metering accounts on a farm.*	Net metered biogas customer generators can aggregate load on adjacent property attributable to milking and water pumping (PUCode Section 2827.9.c.1). PUCode does not permit aggregation, wheeling or self-wheeling by other biogas or biomass generation.
e. *Implementing mechanisms, including establishing appropriate avoided costs and long-term contracts, to preserve existing biopower facilities.*	650 MW of biomass QFs with bilaterally negotiated contracts have access to Standard Offer contracts. PUC approval of investor owned utility (IOU) (SCE) standard offer bioenergy contracts eliminated the complex negotiation process that is needed for larger projects and give bioenergy contracts for facilities up to 20 MW the opportunity to execute contracts with the IOU and contribute to California's RPS goals.
f. *Evaluating unique benefits that biopower may provide in meeting resources adequacy and RPS requirements and global climate change reduction targets.*	Revisions to the Market Price Referent in the RPS Proceeding put forth in the Proposed Decision in R.06-02-012 issued on September 16, 2008, provide more value for the reductions in GHG emissions. http://docs.cpuc.ca.gov/efile/PD/90863.pdf Under the Climate Smart Tariff, methane capture projects are now deemed eligible GHG offsets following the protocol developed by the California Climate Registry.