

2012 Bioenergy Action Plan

Prepared by the Bioenergy Interagency Working Group



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DISCLAIMER

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PREFACE

The *2012 Bioenergy Action Plan* outlines strategies, goals, objectives, and actions that California state agencies will take to increase bioenergy development in California. The plan builds upon the state's *2006 Bioenergy Action Plan* and *2011 Bioenergy Action Plan*. These plans were developed with input from the Bioenergy Interagency Working Group, the California Biomass Collaborative and stakeholders and other public comments. An in-depth status report on bioenergy development and analysis of the issues are contained within the *2011 Bioenergy Action Plan*, which was adopted by the California Energy Commission in March 2011. The *2012 Bioenergy Action Plan* updates the strategies, objectives, and state agency actions to reflect Governor Jerry Brown's energy, waste reduction, and jobs policies and to formalize additional state actions not included in 2011 Plan.

ABSTRACT

California has an abundance of biomass residues from the state's agricultural, forest, and urban waste streams. Sustainably collected biomass can be used to produce renewable energy, such as transportation fuels, methane, or electricity. Using biomass to produce energy reduces the need for traditional disposal options for biomass such as landfill disposal or burning in place, while reducing dependence on fossil energy sources. The *2012 Bioenergy Action Plan* is a coordinated state agency approach to addressing challenges and maximizing opportunities for the development of bioenergy projects that promote economic development and provide the greatest environmental benefit. The plan outlines state agency actions that: 1) stimulate cost-effective utilization of the state's diverse biomass resources for conversion to "low-carbon" biofuels, biogas, and renewable electricity; 2) increase research, development and demonstration of bioenergy toward commercializing new technologies; 3) streamline the regulatory and permitting processes; and 4) quantify and monetize the benefits of bioenergy.

Keywords: California Energy Commission, Bioenergy Interagency Working Group, bioenergy, biopower, biofuels, biomass, biogas, biomethane, biorefinery, biogenic, Bioenergy Action Plan, renewable; biomass residues

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EXECUTIVE SUMMARY

California has enormous potential to create energy from organic waste materials. Urban, agricultural and forest wastes that would otherwise go to landfills or be burned can, instead, be used to produce electricity, transportation fuels, combined heat and power, and more. Expanding bioenergy also creates jobs, provides local energy, enhances energy security, and helps protect public health and safety by reducing waste materials and fire danger.

California has adopted numerous policies to promote bioenergy, but significant barriers to its development remain. The *2011 Bioenergy Action Plan* identifies those barriers and recommends actions to address them so that the state can meet its clean energy, waste reduction and climate protection goals. The *2012 Bioenergy Action Plan* updates the 2011 Plan and provides a more detailed action plan to achieve the following goals:

- Increase environmentally and economically sustainable energy production from organic waste.
- Encourage development of diverse bioenergy technologies that increase local electricity generation, combined heat and power facilities, renewable natural gas, and renewable liquid fuels for transportation and fuel cell applications.
- Create jobs and stimulate economic development, especially in rural regions of the state.
- Reduce fire danger, improve air and water quality, and reduce waste.

Status of Bioenergy in California

Bioenergy is renewable energy produced from biomass wastes including forest and other wood waste, agriculture and food processing wastes, organic urban waste, waste and emissions from water treatment facilities, landfill gas and other organic waste sources. Biomass waste can be used to generate renewable electricity, liquid fuels and biogas.

Current bioenergy production in California includes:

- 33 biomass plants that generate a combined 600 megawatts of electricity, nearly 2 percent of California's total electricity supply.
- 11 dairy digesters that produce electricity, combined heat and power, and biogas.
- 500 megawatts of electricity is generated at biogas facilities at wastewater treatment plants and landfills.
- 50 to 100 million gasoline gallon equivalent is produced at in-state ethanol and biodiesel facilities.

California generates 36 million bone-dry tons of biomass from the urban, agricultural and forest sectors. Using that resource to produce energy provides numerous benefits. Bioenergy produced from in-state biomass reduces California's reliance on fossil fuels and out-of-state fuels. Biomass can be used to generate renewable electricity that is available 24/7. Bioenergy can significantly reduce water and air pollution, including greenhouse gas emissions. Woody biomass facilities are also critical to reduce forest fire hazards by reducing excess fuel loads. Biomass can also produce combined heat and power for schools, hospitals and industrial

processes. Bioenergy from organic urban wastes helps reduce waste going into the state's landfills and bioenergy from agricultural wastes reduces open field burning.

Bioenergy production creates jobs and revenues. In 2010, biopower facilities generated 5,745 gigawatt-hours of energy, impact worth \$575 million and providing about 5,000 direct jobs. As reported by the California Biomass Energy Alliance, the largest share of jobs and economic impact came from existing woody biomass electric facilities which employed 750 people at the facilities and 1,200 to 1,500 in the fuel supply infrastructure. Increasing biopower capacity by 50 percent could provide an additional 2,500 jobs in California and generate an additional \$287 million in revenues. Public data is not readily available on the employment and economic impact of existing biofuel facilities. However, biofuels has the potential to add over 1,600 jobs.

Challenges

Despite its many benefits, bioenergy production uses only 15 percent of California's available biomass waste, and production is decreasing. Regulatory and financial incentives for renewable power do not adequately monetize the many benefits of bioenergy, and regulatory barriers compound these challenges. Some incentives for bioenergy have been inconsistent or discontinued while others have failed to account for the additional costs and benefits of biomass. Environmental, waste disposal, public health, and pipeline safety regulations often complicate bioenergy permitting and development and sometimes contradict each other. Access to transmission lines, pipelines and other distribution networks also pose significant challenges to bioenergy development.

Some of these challenges require additional research and demonstration to ensure that bioenergy production is environmentally and economically sustainable. Other barriers require regulatory changes, including permit streamlining and consolidation, utility procurement requirements, financial incentives that reflect the many benefits of bioenergy, and other changes.

Recommended Actions

To meet California's renewable energy, waste reduction, environmental, and public safety goals, the Bioenergy Working Group recommends the following:

- Increase research and development of diverse bioenergy technologies and applications, as well as their costs, benefits, and impacts.
- Continue to develop and make accessible information about the availability of organic wastes and opportunities for bioenergy development.
- Streamline and consolidate permitting of bioenergy facilities and reconcile conflicting regulatory requirements to the extent possible.
- Assess and monetize the economic, energy, safety, environmental, and other benefits of biomass.
- Facilitate access to transmission, pipelines, and other distribution networks.

CHAPTER 1:

Benefits and Potential Development of Bioenergy

Energy production from biomass can be generated from a variety of feedstocks and processes and has potential for significant growth in California. This chapter discusses the various types of bioenergy, their benefits, and efforts to monetize the environmental and indirect economic benefits. This chapter also provides an assessment of the potential to develop biomass in California.

Types of Bioenergy

Bioenergy is energy converted from biomass or biogas, from sources such as animal waste and plant residues produced on farms and in forests, crops grown specifically to produce energy (energy crops), and urban-derived food, yard, and other organic waste, as well as energy produced from landfill emissions and gas or waste from water treatment facilities. Bioenergy comes in many forms, including electricity, heat, gas (biogas or biomethane as well as synthetic natural gas¹), and liquid transportation fuels. In California, biomass feedstocks (with the exception of purpose-grown energy crops) are residues from industrial, agricultural, urban², forestry, and other processes. Use of biomass residues reduces the amount of waste buried, burned, or otherwise left to decay³ each year.

When used to produce energy, sustainably collected biomass provides a range of economic and environmental benefits. For example, bioenergy reduces the state's dependence on fossil energy sources such as oil, natural gas, and coal, while diversifying the state's energy supply and improving energy security. Bioenergy is a flexible energy resource that is ideal for "distributed" generation or locally used renewable transportation fuels applications, which preserves local wealth while stimulating job growth and economic development.

1 Synthetic natural gas is a renewable methane gas produced from thermochemical gasification of biomass with extensive processing and cleaning of the product gas.

2 Urban-derived biomass may be comingled with unrecyclable components of the municipal solid waste stream. Use of this material may require additional processing to remove contaminants to be an RPS eligible biomass feedstock.

3 Residues in agriculture are commonly returned to soils where they contribute to soil organic matter and return nutrients to the soil, although some crops (such as rice) and orchards generate excess residues. Livestock manures can be anaerobically digested without loss of value as a soil amendment. Forest residues are commonly consolidated in piles. If these are far from biomass to electricity facilities, they are burned in place, left to decay, or transported to a landfill. Excess biomass left to decay can create potential fire risk and release excess methane into the atmosphere.

Biopower, electricity generated from organic waste, is a baseload renewable energy resource⁴ that is available 24 hours a day and, in some applications, can be quickly turned on and off to follow load. Efficiency can be maximized by employing combined heat and power technologies, which provide heat for industrial and other purposes while also producing electricity.

Biogas is a gas produced by converting biomass to a gaseous mixture of carbon dioxide and methane. Biogas can be used directly to produce electricity or can be converted to biomethane by removing carbon dioxide and other impurities. Biomethane can replace fossil sources of natural gas in homes and factories and compressed or liquefied natural gas used in vehicles. Biomethane can also be used to produce renewable hydrogen in fuel cells.

Biofuels such as ethanol, biodiesel, or proposed drop-in substitute fuels for gasoline or diesel can be used as transportation fuels. For liquid biofuel production in California, agricultural and livestock waste and urban biomass residues are the most likely feedstocks in the short to mid-term.

While biomass can be used to produce power, gas, or liquid fuels, the balance between these uses will depend on markets, public policy choices, and development of new technologies. Currently, there is significant unused biomass that can be used to continue transforming California's energy economy.

Benefits of Biomass Use in California

Bioenergy offers multiple economic and environmental benefits, if biomass is sustainably harvested and converted to energy.⁵ These benefits include, but are not limited to, locally sourced renewable energy, improved air and water quality and other ecosystem benefits, less waste buried in landfills, as well as reducing California's dependence on fossil fuels and vulnerability to wildfire. These benefits can produce economic growth and increase employment, avoid catastrophic wildfires, improve public health, and reduce net greenhouse gas (GHG) emissions.

Many processes that produce bioenergy also produce bioproducts⁶ that have additional non-energy value. For example, anaerobic digesters produce a by-product that can be used as fertilizers and fiber for animal bedding. Biomass combustion facilities produce fly ash, which is a valuable additive for cement manufacturing. Research is underway to determine if char from low temperature gasification of biomass has value as a soil amendment or carbon sequestration.

⁴ Biopower and geothermal can provide predictable baseload power, unlike solar and wind. Integrating biomass with other renewables may make overall integration with conventional sources in the state's power grid more feasible.

⁵ S. R. Kaffka, M.W. Jenner, D. Wickizer, and R.B. Williams. California Biomass Collaborative (www.biomass.ucdavis.edu)

⁶ A product that is composed, in whole or in significant part, of biomass. Bioproducts can include chemicals, materials, or other products derived from biomass.

Job Creation and Economic Benefits

Developing renewable energy and fuels in California will create thousands of jobs and build twenty-first century businesses and energy infrastructure. The use of biomass and production of bioenergy creates and preserves jobs in economically struggling rural and urban communities. Unique among renewable energy sources, bioenergy production relies on a consistent supply of local feedstocks and requires more labor than other technologies (on a net energy basis).

Renewable energy in general provides more jobs per dollar invested than fossil fuels.^{7,8} Bioenergy requires jobs for biomass collection and transportation, facility construction and operations, and creates secondary jobs through local and regional economic impacts. Jobs are created in both rural and urban areas, though rural areas where forest and agricultural biomass resources are concentrated will benefit most.^{9,10} Estimates of the number of bioenergy jobs vary, but range from 3 to 7 per megawatt (MW) installed capacity (includes plant operation and fuel logistics and support jobs).^{11,12,13}

In-state biopower generated 5,745 gigawatt-hour (GWh) in 2010, or 2.8 percent of the total power generated in state.¹⁴ Direct economic impact, as energy revenue, was about \$575 million (assuming an average market price of \$0.10 per kilowatt-hour). By increasing biopower production by 50 percent and developing California's in-state biorefinery industry to produce 1.6 billion gallons of gasoline equivalent (gge) per year, bioenergy revenue and direct jobs are estimated to be \$7.6 billion and 9,100 jobs, respectively (Table 1).¹⁵

7 Jenkins, B. M. (2005). Biomass in California: Challenges, opportunities, and potential for sustainable management and development, CEC-500-2005-160. California Biomass Collaborative.

8 Kammen, D.M., K. Kapadia and M. Fripp. 2004. *Putting renewables to work: how many jobs can the clean energy industry generate?* Report of the Renewable and Appropriate Energy Laboratory, University of California, Berkeley, CA

9 Jenkins, B. M. (2005). Op. cit.

10 Domac, J., L.K. Richards, and S. Risovic, Socio-economic drivers in implementing bioenergy projects. *Biomass & Bioenergy*, 2005. 28(2): p.97-106.

11 Kammen, et al., 2004, Op cit;

12 Morris, G. (1999). Op. cit.

13 Thornley, P., J. Rogers, et al. (2008). "Quantification of employment from biomass power plants." *Renewable Energy* 33(8): 1922-1927.

14 2010 California Total System Power. Accessed Nov., 2011:
http://www.energyalmanac.ca.gov/electricity/total_system_power.html

15 Broad average estimates for job multipliers and other consequential effects from biomass are used here. Future alternative energy project-specific assessments will more accurately estimate these effects, and are discussed again below.

Table 1. Direct Bioenergy Economic Impact Estimates for California (heat energy not included)

Biopower	Feedstock (Million BDT)	Capacity (MW)	Energy (GWh/y) ^a	Direct Jobs ^b	Direct Value (million \$) ^c	Jobs (/Million BDT)	Value (\$/BDT)
Current Biopower	9.63	1,000	5,745	5000	\$575	519	\$60
Projected Additional 50% Biopower	4.82	500	2,873	2500	\$287	519	\$60
Total Current and Projected	14.45	1,500	8,618	7,500	\$862	519	\$60
Biofuels	Feedstock (Million BDT)	Capacity (Million gge) ^d		Direct Jobs ^b	Direct Value (million \$) ^c	Jobs (/Million BDT)	Value (\$/BDT)
Projected Potential	18.05	1,676	---	1,676	\$6,704	88	\$371
Grand Total	32.50	---	---	9,176	\$7,566		

Sources and assumptions:

a. 2010 California Total System Power. Nov., 2011: http://www.energyalmanac.ca.gov/electricity/total_system_power.html

b. Biopower: 5 jobs per MW capacity, Biofuels: 1 job per million gge capacity (Urbanchuk, John. 2011.)

c. Assumes \$0.10 per kilowatt-hour and \$4/gge.

The 1,676 Million gge is derived from the 32.5 Million BDT estimated by Williams et. al. 2008, and subtracting existing rates of feedstock consumption from known biomass power plants and residues. Once the additional 50 percent increase was accounted for, the balance of 18.05 was mathematically converted to gge via ethanol and biodiesel estimates. A factor of 70 gallons of cellulosic ethanol per ton biomass was assumed.

Public Health, Safety and Environmental Benefits

Bioenergy production can provide many benefits to public health and safety, the environment and economy. In many cases, avoiding disposal or treating biomass improves air and water quality and ecosystem health, while improving the economics of public works projects. For example, decomposing biomass releases methane, a potent greenhouse gas, into the atmosphere. Landfill gas collection systems and biogas conversion technologies reduce these methane emissions and turn the potentially harmful gas into a useful energy resource.

Conversion technologies, such as anaerobic digestion, can be used to manage dairy waste (manure and processing wastes) and organic waste either at a stand-alone facility or integrated as part of a municipal wastewater treatment process. Anaerobic digestion improves regional water quality; reduces methane emissions from manure lagoons, storage ponds and landfills; and minimizes odor. In many cases, treated by-products of anaerobic digestion can be used as a pathogen-free soil amendment, which can reduce the need for chemical fertilizers, improve plant growth, reduce soil erosion and nutrient run-off, alleviate soil compaction, and help soil retain water.

Diverting fats, oils, and grease (FOG) to anaerobic digesters can prevent sewer overflows, which protects water quality and saves money. FOG disposed of through the public sewer system can accumulate and clog pipes and pumps both in the sewer lines as well as in wastewater treatment facilities, while FOG can increase methane production in anaerobic digesters when codigested with other biomass or wastewater.

Increased utilization of forest biomass residues improves community safety and forest health by offsetting costs of forest restoration, fuel reduction, and forest thinning treatments. These

activities reduce wildfire hazards and mitigate wildfire damage to public health and safety, natural resources, infrastructure, and public and private property. Restoration activities can also make forest ecosystems more resilient to the effects of climate change.

Community-scale distributed generation facilities using forest biomass residues are important for forest restoration and protection as well as community development. Scaling bioenergy facilities to the community's resource potential ensures that biomass use is environmentally and economically sustainable. Sustainable development will promote long-term economic and social stability in rural, economically-disadvantaged communities by providing construction, plant operation, and in-forest biomass collection and transportation jobs.

Sustainably grown energy crops and crop residues have the potential to improve farm profitability and preserve agriculture, reduce overall irrigation or make water-use more efficient at the farming systems level, and create additional higher value uses for crop residues. Historically, about five percent of the irrigated land in California (400 to 500 thousand acres) has been used for new or low acreage crops annually and this land has the greatest potential for use for energy feedstocks like winter annual oilseed crops (for biodiesel), sugar beets or sweet sorghum, (ethanol, biogas) and other crops. Other lands that could be used occur in the Imperial Valley of California, dry farmed areas of the coastal mountains, and double cropped areas in some orchards and vineyards, and salt affected areas in the San Joaquin Valley.

The most efficient cropping systems in California can produce approximately 1,000 gallons per acre of ethanol or up to 250 gallons per acre of biodiesel. Growing energy-crops using waste waters or saline drainage waters can help mitigate the environmental problems resulting from traditional disposal options.¹⁶ Eventually, algae-based systems may prove even more productive; integrating these systems with biorefineries will capture carbon and upgrade waste flows from these biorefineries.

Monetizing or "internalizing" the value of environmental and societal benefits (or costs) due to bioenergy policy initiatives is challenging and, in many areas, requires additional research and quantification. Morris (1999)¹⁷ estimated the value of ancillary services provided by biopower in the United States including reducing criteria pollutant and GHG emissions, improving forest and watershed health, increasing employment and economic development, among other benefits.

An area that is important but difficult to monetize is ecosystem services, including watershed protection, habitat creation or preservation, public health, ecosystem health, and climate

16 Salt accumulation has become a significant problem in the Central Valley. The Central Valley Water Control Board is in the process of developing a comprehensive salt and nitrate management plan. Potentially, rotational crops with high salt uptake and high energy content could address this issue.

17 Morris, G. (1999). *Value of the Benefits of U.S. Biomass Power*. Subcontractor report to NREL. Golden, CO, NREL/SR-570-27541.

regulation.¹⁸ Ecosystem services often include metrics for income distribution, and localized pollution effects, sometimes included in the term “social justice.” Many of these resources are considered public goods, making economic values difficult to define, measure, and assign. It is also difficult to quantify the value of specific policy actions and the effects of intervention, and therefore, markets have difficulty accounting for and pricing these services.

One area where the benefits of biomass can be quantified is forest based biomass. Fire costs are well-known and increasing, fuel treatment is a proven strategy to reduce fire risks and impacts, and use of forest wastes in biomass facilities provides multiple benefits. Wildfires pose increasing risks to human health and safety. Forest fires also cause unproductive loss of biomass, large emissions of criteria pollutants and GHGs, property destruction, adverse public health consequences, and sometimes, permanent loss of ecosystem structure and function. These changes in turn lead to increased soil erosion, sedimentation in dams, declining water quality and quantity, and habitat and species loss.

Fighting massive wildfires is very costly. Since 2005, wildfires have burned more than 900,000 acres per year statewide on average, while over the last two decades, the area burned has been increasing. The California Department of Forestry and Fire Protection (CAL FIRE) spends an estimated \$200 million per year on fire suppression. Average property losses due to fires within CAL FIRE’s jurisdiction are over \$100 million annually.¹⁹ Fires also threaten transmission lines and other energy infrastructure. In 2007, fires caused more than \$43 million in damage to transmission lines and electricity substations in San Diego County.

Wildfire management costs in California (state and federal agencies) averaged approximately \$1.2 billion dollars per year from 2006 to 2010. These costs include those for post-fire landscape mitigation and compensation to landowners for fires related to transmission infrastructure or other public agency responsibilities.²⁰ Climate change projections suggest that wildfire losses will increase.²¹ Aside from accounting for the costs of wildfire suppression, accurately estimating all the costs of diverse ecosystem functions lost from uncontrolled wildfires is

18 Kinzig, Perrings et al. (2011), “Paying for ecosystem services-promise and peril.” *Science* 334(4)603-04.

19 D. Pimlott 2011, CAL FIRE, cited in: Placer County Air Pollution Control District: Opening Comments to October 13, 2011 Renewable Feed in Tariff staff proposal. Rulemaking 11-05-005, May 5, 2011; and D. Wickizer, CAL FIRE, personal communication.

20 Placer County Air Pollution Control District: Opening Comments to October 13, 2011 Renewable Feed in Tariff staff proposal. Rulemaking 11-05-005, May 5, 2011

21 Bryant, B.P., and Westerling, A. L., 2009. *Potential effects of climate change on residential wildfire risk in California*; CEC-500-2009-048-F, <http://www.energy.ca.gov/2009publications/CEC-500-2009-048/CEC-500-2009-048-F.PDF>; Westerling, A.L., Bryant, B. P., Preisler, H.K., Holmes, T.P., Hidalgo, H.G., Das, T., and Shrestha, S.R., 2009; *Climate change, growth, and California wildfire*, CEC-500-2009-046-F, <http://www.energy.ca.gov/2009publications/CEC-500-2009-046/CEC-500-2009-046-F.PDF>

difficult. Nonetheless, fuel load reduction in at-risk forests is regarded as a means of minimizing costly and ecologically harmful consequences of intense wildfires.²²

Placer County Air Pollution Control District (APCD) recently estimated the economic benefits of generating power using forest biomass in its part of the Sierra Nevada region. They estimate that a modest increase in fuel load reduction that treats an additional 31,000 acres of forestland per year could fuel 50 MW of new local distributed generation facilities and generate up to 372 GWh per year.²³ To treat forests in this way, they assume \$0.055 per kilowatt-hour is paid to the power producer (as a wildfire hazard reduction adder) and estimate that the cost to investor-owned utility (IOU) ratepayers is \$0.15 per month. These values represent a recent attempt to estimate costs and benefits from fuel load reduction and are consistent in part with some earlier estimates. However, the value of ecological or human health, and other benefits from reduced catastrophic wildfires were not estimated in the Placer County APCD study.

Future Efforts to Analyze Benefits from Bioenergy

To support future policy discussions, integrated assessments are needed to quantify the full costs and benefits of biomass use for energy. Performing an integrated assessment may quantify the consequences of new projects and policies, and assess the tradeoffs associated with new biomass uses. Such assessments can inform state and local agencies as they guide new public investments and analyze and permit new bioenergy projects.

Biomass residues from agriculture, forestry and other landscape-based activities can be used in several and sometimes competing ways. As new policy objectives are developed, there may be increased need for these sectors to provide feedstocks for bioenergy and bioproducts.

Balancing the costs and benefits of bioenergy projects is needed to sustain development. Recent California laws like Assembly Bill 118 (Núñez, Statutes of 2007, Chapter 750)²⁴ and AB 32 (Núñez and Pavley, Chapter 488, Statutes of 2006)²⁵ require that sustainability be assessed, including economic costs and benefits, but also non-monetized benefits and values. In many ways, this is an unprecedented and difficult requirement and calls for creative analytical approaches that cross agency-specific legal authorities.

22 USFS Southwest Research Station. 2009. *Biomass to Energy: Forest management for Wildfire Reduction, Energy Production and Other Benefits*. California Energy Commission, PIER program. CEC-500-2009-080, <http://www.energy.ca.gov/2009publications/CEC-500-2009-080/index.html>

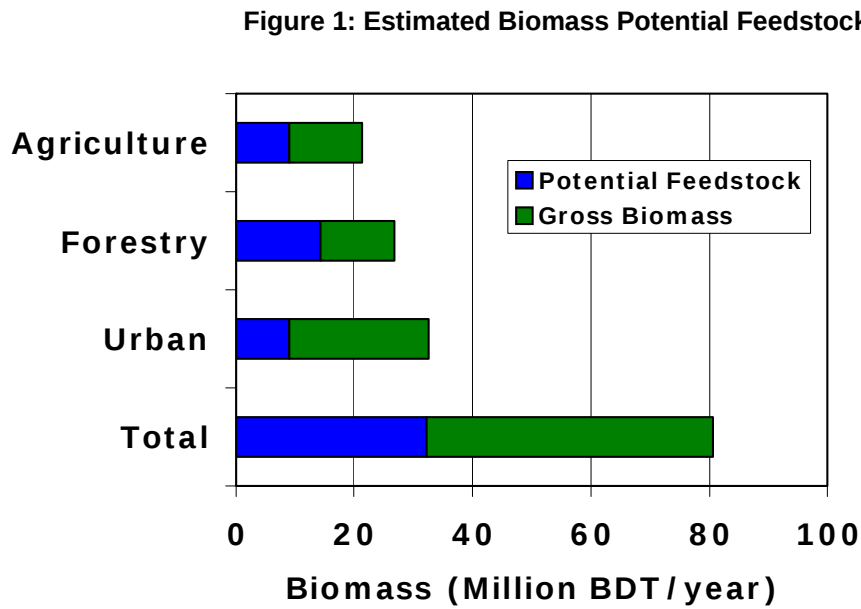
23 Placer County Air Pollution Control District: Opening Comments to October 13, 2011 Renewable Feed in Tariff staff proposal. Rule Making 1105-005, May 5, 2011.

24 AB 118 directs the California Energy Commission to develop and implement the *Alternative and Renewable Fuel and Vehicle Technology Program* (Health & Safety Code, Section 44270 et seq).

25 The Global Warming Solutions Act of 2006.

Technical Potential of Biomass

California has a wide range of biomass distributed throughout the state.²⁶ The primary types are woody biomass from forests and shrub lands, agricultural crops and residues, and the organic fraction of municipal solid wastes and other urban-derived material (Figure 1).



Potential estimated biomass amounts usable for diverse types of energy, compared to total amounts of biomass in California by primary source. (BDT: bone dry tons per year).
Source: Jenkins et al. 2006.

Technically available biomass is estimated to be approximately 36 million bone dry tons per year (BDT/year) in 2010 and 40 million BDT/year in 2020 (not including purpose grown energy crops).²⁷ In 2010, existing solid-fuel biomass facilities used about 4.5 million bone-dry tons of biomass residues to generate over 4,300 GWh (less than 15 percent of the resource).

Biogas (or biomethane) captured from the anaerobic decomposition of manure, food processing wastes, landfills, and wastewater treatments plants is also underutilized. For example, only 1 percent of the manure on dairy farms is currently digested, and the current use of food and food processing wastes represents similarly underutilized potential resources.

26 *Biomass Energy Use in California: Current Capacity, Unrealized Potential and Environmental Benefits*. Steve Kaffka, California Biomass Collaborative, Unpublished Draft Memo to the California Energy Commission. June 6, 2011.

27 Williams, R.B., M. Gildart, and B.M. Jenkins. 2008. *An Assessment of Biomass Resources in California*, 2007. California Biomass Collaborative Contract 500-01-016.

CHAPTER 2: California's Policies on Bioenergy

Bioenergy has an important – and often unique – role to play in addressing California's clean energy, waste management, public safety and environmental goals. Although there are many non-energy policies that govern the management of biomass residues, this chapter focuses primarily on state energy policies.

Renewable Energy Policies

In the electricity sector, biopower contributes to the state's renewable energy goals. California's Renewables Portfolio Standard (RPS) requires that utilities increase the ratio of renewable electricity purchased to total electricity sold to a minimum of 20 percent per year from January 1, 2011 to December 31, 2013; 25 percent by December 31, 2016, and 33 percent by December 31, 2020.²⁸

There are four types of bioenergy identified as eligible for the RPS.

1. Biomass – Technologies that convert eligible biomass to electricity.
2. Digester gas – biogas and biomethane produced through anaerobic digestion.
3. Landfill gas – biogas produced in landfills from natural decomposition of organic waste.
4. Municipal Solid Waste²⁹ (MSW), subject to the fuel-specific requirements described below:
 - a. Solid Waste Combustion Facilities: if the facility is located in Stanislaus County and was operational before September 26, 1996.
 - b. Solid Waste Conversion Facilities: if the facility uses a two-step process where in the first step (gasification) a non-combustion thermal process that consumes no excess oxygen is used to convert MSW into a clean burning gaseous or liquid fuel, and then in the second step this clean-burning fuel is used to generate electricity. The facility and conversion technology must meet all applicable criteria in accordance with Public Resources Code Section 25741, Subdivision (b)(3).

²⁸ Public Resources Code section 25740 provide that "It is the intent of the Legislature in establishing this program, to increase the amount of electricity generated from eligible renewable energy resources per year, so that it equals at least 20 percent of total retail sales of electricity in California per year by December 31, 2010." Passed in the 2011-2012 Legislative session, Senate Bill X1 2 (Simitian, Chapter 1, Statutes of 2011) amends Public Resources Code section 25740 as stated, "It is the intent of the Legislature in establishing this program, to increase the amount of electricity generated from eligible renewable energy resources per year, so that amount equals at least 33 percent of total retail sales of electricity in California per year by December 31, 2020."

²⁹ MSW may contain material not derived from biomass.

Governor Jerry Brown's Clean Energy Jobs Plan calls for the state to increase renewable capacity by 20,000 MW by 2020, including 12,000 MW of energy located on-site or close to where energy is consumed (distributed generation) and 8,000 MW of new large-scale renewable energy. Biopower has the potential to provide between 2,000 and 5,000 MW of the renewable distributed generation needed to achieve the Governor's goals.

The Low Carbon Fuel Standard (LCFS), adopted by the Air Resources Board in 2009, requires fuel producers to reduce the carbon intensity of transportation fuels used in California by an average of 10 percent by 2020. Forty percent of the state's fossil carbon emissions derive from the combustion of transportation fuels.

Biomass is expected to play a key role as a feedstock for the production of transportation fuels needed to meet LCFS and the federal Renewable Fuel Standard (RFS2). On a life-cycle basis, biofuels, such as compressed biomethane and ethanol generated from urban-biomass resources and purpose-grown crops, will play an important role in reducing the life-cycle GHG impact from transportation sector. Advanced ethanol production techniques have the potential to greatly increase the volume and feedstock diversity of ethanol that can be produced from energy stored in cellulose, the main component of plant cell walls and the most common organic compound on earth. Cellulosic feedstocks include woody biomass from dedicated agricultural crops, crop and forest residues, and other urban biomass waste.

As automakers begin to commercialize fuel cell vehicles in the latter half of this decade, biomass and biogas could also provide an important supply for renewable hydrogen, and help meet the requirements under Senate Bill (SB) 1505 (Lowenthal, Chapter 877, Statutes of 2006).³⁰ In addition, several studies indicate that biofuels will be needed to achieve long-term energy and climate goals in the transportation sector, especially for aviation, shipping, and heavy-duty and off-road vehicles that cannot be easily electrified.³¹ The Energy Commission is charged with developing and deploying innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies, as contemplated under these policies and AB 118, and as specified in Health and Safety Code section 44272.

Recognizing the benefits and the contribution that bioenergy could make to achieve California's renewable energy goals, Governor Schwarzenegger signed Executive Order S-06-06 on April 25, 2006. This order committed California to expanding the sustainable use of bioenergy by establishing the following targets:

30 SB 1505 requires 33 percent of hydrogen supply to come from eligible renewable resources.

31 For example, see: California Council on Science and Technology (2011) *California's Energy Future – The View to 2050*, available at (<http://www.ccst.us/publications/2011/CEF%20index.php>); California's Climate Challenge; or Yang et al (2009) Meeting an 80% Reduction in Greenhouse Gas Emissions from Transportation by 2050: A Case Study in California, USA, *Transportation Research Part D: Transport and the Environment*, Vol. 14, Issue 3, 147-156.

- The state should produce a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050.
- The state should meet a 20 percent procurement target for biopower within state goals for renewable generation for 2010 and continuing through 2020.

In response to the Executive Order, the Bioenergy Interagency Working Group drafted Bioenergy Action Plans in 2006 and 2011 to meet the goals of the Executive Order.

AB 32 and Bioenergy

The recently adopted cap-and-trade regulation by the California Air Resources Board is designed to incent the use of biomass derived fuels over the use of fossil fuels. The cap-and-trade program covers the largest greenhouse gas sources in the state. This includes large stationary sources such as power generation plants and fuel suppliers. Any greenhouse gas emissions associated with the use of biomass fuels that meet specific criteria in the cap-and-trade regulation are exempt from holding a compliance obligation. The cap-and-trade program also does not assign a compliance obligation for electricity imports that can be verified to meet the RPS. As the cap declines, the cost for emitting greenhouse gases will increase and regulated entities will have to reduce their greenhouse gas emissions with a compliance obligation or find fuels that are not subject to a compliance obligation. Examples of biomass fuels not subject to a compliance obligation include agricultural waste and wood waste.

The program also includes a compliance offset project protocol that provides an incentive for offset project developers to capture biomethane gas through livestock digester projects and either flare that gas or use it for energy generation. These projects reduce the methane that is directly emitted into the atmosphere as a greenhouse gas and can lower the compliance obligation of a covered entity that uses that biomethane gas.

Waste Diversion Policies

The California Integrated Waste Management Act of 1989 requires that landfills divert 50 percent of all solid waste from landfill disposal or transformation, through source reduction, recycling, and composting. Assembly Bill 341(Chesbro, Statutes of 2011, Chapter 476) creates a statewide goal for 75 percent of all solid waste generated to be source reduced, recycled, or composted by the year 2020. Landfill diversion requirements have increased transfer of organic material to composting facilities, and on a much smaller scale, anaerobic digestion facilities. However, biomass still comprises 18 million tons per year of landfill waste, or nearly 60 percent of the material landfilled each year.³² Therefore, achievement of the statewide recycling goal will require significant diversion of organics from landfills and new waste treatment options.

32 Cascadia Consulting Group. 2009. *2008 Waste Characterization Study*. California Environmental Protection Agency. and California Department of Resources Recycling and Recovery's *Disposal Reporting System* (available at: www.calrecycle.ca.gov/LGCentral/Reports/ReportViewer.aspx?ReportName=ReportEDRSAnnualWaste)

New bioenergy development can help increase diversion of organic materials from landfills, helping the state achieve a 75 percent diversion of waste from landfills. Waste-based resources can also improve the environmental impacts of bioenergy as they avoid some of the sustainability concerns associated with forestry and agricultural feedstocks, such as purpose-grown crops.

For example, urban-derived lumber provides a sustainable source of feedstock for the production of baseload electricity at the State's biomass facilities. CalRecycle estimates that 4 million tons of urban-derived lumber is landfilled annually. In addition, the diversion of organic material from landfills can provide a significant reduction in GHG emissions through landfill methane avoidance, alternative energy production, and water conservation.

CalRecycle has developed a number of initiatives and directives that promote the development of bioenergy projects using waste-based resources such as:

- CalRecycle's Anaerobic Digestion Initiative – Encourage the development of anaerobic digestion facilities in California and actions to implement the policy.³³
- Strategic Directive 2.3 – Foster the development of alternative energy and biofuels derived from waste materials after high-value recyclables have been removed, and continue to play an active role in the Bioenergy Interagency Working Group.³⁴
- Strategic Directive 6.1 – Reduce the amount of organics in the waste stream by 50 percent by 2020.³⁵
- Strategic Directive 9.2 – Encourage the development of alternative energy and biofuels.³⁶

Although these policies help advance bioenergy, the state's current waste management hierarchy does not reference energy recovery. However, some policy discussions have suggested revisions to include placing energy recovery above landfilling in the solid waste management hierarchy. This would provide for energy recovery from post-recycled urban-derived biomass (after the removal of recyclables) prior to landfilling. To do this, revisions to the waste management hierarchy would need to include the establishment of environmental performance-based standards as well as strict enforcement protocols to ensure the recovery of recyclables, in addition to technology-neutral emissions standards for energy recovery from post-recycled urban derived residues.

33 <http://www.calrecycle.ca.gov/Actions/PublicNoticeDetail.aspx?id=455&aiid=438>

34 <http://www.calrecycle.ca.gov/AboutUs/StrategicPlan/2009/SD02.htm>.

35 <http://www.calrecycle.ca.gov/AboutUs/StrategicPlan/2009/SD06.htm>.

36 <http://www.calrecycle.ca.gov/AboutUs/StrategicPlan/2009/SD09.htm>.

Protecting Forests for Public Safety, Economic and Environmental Benefits

Numerous state policies require protection of California's forests for public safety, economic and environmental benefits. As the 2010 Forests and Rangelands Assessment (the "2010 Assessment") points out, "Forests and rangelands, and urban forests, remain valued assets, critical to the economic, social, and environmental well-being of California."³⁷ Forests provide income and jobs from the timber industry, tourism and recreation, livestock and more. Forests also provide much of the state's water supply and important fish and wildlife habitat. Rural and urban forests protect both water and air quality, and provide significant carbon sequestration.

The Legislature has recognized the importance of managing California's forests to meet the state's climate protection goals. In 2010, the legislature passed AB 1504 to amend the state's Forest Practices Act to explicitly recognize that forests "play a critical and unique role in the state's carbon balance by sequestering carbon dioxide from the atmosphere and storing it long term as carbon. . . There is increasing evidence that climate change has and will continue to stress forest ecosystems, which underscores the importance of proactively managing forests so that they can adapt to these stressors and remain a net sequester of carbon dioxide."

One of the most important means to ensure that forests remain net sequesters of carbon – and continue to provide their other many benefits – is fuel treatment to reduce fire risks and impacts. As the 2010 Assessment points out "wildfire poses a significant threat to life, public health, infrastructure and other property, and natural resources. . . Addressing wildfire as a threat is also a major management and policy issue." The US Forest Service, California Department of Forestry and Fire, Sierra Nevada Conservancy, California Energy Commission, Placer County and others are working together to identify and promote community-scale biomass facilities in high fire hazard areas to reduce fire risks while providing local energy and other benefits.

Research and Renewable Energy Programs

For the past 15 years, the Public Goods Charge, a utility surcharge on ratepayers, has been used to fund energy research and development, as well as provide incentives to existing biomass facilities. Although the Legislature did not reauthorize the Public Goods Charge, the California Public Utilities Commission (CPUC) adopted the Electric Program Investment Charge in December 2011 to continue funding for public research and development and renewables programs. In May 2012, the CPUC approved \$162 million annually from 2013-2020, will be administered 80 percent by the California Energy Commission for research, development, and demonstration, and market facilitation, and 20 percent by the utilities in the area of technology demonstration and deployment. In its Final Decision, the CPUC set-aside a minimum of 20 percent of the Energy Commission's technology demonstration and deployment funding, during the three-year period of the first investment plan, to fund bioenergy projects. During the

³⁷ <http://frap.fire.ca.gov/assessment2010.html>

first investment plan cycle, the Energy Commission must budget a minimum of \$9 million per year for bioenergy projects in this category. This set-aside will be reevaluated in subsequent investment plan cycles depending on the results during the 2012-2014 cycle.

The Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 provide funds for research and development that should facilitate improvements to the current cellulose-to-ethanol conversion technologies. Both the United States Department of Energy and the United States Department of Agriculture (USDA) offer incentives for bioenergy development and deployment.

CHAPTER 3:

Action Plan to Increase Use of Biomass Residues

This chapter explores strategies to increase the use of biomass, consistent with the state's policies on bioenergy. It also identifies goals and objectives for biomass use and provides a roadmap of specific state energy actions to achieve the goals.

Strategies to Increase Bioenergy Production and Reduce Waste

The Bioenergy Interagency Working Group (BIWG) has developed a comprehensive biomass utilization strategy, calling for increased use of biomass residues for electricity generation and production of transportation fuels and other bioproducts. Use of biomass residues complements California's existing waste management policies, including reducing, reusing, recycling, and composting.

Although debate continues on the most efficient and beneficial use of biomass, its most economically and technically viable use in the short-term will likely be biopower production.³⁸ California should continue to promote near-term growth in the bioenergy sector with an emphasis on new biomass and biogas projects, while also pursuing long-term opportunities in the transportation sector. This will encourage beneficial use of the material, waste reduction, and generation of renewable electricity in the near-term while providing an opportunity to transition to biomethane production in the transportation sector over time.

The following strategies are intended to increase biomass use for energy production:

1. Develop policies and programs to increase sustainable use of biomass residues from the forestry, agricultural, and urban sectors with safeguards to protect and restore ecosystem health.
2. Increase research, development and demonstration of bioenergy to advance the development of new technologies.
3. Identify and create solutions or remedies to address regulatory, statutory, and utility interconnection challenges that have inhibited the development of distributed or community-level renewable energy projects and biomethane injection into utility pipelines.
4. Develop market-based pricing mechanisms for electricity, transportation, and waste management that monetize the benefits that bioenergy provides to local communities and California more broadly.

³⁸ However, purpose-grown crop and crop residue derived liquid biofuels may be possible in the near-term.

Goals and Objectives of the 2012 Bioenergy Action Plan

The goals of 2012 *Bioenergy Action Plan* are to:

- Increase environmentally and economically sustainable energy production from biomass residues, including but not limited to forest-derived wood waste, agricultural and food processing waste, wastewater, and urban-derived biomass.
- Increase the use of biomass for local distributed generation, combined heat and power facilities, fuel cells, and renewable transportation fuels.
- Undertake research and demonstration projects and develop funding mechanisms to stimulate deployment of cost-effective and sustainable bioenergy technologies.
- Stimulate economic development in rural and economically disadvantaged regions of the state.
- Reduce the risks and impacts of wildfires in forested regions.
- Improve air and water quality.
- Increase diversion of biomass from landfills.
- Streamline the permitting process through collaboration with stakeholders and local, regional, state, and federal agencies.
- Reduce emissions of potent GHG emissions such as methane that would otherwise be released into the atmosphere from animal waste and decomposing organic material.

California's biomass policy objectives focus on developing new and sustainable sources of renewable energy, reducing waste, creating jobs and economic development, reducing fire hazards, reducing GHG emissions, and protecting public health. The 2012 *Plan* identifies near- and long-term objectives for increasing biomass use. The goal is to achieve the near-term objectives by December 31, 2013 and the long-term objectives by 2020.

Near-term objectives

1. Codify legislation and issue formal executive direction regarding increased biomass use through in-state bioenergy and biofuel development.
2. Facilitate growth of California's bioenergy industry by making the regulatory and permitting process more efficient for project developers and permitting officials by eliminating redundant and conflicting regulatory actions and requirements, and providing permit guidance and assistance to developers and government officials.
3. Develop front-end processing standards to ensure that recyclables are removed prior to bioenergy production. These standards must incorporate safeguards to protect existing recycling systems and markets and allow for growth of those systems, including enforcement to ensure recovery of recyclables.
4. Allocate a significant portion of the Electric Program Investment Charge to fund research, development, and deployment of new and emerging technologies that:
 - a. Produce biomethane or biogas from biomass residues.
 - b. Upgrade biogas to biomethane (meeting utility gas quality standards).
 - c. Increase development of community-scale, forest-based biomass facilities.

- d. Produce energy from dairy, food processing, urban derived and other agricultural wastes.
 - e. Produce energy from urban organic waste or waste from water treatment facilities.
 - f. Quantify the benefits and cost of biomass use.
 - g. Increase the feasibility of collecting and transporting biomass or biogas resources.
5. Allocate funding for research, development, and deployment of advanced conversion technologies needed by 2018 to comply with the LCFS.

Long-Term Objective

The long-term objective of the *2012 Bioenergy Action Plan* is to create a competitive bioenergy market in California, including biopower, biofuels, and biogas.

State Agency Actions

Below is a list identifying actions needed to meet the state bioenergy goals, the lead and supporting agencies, and the completion date for the action. A summary table of the actions and responsible agencies is provided in the **Appendix**.

1. Actions to Increase Sustainable Utilization of Biomass

1.1 Increase Bioenergy from Forest Waste to Reduce Fire Hazards

Problem Statement: Strategically placed, community-scale biomass facilities are important to reduce fire risks, restore forest ecosystem health and provide local energy needs in California. Costs, transmission access and permitting continue to pose challenges to community-scale forest biomass, however, and require inter-agency cooperation to overcome these barriers. State and federal agencies participate in a monthly biomass collaborative to identify and address these barriers, but the collaborative would be more effective with the additional participation of the CPUC and California Environmental Protection Agency (CalEPA), additional industry stakeholders, and the utilities.

Action: The Resources Agency, Sierra Nevada Conservancy (SNC), CAL FIRE, Energy Commission and other agencies should continue working with stakeholders and expanding the forest biomass collaborative to identify and promote small-scale forest biomass projects that reduce fire hazards, restore healthier, more resilient forests, provide renewable energy, and promote rural economic development. The CPUC and CalEPA should also participate in the forest biomass collaborative.

Lead Agency: Natural Resources Agency

Supporting Agencies: CAL FIRE, Sierra Nevada Conservancy, Energy Commission, CPUC, CalEPA

Completion Date: December 31, 2013

Action: The CPUC should consider, in consultation with CAL FIRE and other relevant entities, the development of fire-threat maps that identify areas where there is an elevated risk of catastrophic power-line fires occurring, and the possible identification on such maps of areas where vegetation biomass should be removed for fire safety purposes. The CPUC should also consider mechanisms to incentivize development of strategically placed, community-scale biomass to reduce fire hazards and should consider the inclusion of bioenergy from forest waste in the planned contractor assessment of societal and environmental benefits of bioenergy, as identified in Action 2.1b below.

Lead Agency: CPUC

Supporting Agencies: CAL FIRE, Natural Resources Agency, US Forest Service, Sierra Nevada Conservancy

Completion Date: December 31, 2012

Action: The Board of Forestry and Fire Protection adopted regulations for a Modified Timber Harvest Plan for Fuels Management. The rules applicable to this fuel treatment focused timber harvest plan became effective January 1, 2012. The Modified Timber Harvest Plan for Fuels Management prescribes standards for harvesting forest fuels which landowners can use to facilitate plan preparation, reduce costs associated with harvest plan preparation costs and simplify regulatory compliance. Effective outreach by CAL FIRE to landowners and Registered Professional Foresters will be critical to understanding the utility of this new harvest plan option and the benefits it can provide to landowners who wish to conduct fuel treatment activities. To facilitate outreach CAL FIRE will conduct workshops and other outreach during 2012.

Lead Agency: CAL FIRE

Supporting Agencies: Natural Resources Agency, California Environmental Protection Agency (CalEPA)

Completion Date: December 31, 2012

1.2. Establish Sustainability Standards for Forest Biomass Feedstock Sourcing, Emerging Markets, and Ecosystem Health

Problem Statement: One of the challenges of increasing the utilization of forest biomass for energy and biofuels are stakeholder concerns that increased markets will promote more intensive harvest practices, resulting in unanticipated impacts, which existing regulations may not adequately address.

The Interagency Forest Work Group (Climate Action Team subgroup) is working across agencies to define and ensure sustainable forest biomass utilization for energy. CAL FIRE, Energy Commission, and the United States Forest Service (USFS) have developed a proposal to project and analyze how markets, landowner behavior, and regulations may interact to affect biomass harvest practices and sustainability of forested

landscapes. The California Air Resources Board's (ARB's) LCFS program and Energy Commission's AB 118 Program will assist with this project, providing input on biofuel market trends and parameters. The intent of this analysis is to assess the adequacy of existing regulations and identify potential gaps.

Action: Define and ensure sustainable forest biomass utilization for energy.

Lead Agency: CAL FIRE, Natural Resources Agency

Supporting Agencies: USFS, Energy Commission, ARB

Completion Date: 2011 – 2013

1.3. Provide Public Education and Outreach

Action: Provide public education and outreach to communities, local agencies, and citizen groups, such as Fire Safe Councils, reduce wildfire hazards and damages (such as hazardous fuel removal, identification of priority areas for fuels treatments, and education about wood biomass treatments) in compliance with the 2010 Strategic Fire Plan.

Lead Agency: Board of Forestry and Fire Protection and CAL FIRE

Completion Date: December 31, 2012.

1.4. Increase Energy Production from Urban-Derived Biomass

Problem Statement: Stakeholders have expressed uncertainty over whether, and under what conditions, MSW conversion is eligible for the RPS.

Action 1.4.a. Develop front-end processing standards to ensure that recyclable materials are removed prior to MSW conversion. These standards will incorporate safeguards to protect existing recycling systems and markets and allow for growth of those systems, including enforcement to ensure recovery of recyclables.

Lead Agency: CalRecycle

Supporting Agency: Energy Commission, Natural Resources Agency

Completion Date: December 31, 2013

Action 1.4.b. Review proposed legislation and statutory definitions relating to conversion technologies and the use of urban derived biomass from the MSW stream, and propose changes as necessary.

Lead Agency: Energy Commission and CalRecycle

Completion Date: December 31, 2012

1.5. Update Web-Based Database of Biodegradable Waste for Codigestion at Anaerobic Digester Facilities

Problem Statement: There is insufficient access to reliable information about the sources and quantities of biodegradable waste available in California for digestion and codigestion.

Action 1.5.a. Update and renew an existing Web-based database to provide location, volume, quality, and seasonality of biodegradable waste suitable for anaerobic digesters and codigestion. The database will include waste from California's agriculture, food processing, and dairy industries.

Lead Agency: Energy Commission, California Biomass Collaborative

Support Agencies: California Department of Food and Agriculture (CDFA) and United States Environmental Protection Agency (U.S. EPA)

Completion Date: June 30, 2014

Action 1.5.b. Integrate locations of post-consumer food waste into the web-based database.

Lead Agency: CalRecycle

Supporting Agency: Energy Commission, California Biomass Collaborative, and U.S. EPA

Completion Date: December 31, 2013

1.6. Update the Biomass Resource Assessment

Action: Update the assessment of California biomass resources, identify locations of biomass material and uses by region, assess value for fire hazard reduction, and evaluate and recommend cost-effective strategies for sustainably collecting and distributing biomass.

Lead Agency: Energy Commission

Supporting Agencies: Natural Resources Agency, CAL FIRE

Completion Date: December 31, 2012

2. Actions to Increase Research, Development and Demonstration of Bioenergy Technologies

2.1. Quantify the Costs and Benefits of Bioenergy

Action 2.1.a. Update research on bioenergy utilization co-benefits and quantify the cost-benefit of biomass use.

Lead Agency: Energy Commission

Supporting Agencies: CAL FIRE, CPUC, Sierra Nevada Conservancy, California Biomass Collaborative, Water Boards, CDFA, and USFS

Completion Date: December 31, 2013

Action 2.1.b. Solicit contractor proposals to quantify the social and environmental benefits of bioenergy. The CPUC released a request for proposals during the first quarter of 2012.

Lead Agency: CPUC

Completion Date: December 31, 2012

Action 2.1.c. Evaluate the social, economic, and environmental benefits of utilizing biomass for energy production. Coordinate with sub-actions (a) and (b) in this task.

Lead Agency: Energy Commission, California Biomass Collaborative

Completion Date: December 31, 2012

2.2 Integrated Bioenergy Facilities and Bioenergy RD&D

Problem Statement: Public and private funding sources are not being efficiently leveraged to reduce the costs and increase the development of integrated bioenergy facilities, especially, but not limited to bioenergy projects co-located with composting, dairy, recycling, solid waste, and manufacturing facilities.

Action 2.2.a. Provide funding opportunities for community-scale renewable bioenergy development, deployment, and integration projects, such as those that capitalize on the synergies of co-locating biopower or biofuel refineries with other biomass to bioenergy projects, dairy facilities, manufacturing facilities, or waste diversion, composting, transfer/processing, or disposal facilities. This will be considered during the development of the 2012-2014 EPIC Investment Plan. An increase in the tipping fee that supports CalRecycle's Integrated Waste Management Account (an action that requires statutory change) could also be considered as an additional source of revenues to fund activities that utilize urban derived organic materials, including bioenergy projects

Lead Agency: Energy Commission

Supporting Agency: CalRecycle, CDFA

Completion Date: December 31, 2014

Action 2.2.b. Perform a technical and economic assessment of the major renewable technologies.

Lead Agency: Energy Commission, California Biomass Collaborative

Completion Date: June 30, 2014

Action 2.2.c. Fund research, development, and demonstration of projects that will advance the science, technology and market penetration in California of grid-connected distributed generation, combined heat and power, and combined cooling, heat, and power systems and that will integrate emerging, breakthrough technologies including energy storage and fuel flexibility. Projects utilizing biomass will be considered with other technologies in this solicitation.

Lead Agency: Energy Commission

Completion Date: August 1, 2012

2.3. Public Interest Natural Gas Research and Development Program

Action: Evaluate the public interest natural gas research and development program to determine what priority and budget should be given to bioenergy research and demonstration.

Lead Agency: CPUC, Energy Commission

Support Agencies: ARB

Completion Date: December 31, 2012

2.4. Community-Scale Woody Bioenergy Facilities

Problem Statement: Biomass energy facilities are essential to achieving forest restoration activities and rural economic development objectives in California's forested areas. Strategic placement and sustainability are key considerations in addressing this issue. Broad-based stakeholder support can help foster development and acceptance of properly scaled facilities that will help rural communities achieve a triple bottom line of improving economic, environmental, and social health. The Sierra Nevada Conservancy is providing state agency leadership in working with a diverse group of stakeholders and government entities to promote small-scale bioenergy projects that are consistent with forest restoration, economic development, and social equity objectives.

Coordinate the Biomass Working Group, a collaborative of agencies, stakeholders and technical experts, to:

Action 2.4.a. Refine criteria for "community-scale" biomass energy facilities, identify a few candidate projects, and seek developers and cost-share for deploying and demonstrating commercial and emerging community-scale bioenergy technologies.

Action 2.4.b. Provide input to CPUC and others on ratepayer and other benefits of converting forest biomass to energy; identify areas where additional research is needed, and coordinate with and/or secure funding from state agencies, private and federal sources, Western Governors' Association or others for this purpose;

Action 2.4.c. Identify and seek private, state, including public interest research and public goods charge, and federal funding for feasibility studies, pilot and demonstration projects, and research to support community-scale biomass utilization projects.

Lead Agency: Sierra Nevada Conservancy

Supporting Agencies: Natural Resources Agency, USFS, CAL FIRE, Energy Commission, Placer County APCD, Placer County Planning Department, with environmental, private and community stakeholders.

Completion Date: 2012-2013

2.5. Biomass Energy Facility Development on CAL FIRE Forestry Conservation Camps

Problem Statement: Energy Commission staff recommends that California state government should target installing 2,500 MW of renewable energy on state properties to help meet the overall 20,000 MW statewide goal. CAL FIRE is exploring opportunities for installing one to three biomass projects for heat and power, using new technologies, at Forestry Conservation Camps. An initial feasibility study was conducted for a project located at CAL FIRE's Parlin Fork Conservation Camp. CAL FIRE is still in the process of completing a full feasibility analysis. The initial study identified four technologies

appropriate for a 1-3 MW size plant. Two technologies using gasification were identified which would alleviate water availability concerns. The economics for the development were positive. The Hayfork Watershed Research and Training Center has conducted preliminary analyses on biomass projects for Devil's Garden and Trinity River Conservation Camps.

Action: Apply for federal grants to conduct engineering and feasibility studies for one or more of these projects. Install one to three combined heat and power units, using new technologies, at Forestry Conservation Camps.

Lead Agency: CAL FIRE

Supporting Agencies: USFS, Hayfork Watershed Research and Training Center

Completion Date: 2011 – 2014

2.6. Challenges to Developing Anaerobic Digesters in California

Action 2.6.a. Assess the technology and economic research gaps for biogas facilities, especially anaerobic digesters at dairies and wastewater treatment plants including technological barriers to regulatory compliance and profitability.

Lead Agency: CDFA, Energy Commission, California Biomass Collaborative

Supporting Agencies: CalEPA, U.S.EPA, Water Boards, South Coast and San Joaquin Air Districts

Completion Date: June 30, 2014

Action 2.6.b. For dairy digester projects: identify and synthesize the reasons for failure of past projects funded by the state. Additional research is needed to gather information from the technological and economic viewpoints to understand why dairy anaerobic digester projects that were successfully constructed in California eventually failed. Once these mechanisms are understood, present the findings to the renewable energy community so modifications to future approaches can be made. The Dairy Digester Working Group should recommend modifications to non-operational digester facilities to re-commission them for energy generation and encourage new investment at existing facilities as well as for facilitating the development of new facilities

Lead Agency: Energy Commission, CDFA

Supporting Agencies: CalEPA, CPUC, GoBiz, California Air Pollution Control Officers Association (CAPCOA)

Completion Date: December 31, 2012

Action 2.6.c. Investigate the improvement potential of biomass gasification technology for use in power cycles and conduct an economic and market assessment of thermochemical conversion (and other gasification) biomass conversion technologies including barriers and recommendations for additional research, development, and demonstration projects to make these technologies economically competitive.

Lead Agency: Energy Commission, California Biomass Collaborative
Completion Date: June 30, 2014

Action 2.6.d. The Energy Commission is currently conducting a value assessment of Biogas Resources based on their relative environmental benefits. This effort should be expanded to create an integrated research agenda with the goal of to understanding the environmental cross-media impacts and benefits of anaerobic digester projects, to spur incentive programs for biogas facilities.

Lead Agency: Energy Commission, ARB and water boards
Supporting Agencies: Energy Commission, CalEPA, CDFA, CalRecycle, Office of Planning and Research
Completion Date: June 30, 2012

2.7 Air Quality Impacts of Bioenergy

Action: Release a solicitation targeting research projects that address air quality concerns slowing the development of bioenergy projects and conduct a life cycle analysis of air emissions and offsets from bioenergy projects.

Lead Agency: Energy Commission
Supporting Agencies: ARB and local air pollution control districts
Completion Date: December 31, 2012

2.8 Greenhouse Gas Benefits from Bioenergy

Action: Release a solicitation targeting research projects that study the life cycle greenhouse gas benefits from various types of bioenergy, i.e., energy generation from biomass and anaerobic digestion of various waste streams. Research should compare both the source differences, process changes and the relative GHG benefits from different end uses, whether for transportation fuel, electricity generation, or fuel cell application.

Lead Agency: ARB, SWRCB
Supporting Agencies: CDFA, CAL FIRE, Energy Commission
Completion Date: December 31, 2013

3. Actions Addressing Permitting, Regulatory, Statutory, and Utility Interconnection Challenges

3.1. Improving Permitting Assistance and Information

Problem Statement: Planning and permitting renewable energy systems can be challenging for both local planning officials and developers, but expanding renewable energy development is critical to protect California's environment and to support clean energy job growth. As renewable energy development increases, the workload for cities, counties and local jurisdictions will also increase. Some jurisdictions are ill-equipped to permit and site renewable energy projects, as they do not having a regulatory

framework or technical expertise in place to review renewable energy development requests or the resources to establish such a framework or expertise.

Improved coordination among state and local permitting agencies can streamline the permitting process and reduce the time and costs of the process.

Action 3.1.a. CalEPA should funnel projects through its Consolidated Permit Application process (Public Resources Code § 71020 *et seq.*) to coordinate the process and recommend improvements in the coordination among regulatory agencies in order to expedite permit application and review of dairy digester projects and remove duplicative regulatory requirements.

Lead Agency: CalEPA

Supporting Agencies: CDFA, water boards, CalRecycle, ARB

Completion Date: December 31, 2012

Action 3.1.b. Encourage bio-energy developers to consult with GoBiz and CalEPA before project application and determine if the Consolidated Permit route would help their permit applications. CalEPA and GoBiz will study existing public information about this process and utilize recommendations from the initial projects funneled through the consolidated permit process to make improvements to communication materials.

Lead Agencies: GoBiz, CalEPA

Supporting Agencies: CDFA

Completion Date: December 31, 2012

Action 3.1.c. Develop industry specific, web-based tools for planning and permitting guidance, links, and agency contacts. Coordinate efforts underway at the Energy Commission, CDFA and CalEPA. CalEPA will develop a web portal with permitting guidance for dairy digester projects, and an online “drop box” or other online technologies to coordinate submission of environmental permits. This technology, once created and successfully utilized, could be replicated for other types of distributed generation bio-energy projects (landfill methane, wastewater treatment facilities, biomass electricity generators, etc.)

Lead Agencies: CalEPA, Energy Commission, GoBiz

Support Agency: CDFA

Completion Date: December 31, 2012

Action 3.1.d. Develop screening criteria to help local agencies determine the applicability of community scale woody biomass technologies and projects in their communities.

Lead Agency: Sierra Nevada Conservancy

Supporting Agencies: CAL FIRE, Natural Resources Agency, Energy Commission, Placer County APCD, Placer County Planning Department, California Biomass Collaborative, Water Boards, and USFS

Completion Date: 2011 – 2014

Action 3.1.e. ARB in consultation with project proponents and local air districts will host an online information database that presents anaerobic digester project overviews to include specifics such as name, location, type of digester technology installed, type of energy production (e.g. electricity, liquid biofuel, biogas, or some combination), energy production technology employed (e.g. fuel cell, micro-turbine, IC engine), and technologies employed to reduce air emissions from the facility.

Lead Agency: ARB

Supporting Agencies: Energy Commission, Affected local air districts and project proponents

Completion Date: June 30, 2012

3.2. Removing Barriers to the Utilization of Biomethane via Natural Gas Pipelines

Problem Statement: In impacted air basins, upgrading and injecting biogas is an attractive alternative to onsite power generation, however, in California, it is not economically viable for small and medium scale projects due to the high capital investment requirements. Despite economic challenges, biogas is a flexible energy source that can offset natural gas use for transportation fuels and power generation, and can be distributed efficiently using the interstate pipeline system. However, there are no uniform biogas quality standards or pipeline interconnection procedures and landfill gas cannot be injected into California's natural gas pipeline system under current IOU pipeline tariffs. Project developers state that uniform and/or clearer gas quality standards for pipeline injection of biomethane would reduce the burden and cost faced by small developers to meet the standards.³⁹ A number of gas quality standards for pipeline injection are specified by the California utilities in their CPUC-approved tariff rules and some additional standards are specified in CPUC General Order 58-A. However, not all of the gas quality standards that may be appropriate for biomethane have been specified in the utility rules or in General Order 58-A. This has created different approaches by utilities applying the existing standards for biomethane injected into the natural gas pipeline.

The BIWG supports the establishment of statewide rules and requirements regarding transporting biogas and biomethane in California's natural gas pipelines and development of a set of uniform standards for both pipeline safety and protection of public health.

Action 3.2.a. Review the Gas Technology Institute's proposed standards for landfill gas and determine whether additional gas quality standards should be adopted for biogas injected into utility natural gas pipelines.

CPUC will work with the legislature to make necessary changes to the statute. After a new law is adopted, CPUC will make necessary changes to General Order 58-A..

³⁹ Paul Relis, CR&R. Staff Workshop 2010 Bioenergy Action Plan Transcript, June 3, 2010, Page 94.

Lead Agency: CPUC

Supporting Agencies: Energy Commission and CalRecycle

Completion Date: December 31, 2013

Action 3.2.b. Assess the proposed SoCal Gas tariff for biogas conditioning and pipeline injection to determine whether this is an effective and efficient means for increasing pipeline injection of biomethane. If this method is not effective, initiate a public process to identify barriers to injecting biogas and landfill gas into the California natural gas pipeline and implement actions to address these barriers.

Lead Agencies: CPUC and Energy Commission

Supporting Agencies: CalRecycle and Natural Resources Agency, CDFA

Completion Date: June 31, 2013

Action 3.2.c. Support research and demonstration projects to reduce the cost of biomethane gas clean-up technologies that can meet gas quality standards for transportation and utility pipelines.

Lead Agency: Energy Commission

Support Agencies: CPUC

Completion Date: December 31, 2012

Action 3.2.d. Perform a comparative assessment of biogas clean up technologies for natural gas pipeline injection and advancement of the use of biogas sources for distributed generation applications. Coordinate with sub-actions in this task.

Lead Agency: Energy Commission, California Biomass Collaborative

Completion Date: June 30, 2014

3.3. Increase Deployment of Anaerobic Digestion Projects

Problem Statement:

Urban Waste Streams: Large amounts of organic waste are disposed of in the state's landfills where they contribute to greenhouse gas emissions. Organic waste (such as food waste) should be redirected to anaerobic digestion projects, which would result in job creation and in-state development of biofuels and bioenergy projects.

Agricultural Waste Streams: As the nation's largest dairy production state, California dairies have a promising opportunity to manage their manure, improve water quality, reduce greenhouse gas emissions and produce renewable energy. Only one percent of the manure on dairy farms is currently captured for renewable energy purposes even through biogas substitutes for natural gas, coal, or other sources of electricity. Anaerobic digestion systems require a significant economic investment. The current dairy market, access to debt financing, energy tariffs, interconnection standards, regulatory barriers, and net-metering policies are not conducive to widespread adoption of digester systems.

In addition, operation of anaerobic digesters in certain parts of the state is increasingly difficult due to air quality and solid waste regulations, as well as local planning agencies' lack of familiarity with the benefits of these facilities. These same issues are amplified in any attempts to permit new anaerobic digesters in impacted air basins or in jurisdictions where local planning agencies do not understand the benefits of these facilities.

To support the deployment of anaerobic digestion projects in California, the following actions will be taken:

Action 3.3a: Provide technical and permitting support for anaerobic digestion projects, including support to jurisdictions and conversion technology developers. Increase awareness and utilization of the Programmatic Environmental Impact Report (EIR) of anaerobic digestion facilities. Update guidance documents that outline how regulations are applied to anaerobic digesters and the requirements that the state and local agencies have regarding anaerobic digesters.

Lead Agencies: CalRecycle, CalEPA

Supporting Agencies: Water Boards, ARB, Energy Commission, Air Districts

Completion Date: December 31, 2012

Action 3.3b: Develop and implement actions that will enhance the economic, regulatory and technical viability of dairy digesters and co-digestion of other agricultural waste. CDFA convened a working group of state and federal agencies, academic and non-profit groups in fall 2011 to address these challenges and it has developed specific policy recommendations and a funding plan to help dairy digesters become commercially and economically viable, and to streamline and reduce duplicative permitting for these facilities.

Lead Agency: CDFA

Supporting Agencies: CalEPA, Natural Resources Agency, GoBiz, Energy Commission, U.S.EPA, USDA, NRCS

Completion Date: Ongoing

Action 3.3c: As stated in Action 3.1a, CalEPA and GoBiz will continue to coordinate consolidated permits for dairy digester project proponents to speed deployment of these projects and to educate applicants about the use of the Programmatic EIR for Dairy Digesters. This will streamline the permitting process for dairy digesters. CalEPA will also develop a web-portal and online application tool to assist applicants.

Lead Agency: CalEPA

Supporting Agencies: GoBiz, CalRecycle, CDFA, CVRWQCB, SJVAPCD

Completion Date: Ongoing

Action 3.3d: Support ongoing development of multi-agency funding program for dairy digesters with multiple end uses: electricity generation, pipeline injection and

transportation fuels development. Funding has been committed from NRCS, USDA, U.S. EPA, the San Joaquin Valley Air Pollution Control District, the Central Valley Water Board. More funding commitments should be made from state agencies with available funds.

Lead Agency: CDFA, U.S.EPA, NRCS

Supporting Agencies: CVWRCB, SJVAPCD, CalEPA

Completion Dates: August 2012 (Joint RFP issuance); December 2012 (identify sources for ongoing incubator funding)

3.4. Programmatic Environmental Impact Report for Biomass Thermochemical Conversion Technologies

Problem Statement: Information about the environmental performance, impacts, and mitigation measures for thermochemical conversion projects has not been compiled in a manner that would facilitate permitting and policy decisions. A Programmatic EIR would assess the environmental impacts that may result from the development of thermochemical conversion facilities. The results of the EIR will inform future policy considerations related to siting and permitting thermochemical conversion facilities and provide background information on technologies, potential impacts, and mitigation measures.

Action: If funding can be secured, develop a program EIR for thermochemical conversion technologies. The EIR will analyze the potential environmental impacts of thermochemical conversion technologies at a program level for select biomass feedstocks. This information will assist state and local agencies in preparing site-specific environmental documentation that may be required for conversion technology facility applications and/or permits submitted to CalRecycle and other state and local regulatory agencies.

Lead Agency: to be determined

Support Agencies: Energy Commission, CalRecycle, and CalEPA

Completion Date: December 31, 2013

3.5. LCFS Pathway for Anaerobic Digestion of MSW

Problem Statement: A LCFS pathway for anaerobic digestion of MSW feedstock is in the process of being developed by ARB. The development of this pathway would provide anaerobic digestion facilities producing MSW-derived transportation fuels the ability to quantify the resultant fuel's carbon intensity relative to traditional fuels and calculate the corresponding LCFS credits. Transportation fuels with low carbon intensity values should have a higher market value than traditional fuels.

Action: Develop a LCFS pathway for anaerobic digestion technologies.

Lead Agency: ARB

Supporting Agency: CalRecycle, Water Boards, CDFA

Completion Date: August 1, 2012

3.6. Biomass for AB 32 Capped Entities

Problem Statement: The Cap-and-Trade Program currently exempts the combustion emissions from specific types of biomass from holding a compliance obligation. As new sources of biomass are identified, there should be a mechanism to review and include those sources in the exemption list

Action: Coordinate with supporting agencies to identify additional types of biomass that could replace fossil fuel use in electricity generation facilities and onsite electricity generation at capped entities which would not hold a compliance obligation under the cap-and-trade program.

Lead Agency: ARB

Supporting Agencies: CalRecycle, Energy Commission, CDFG

Completion Date: December 31, 2014

3.7. Interconnection Challenges for Distributed Generation Projects

Action: Review the Rule 21 tariff interconnection processes. The CPUC will address Rule 21 issues in Rulemaking (R) 11-09-011.

Lead Agency: CPUC

Supporting Agency: Energy Commission

Completion Date: December 31, 2012

3.8. Air-Related Equipment Certification Programs

Action: To help expedite the permitting process, ARB, in conjunction with local air districts through CAPCOA, will provide manufacturers of biopower generation technologies (including engines, fuel cells and microturbines) guidance on how to expeditiously permit biopower projects by proposing technologies that meet the latest regulatory requirements and how to retrofit existing facilities to meet tightening air quality regulations.

Specifically, the ARB and CAPCOA will provide information about the air quality permitting process for local air districts. ARB will also provide information about the state Precertification and Distributed Generation Certification programs.

Lead Agency: ARB

Supporting Agencies: CAPCOA

Completion Date: Ongoing through December 31, 2012

3.9. AB 1318 – Wildfire Emissions Offset Credits for Particulate Matter

Action: Evaluate the regulatory feasibility and economic viability of forest health and hazardous fuels reductions programs as a potential source of particulate matter emission reduction credits in the South Coast Air Quality Management District and other non-attainment areas in California.

Lead Agency: ARB

Supporting Agencies: Energy Commission, CAL FIRE, USFS, and local air pollution control districts

Completion Date: December 31, 2012

3.10. Federal Bioenergy Policies and Regulations

Problem Statement: Federal regulations and legislation, such as the EPA's proposed rule on Maximum Available Control Technology (MACT) for biomass facilities and federal tax credits, have the potential to impact bioenergy development and biomass operations within California.

Action: Continue to monitor and comment on federal regulatory and legislative proposals that will impact the state's ability to develop bioenergy projects, including but not limited to:

- o U.S. EPA's development of GHG tailoring rule and changes to the MACT and Non-Hazardous Secondary Materials regulations.
 - If necessary, the Working Group will work with U.S. EPA Region 9 to develop a Memoranda of Understanding that will help define traditional materials under the Non-Hazardous Secondary Materials Rule.
- o Federal legislation that allows states to implement feed-in tariffs for renewable energy projects, including bioenergy projects.
- o Federal legislation that allows use of woody biomass harvested sustainably from federal lands in California to be eligible as a renewable feedstock for the production of biofuels.
- o Extend federal tax credits for existing solid-fuel biomass facilities and new biomass and biogas facilities.
- o Federal tax credits for biomethane injected into natural gas pipeline.

Lead Agency: Governor's Washington DC Office and all BIWG agencies

Completion Date: On-going

4. Actions to Incentivize and Monetize the Benefits of Bioenergy

4.1. Public Goods Charge Transition

Problem Statement: Bioenergy needs continued investment in research, development and commercialization. Since the Public Goods Charge expired at the end of 2011 without legislative reauthorization, the CPUC has adopted the Electricity Program Investment Charge (EPIC). EPIC funds, \$162 million annually from 2013-2020, will be administered 80 percent by the California Energy Commission for research, development, and demonstration, and market facilitation, and 20 percent by the utilities in the area of technology demonstration and deployment. All funds will be administered under CPUC oversight, with a proceeding at least every three years to

consider more detailed investment plans presented by the administrators. The PUC's decision also allocates a minimum of 20 percent of the renewable energy funds to bioenergy development and commercialization.

Action 4.1 Ensure that a substantial portion of EPIC funds is devoted to developing and commercializing new bioenergy facilities that are environmentally and economically sustainable, as well as upgrading and maintaining existing bioenergy facilities as appropriate.

Lead Agency: CPUC and Energy Commission

Supporting Agencies: Natural Resources Agency, CalEPA, CDFA

Completion Date: Ongoing

4.2. Feed-In Tariffs for Renewable Projects

Problem Statement: Community-scale bioenergy developers would benefit from a simple and streamlined procurement tool that offers an established price sufficient to incentivize new bioenergy development. In May 2012, the CPUC adopted a pricing mechanism called a "Renewable market Adjusting Tariff" or "Re-MAT" for projects up to 3 megawatts. The Re-MAT establishes a starting price for baseload, peaking as-available, and non-peaking as-available power. The prices will be adjusted every two months based on market response and will also be adjusted based on actual power deliveries. The Re-MAT does not include adders for specific technologies or benefits such as fire hazard reduction.

Action 4.2.a. Monitor use of Re-MAT to assess whether and the extent to which it is incentivizing new bioenergy projects. Make adjustments if needed to ensure it incentivizes different forms of bioenergy and adequately accounts for the different bioenergy types' costs and benefits.

Lead Agency: CPUC

Support Agencies: CAL FIRE, CalRecycle, Natural Resources Agency, Energy Commission, CDFA, State Water Resources Control Board

Completion Date: Ongoing

Action 4.2.b. Ensure that dairy digesters, community-scale forest biomass and other types of bioenergy projects benefit from the SB 32 feed-in-tariff and consider use of other procurement mechanisms for small scale bioenergy projects.

Lead Agency: CPUC, CDFA, CAL FIRE, CalRecycle,

Support Agencies: Energy Commission, CalEPA

Completion Date: December 31, 2013

4.3. Alternative Fuel Investment Plan

Problem Statement: To promote restarting or retooling existing biofuel plants, and to promote development of new in-state production capacity, the Energy Commission will

develop and implement funding programs through the *Alternative and Renewable Fuel and Vehicle Technology Program*.

Action 4.3.a. As part of the Alternative Fuels Investment Plan, funding will be allocated to do the following:

- o Study the feasibility of low-carbon cellulosic ethanol feedstock, including feasibility studies of modifications to existing plants.
- o Research to improve conversion efficiencies of biofuels derived from cellulosic biomass residues, including the organic fraction of MSW.

Lead Agency: Energy Commission

Completion Date: December 31, 2012

Action 4.3.b. Provide technical reviews of relevant anaerobic digester project proposals submitted under the *Alternative and Renewable Fuel and Vehicle Technology Program*.

Lead Agency: CalRecycle.

Supporting Agencies: BIWG, CalEPA

Completion Date: December 31, 2012

4.4. *Advanced Biofuels and Renewable Energy Facilities*

Problem Statement: There is limited availability of low interest financing for biofuel and renewable energy projects that use MSW as feedstock.

Action 4.4.a. CalRecycle's Recycling Market Development Zones program will provide low interest loans and technical and permitting assistance to eligible biofuel and renewable electricity projects that utilize MSW.

Lead Agency: CalRecycle

Completion Date: December 31, 2012

Action 4.4.b. Work with the California Pollution Control Financing Authority to help anaerobic digestion project proposals obtain funding.

Lead Agency: CalRecycle

Completion Date: December 31, 2012

4.5 *Pursue Federal Funding Opportunities for Bioenergy*

Action: State and Federal agencies will coordinate to identify and pursue opportunities for federal research, development and commercialization of bioenergy facilities, including funding from the US Department of Agriculture, Forest Service, Environmental Protection Agency, Department of Energy and other federal partners.

Lead Agencies: CDFA, CAL FIRE, Sierra Nevada Conservancy, CalEPA

Supporting Agencies: Energy Commission, Resources, ARB

Completion Date: Ongoing

4.6 Consider Adoption of Offset Protocols for Bioenergy

Problem Statement: Currently, the Air Resources Board has a greenhouse gas offset protocol for reducing the emissions from livestock waste, but not for other greenhouse gas reductions associated with bioenergy. Adoption of additional offset protocols under AB 32 could help to monetize the greenhouse gas emissions benefits associated with bioenergy.

Action: The Air Resources Board should consider the adoption of additional protocols and additional opportunities under AB 32 to measure, account for and verify the greenhouse gas emissions benefits of different bioenergy sources and technologies.

Lead Agency: Air Resources Board

Supporting Agencies: CalEPA, CalRecycle, CDFA, CAL FIRE, Energy Commission, Water Board

Completion Date: December 31, 2014

Acronyms

AB	Assembly Bill
APCD	Air Pollution Control District
ARB	Air Resources Board
BDT	bone dry tons
BIWG	Bioenergy Interagency Working Group
CalEPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
CalRecycle	California Department of Resources Recycling and Recovery
CAPCOA	California Air Pollution Control Officers Association
CDFA	California Department of Food and Agriculture
CPUC	California Public Utilities Commission
CREC – CBC	California Renewable Energy Center – California Biomass Collaborative
EIR	environmental impact report
FOG	fats, oil, and grease
Gge	gallons of gasoline equivalent
GHG	greenhouse gas
GWh	gigawatt-hour
IOU	investor-owned utility
LCFS	Low Carbon Fuel Standard
MACT	Maximum Achievable Control Technology
MSW	municipal solid waste
MW	megawatt(s)
PIER	Public Interest Energy Research Program
RPS	Renewables Portfolio Standard
RD&D	research, development, and demonstration
SB	Senate Bill
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USFS	United States Forest Service