

Biogas Production and Use on California's Dairy Farms

A Survey of Regulatory Challenges

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1. EXECUTIVE SUMMARY

California hopes to significantly reduce greenhouse gas (GHG) emissions over the next two decades. Several recently adopted laws and policies have set in motion a process to seek strategies and solutions to lowering the state's climate change impacts. Producing energy from organic materials – also known as bioenergy – has emerged as an important strategy to reduce greenhouse gas emissions. In particular, producing biogas through anaerobic digestion of organic matter is gaining momentum in the United States and Europe as a viable method of bioenergy production.

California is home to about 1,800 dairies that represent over 1.7 million dairy cows. The resulting manure is a significant source of methane, a particularly potent GHG with a global warming potential 23 times higher than carbon dioxide (CO₂). Capturing methane through anaerobic digestion of manure allows for its use as an alternative to natural gas in combustion, power production, or as a transportation fuel. The California Air Resources Board (CARB) estimates that manure management projects utilizing anaerobic digestion could eliminate up to 1 million metric tons of carbon dioxide equivalent (MMTCO₂E) by 2020.¹

Anaerobic digestion is a biological process in which bacteria converts organic materials into biogas in an oxygen-free environment. Dairy-based digesters typically use manure to create biogas. It is also possible to introduce other organic wastes into the process, such as crop residue, byproducts from food processing, and green waste. This process is called co-digestion. In contrast to dairy-based digesters, large biogas projects can be located in near sources of manure and other materials that can be transported to a centralized digester. Co-digestion and centralized projects are more common in European countries such as Denmark. California currently has about 22 biogas-producing digesters located on dairy farms. By contrast, some European countries, for example Germany, have thousands of farm-based digesters and are producing significant quantities of biogas.

Market, financing, and regulatory challenges to producing biogas exist in California. This paper focuses on the regulatory challenges that could inhibit expansion of the biogas market. The purpose of this paper is to conduct a preliminary review of existing water, air, solid waste management, electricity, and natural gas regulations to identify challenges or areas of uncertainty that might affect biogas production in California.

The following provides a summary of the key findings and recommendations.

1.1. Key Findings

1.1.1. Anaerobic Digestion Can Yield Multiple Benefits

Using anaerobic digestion, including co-digestion, to extract methane from animal manure and other feedstocks like food processing wastes yields multiple benefits: reduced greenhouse gases, reduced fossil fuel consumption, and reduced organic waste flow into landfills, and reduced use of non-organic fertilizer. In addition, biogas production represents a potential economic opportunity for California and its dairy farmers.

¹ California Air Resources Board, Proposed Early Actions to Mitigate Climate Change in California 7 (April 20, 2007), available at http://www.climatechange.ca.gov/climate_action_team/reports/2007-04-20_CARB_early_action_report.pdf (last visited August 7, 2007).

1.1.2. Significant Policy Support Exists to Promote Bioenergy, Including Biogas

California enacted general legislation that encourages the development of renewable energy, including bioenergy and biogas. AB 32, the Global Warming Solutions Act of 2006, establishes greenhouse gas emissions reduction targets. In addition, California's Renewable Energy Portfolio Standard, requires investor-owned utilities to provide 20 percent of their energy from renewable sources by 2010. Both initiatives have encouraged development of clean energy projects, including methane digester projects.

California has also adopted specific policies to encourage and promote bioenergy. On April 25, 2006, Governor Arnold Schwarzenegger issued Executive Order S-06-06, establishing the bioenergy use and production targets: the state should produce a minimum of 20 percent of its biofuel needs by 2010, 40 percent by 2020, and 75 percent by 2050; and the state should use bioenergy to meet 20 percent of the overall renewable portfolio standard requirements.² An interagency working group, led by the California Energy Commission, formulated the Bioenergy Action Plan in order and outlined near-term actions for participating agencies in order to meet the goals of the Executive Order.³

1.1.3. Significant Potential Exists for Biogas Production

California's agricultural sector generates significant biomass resources, including animal manure, crop residues, food processing wastes, and other organic materials that can be converted to energy. One estimate suggests an annual production of nearly 15 billion cubic feet of biogas. This estimate could be significantly higher if co-digestion were used more widely.

1.1.4. No Integrated Regulatory Framework Exists for Anaerobic Digestion

Biogas has been captured and used for many years by landfills and wastewater treatment plants, which represent the largest current supply of biogas in California; however, biogas production and use on dairy farms is relatively new and not widespread. As such, many regulatory agencies are still developing clear requirements for biogas production and use. Since the entire cycle of biogas production and use cuts across many regulatory agencies, it can be difficult for project developers to complete the permitting process and for agencies to coordinate their processes.

Some agencies have regulations and standards that specifically address biogas, while others use existing, not always relevant, frameworks to regulate anaerobic digestion. For example, the CIWMB uses existing composting regulations as a way to accommodate anaerobic digestion. The CPUC has policies on net metering, financial incentives, and renewable portfolio standard eligibility that specifically address biogas. On the other hand, water agencies, such as the Central Valley Water Board, don't have specific rules relating to anaerobic digestion but have significant concerns about the water quality impacts of dairy lagoons, including those used in combination with anaerobic digestion. Since no predictable and integrated regulatory standard exists for projects to meet, many biogas production projects are being processed on a case-by-case basis.

² Governor of the State of California. Executive Orders S-06-06 (April 2006), *available at* <http://gov.ca.gov/index.php/executive-order/183/> (last visited August 20, 2007), *supra* note 1.

³ The Working Group comprises the California Energy Commission (Energy Commission) – the lead agency, the Air Resources Board (CARB), California Environmental Protection Agency (CalEPA), California Public Utilities Commission, California Resources Agency, Department of Food and Agriculture, Department of Forestry and Fire Protection, Department of General Services, Integrated Waste Management Board, and the State Water Resources Control Board.

1.1.5. Regulatory Challenges Exist for Producing and Using Biogas

Our research identified regulatory challenges in the areas of water, air, electricity, natural gas, and solid waste management. These challenges are discussed in detail in Sections 4 through 8 of the report. Provided here is a brief summary.

Water

- *No Salt Standards Exist* – Currently no salt standards exist to provide guidance on use of solid and liquid digestate, particularly if co-digestion is being used.
- *Pond Design Standards* – The Central Valley Water Board recently adopted new design standards for dairy new and reconstructed manure retention ponds. It is unclear how these standards will affect anaerobic digestion.

Air

- *Gap in Air Regulations Affecting Smaller Dairies* – Small dairies that are exempt from local permitting requirements must comply with the CARB's distributed generation certification program. Currently no internal combustion engines qualify; therefore, dairies with fewer than 1,000 cows do not have viable generation options to produce electricity from biogas.

Electricity

- *Biogas Net Energy Metering Credit* - The energy credits provided under the current biogas net metering pilot program may not be sufficient to encourage electricity production from biogas.
- *Excess Energy Production Under Biogas Net Metering Pilot* - Customer generators do not receive any credit for energy produced above their annual consumption needs. This could discourage maximum production of biogas for electricity generation.
- *Biogas Net Energy Metering Cap* - The biogas net metering pilot tariff is available to projects that become operational by December 31, 2009, or until such time that the “combined statewide cumulative rated generating capacity used by the eligible biogas digester customer-generators in the service territories of the three largest electrical corporations in the state reaches 50 megawatts.” This could limit the total amount of electricity generated by biogas combustion.⁴
- *Self-Generation Incentive Program Eligibility for Biogas* - After January 1, 2008, the existing Self-Generation Incentive Program will not provide incentives for fossil-fuel based distributed generation technologies, including those fueled with biogas.⁵
- *Tariff Structures Can Discourage Biogas Production* - Tariff structure can encourage or discourage use of distributed generation. In particular, low off-peak energy costs and high non-coincident demand charges can discourage distributed generation.
- *Uncertainty about Ownership of Renewable Energy Credits* - The CPUC ruled in D.07-01-018 on ownership of renewable energy credits from renewable distributed generation. It is unclear if this ruling applies to all renewable distributed generation or to solar only.

⁴ Pending legislation (AB 1428) would increase the cap to 70 MW.

⁵ Pending legislation (SB 1064) would make biogas-fueled distributed generation eligible for SGIP incentives.

Natural Gas

- *Biomethane Quality Standards* – Currently, there are no gas quality standards specifically for biogas. Given the constituents of biogas, it might be necessary to develop such standards.
- *No Market Price Referent for Biogas* – The CPUC has adopted market price referents (MPR) for renewable electricity but has not yet adopted similar referents for biogas. A biogas MPR could help to remove some uncertainty in developing and contracting.
- *Interconnection Costs* – Interconnection costs vary widely between gas utilities. High interconnection costs can make biogas production projects less cost effective.
- *Introducing Biogas into the Distribution System* – Currently, biomethane can only be introduced into the gas transmission system and not into the distribution system. This could limit the overall biogas production market.

Solid Waste Management

- *Regulatory Ambiguity Exists* – Ambiguity remains over whether and the extent to which the CIWMB has jurisdiction over parts of the anaerobic digestion process. CIWMB considers anaerobic digestion to be composting, which falls under its regulatory purview.
- *No Definition of Anaerobic Digestion* – No statutory or regulatory definition for anaerobic digestion exists. Establishing a definition could help to resolve jurisdictional questions.

1.1.6. More Information May be Needed to Develop Appropriate Regulations

There appears to be insufficient technical information about the anaerobic digestion and co-digestion processes on dairy farms in California to allow regulators to develop appropriate regulations. More information and data may be needed in several areas:

- The nutrient, salt, other content of solid and liquid effluent;
- The level of impurities in biogas, particularly for purposes of injecting;
- Available technology for gas conditioning;
- The net energy, solid resource, nutrient and carbon balance of the biogas production and use cycle; and
- Other regulatory models from other state and countries.

1.1.7. Innovative Regulatory Approaches May Be Needed

Reducing GHGs is complex and may require innovative regulation. There is a tendency to regulate media in silos – water, air, solid ‘waste’, and electricity and natural gas. Many of the solutions to reduce GHG cut across many different regulated areas. Biogas production on dairy farms is a good example. Reaching the ambitious goals established by AB 32, Executive Order S-06-06, and the Bioenergy Action Plan may require considering integrated regulatory approaches. For example, establishing a set of reference standards for biogas production that provides biogas project developers a list of benchmarks to be met could help establish more predictable regulatory processes. Also, because there can be conflicting regulations between and among different agencies, considering an approach that considers that net environmental benefits of a project rather than how it may or may not meet a specific standard for a single media could be appropriate. In the case of biogas production on dairy farms, significant GHG reduction possibilities could be limited by standards for salinity and criteria emissions.

1.2. Recommendations

Recommendations are broken into two general categories: general and area-specific. The general recommendations are broader in scope and are not necessarily associated with a particular regulatory agency or process. The area-specific recommendations are directly relevant to a particular agency or regulated area, including water, air quality, electricity, natural gas, and solid waste management. The area-specific recommendations are summarized in Section 11.1 of the Appendix.

1.2.1. General Recommendations

Develop a Policy Position on the Preferred Use of Biogas

California policymakers, possibly the CA Bioenergy Working Group, should determine whether there is a preferred use of biogas produced on dairy farms or other agricultural lands. As this report indicates, there are multiple ways to use biogas, each with its own challenges and opportunities. Should policies encourage on-site use of biogas for electricity generation? Or is it more advantageous to inject the conditioned biogas into the gas pipeline system? Should California encourage large, centralized community digestion plants that gather feedstocks from surrounding farms and produce biogas for biomethane injection? Developing a policy – a “loading order” for biogas use – could help to prioritize actions to expand the production and use of biogas.

Develop a White Paper on the Co-Digestion Process

Biogas production through anaerobic digestion, particularly via co-digestion, is a relatively new process in California. To better understand the regulatory and policy issues related to co-digestion, it would be helpful to develop a detailed white paper that outlines the co-digestion production and use processes, identifying the range of possible feedstocks and the associated regulatory implications of each, including biosecurity issues related feedstocks like animal renderings. This white paper, possibly coordinated by the California Bioenergy Working Group, would help to determine which technologies fit existing regulatory constraints, and to consider policies that encourage future biogas market development. Californian policy makers should survey the methods of biogas production in Europe, such as Sweden and Germany, which have installed significant numbers of co-digestion projects.

Expand Regulatory Information Exchange with European Countries

Unfortunately, California currently lags behind the European Union in biogas production. However, the state can learn from Europe’s technology innovations and practices as well as their regulatory approach. California has a strategic alliance with Sweden to promote bioenergy.⁶ While the exchange of technical information is crucial, it is important also to understand the regulatory structure in which the European bioenergy market operates. California regulators and policymakers should send a delegation to countries with advanced biogas industries, such as Germany, Denmark, or Sweden, to explore policies and practices that encourage biogas development. Delegates should report on their findings in a white paper distilling information gathered abroad, helping guide legislative and regulatory bodies as they design a straw framework encouraging bioenergy development in California. Possible topics for discussion include nutrient and salt content of solid and liquid effluent, pre- and post-treatment of substrates for salt, pathogen, and nutrient reduction, injection

⁶ California Resources Agency. Memorandum of Understanding between the state of California and the Government of the Kingdom of Sweden on Renewable Fuels and Energy, *available at* http://resources.ca.gov/press_documents/CaliforniaSwedenBiofuelsMOU.pdf (last visited August 8, 2007).

of biogas into the pipeline, gas conditioning technology, and net energy and carbon balance of biogas production and use.

Develop a Process to Evaluate Projects on the Basis of Net Environmental Benefits

California should evaluate the possibility of developing a permit process for complex and cross-cutting projects like biogas production. The process would allow a single state agency, perhaps the Environmental Protection Agency, to assess a complex project through a multi-media review by integrating standards from several different agencies, and to determine whether there is a net environmental benefit. Because biogas production and use requires approval from so many different state and local agencies, centralizing and standardizing the permit process could help to ease the regulatory burden for participants and help California attain its greenhouse gases reduction goals.

Develop Other Incentives to Encourage Biogas Production

California lawmakers and regulators should consider new incentive mechanisms to encourage biogas production, perhaps with policies broadened to apply to other bioenergy facilities. Possible incentive mechanisms include tax incentives, state bond financing or industrial development bond authority, or the use of enterprise zones to defer tax on the capital investment in plant equipment. More research is necessary to identify and evaluate incentive mechanisms used by other states and countries. While many different uses of biogas are likely, incentives should be designed to encourage desired uses of biogas, in line with preferred uses of biogas. For example, if centralized digesters are preferred to individual sites, policymakers should consider providing low-cost loans for the construction of community digestion facilities, streamline permitting to allow facilities to begin operation more quickly, and ensure that the regulatory environment does not cause the transportation of manure and other feedstocks to become too cost-prohibitive.⁷

1.2.2. Water

Develop a Process to Assess Sites for Covered Lagoon Digesters

As a result of Order No. R5-2007-0035, dairies in the Central Valley Region must monitor groundwater impacts of manure lagoons and in certain cases might need to reconstruct ponds. To facilitate implementation of this new general order, a process should be developed to help assess and evaluate the potential need for pond reconstruction. For example, the Central Valley Regional Water Board has provided two construction options for new and reconstructed ponds that will contain manure and may be used as an anaerobic digester. Tier 1 requires a synthetic liner, Tier 2 requires modeling to demonstrate lack of groundwater impact. Potential sites that would use Tier 2 could be grouped by site characteristics, and assessments of potential leakage can be made for each group. Such assessments could make it easier to identify sites that appear to be suitable for covered-pond digesters.

Develop a White Paper on Anaerobic Digestion and Salinity

The Central Valley Water Board has established a process to evaluate the salinity problem in their region. As part of the overall process to develop salt loading standards, a designated workgroup should assess the impact

⁷ Sean Hurley et al., California Institute for the Study of Specialty Crops, Clustering of Independent Dairy Operators for Generation of Bio-Renewable Energy: A Feasibility Analysis 6 (2006), *available at* <http://ciscc.calpoly.edu/research/dairy-grant-final-report-7-31-06-2.pdf> (last visited June 29, 2007).

of anaerobic digestion on regional salinity levels. The workgroup should evaluate data from European digesters, as there are many anaerobic digesters using various feedstocks in operation there. Germany has over 3,000 dairy-based anaerobic digestion systems, and Denmark has developed a significant number of centralized co-digestion plants. The white paper should include an evaluation of how various feedstocks affect nutrient and salt concentrations.

Develop a Salt Loading Standard for Anaerobic Digestion

The Central Valley Water Board is increasingly concerned about salinity in their region and seeks to improve salt management practices; however, at this time no standards exist. The absence of standards for salts creates uncertainty on the part of farmers and other project developers seeking to use an anaerobic digester to produce biogas. The Central Valley Regional Board and other Regional Water Boards should develop a salt loading standard and compliance process that apply to manure management systems, including anaerobic digestion.

1.2.3. Air Quality

Develop a Compliance Mechanism for Small Farms to Use Distributed Generators

If certain agricultural customers are exempt from local air quality permitting, they are required to meet the CARB certification standards for onsite generation with digester gas, which cannot be met with internal combustion engines typically used by farmers. The CARB should develop a regulatory compliance mechanism to allow farmers that are exempt from local air standards to use distributed generation equipment to produce electricity from biogas. One possibility is to consider anaerobic digestion for purposes of producing biogas as different from traditional agricultural operations, which are covered under local air regulations.

1.2.4. Electricity

Increase the Biogas Net Metering Credit

The energy credits provided under the current biogas net metering pilot program are in some cases lower than the energy generation cost paid for energy consumed by dairy farmers and may not be sufficient to encourage electricity production from biogas. The legislature and CPUC should consider increasing the biogas net metering credit to a level equal to or greater than the bundled retail rates that farm owners pay for electricity.⁸

Require Utilities to Purchase Excess Generation

Customer generators do not receive any credit for energy produced above their annual consumption needs. This could have the unintended effect of discouraging the maximum production of biogas for electricity usage. California should require electric utilities to purchase excess power from biogas production at a

⁸ California Energy Commission, PIER Final Project Report: Evaluation of Policy Impacts on the Economic Viability of California-Based Combined Heat and Power from a Project Owner's Perspective app. C, v (2006), available at <http://www.energy.ca.gov/2006publications/CEC-500-2006-068/CEC-500-2006-068.PDF>. (last visited August 16, 2007).

standard rate. Legislation (SB 463) currently under consideration would allow customers to sell excess energy to an investor-owned utility at the market price referent.

Increase the Biogas Net Metering Program Capacity Cap

The biogas net metering pilot tariff is available to projects that become operational by December 31, 2009, or until such time that the “combined statewide cumulative rated generating capacity used by the eligible biogas digester customer-generators in the service territories of the three largest electrical corporations in the state reaches 50 megawatts.” The CPUC should consider increasing the biogas net metering capacity cap to accommodate growth in this sector. Legislation (AB 1428) currently under consideration would increase the cap for biogas net metering to 70 megawatts.

Allow Biogas from Anaerobic Digestion to be Eligible for SGIP Incentives

After January 1, 2008, the existing Self-Generation Incentive Program will not provide incentives for fossil-fuel based distributed generation technologies. Biogas-fueled distributed generation should be eligible for financial incentives through the Self-Generation Incentive Program. The program should define biogas to include that from anaerobic digestion. Pending legislation (SB 1064) would consider biogas-based systems to be eligible for incentives.

Develop Agricultural Tariffs that Encourage Electricity Production from Biogas

Tariff structure can encourage or discourage use of distributed generation. In particular, low off-peak energy costs and high non-coincident demand charges can discourage distributed generation. The CPUC should review existing agricultural tariffs to determine whether rate structures discourage biogas-fueled distributed generation and modify rate structures as appropriate.

Clarify that Owners of Biogas Electricity Systems Own the Renewable Energy Credits

The CPUC ruled in D.07-01-018 on ownership of renewable energy credits from renewable distributed generation. It is unclear if this ruling applies to all renewable distributed generation or to solar only. The CPUC should clarify this decision and allow the owner of a distributed generation system that generates electricity from biogas to retain the renewable energy credits.⁹

1.2.5. Natural Gas

Conduct Research to Determine the Quality of Biomethane

Biogas must be conditioned to pipeline quality before being introduced into the existing gas infrastructure. More information is needed to determine the type and level of impurities in biomethane, particularly biomethane generated from co-digestion. The CPUC in partnership with gas utilities and biogas producers should conduct research to determine the type and level of impurities in biogas, including that produced from co-digestion. Sweden and Denmark have extensive experience in this area. Significant data likely already exists in these countries regarding biomethane purity.

⁹ This should only apply to cases other than those directly related to RPS compliance or with contractual arrangements for disposition of RECs.

Biomethane Quality Standards

Biogas must be conditioned to pipeline quality biomethane prior to introduction into the existing gas infrastructure. Standards exist for natural gas but there is no specific standard for biomethane, particularly biomethane produced from co-digestion. The CPUC should determine whether a specific quality standard for biomethane is necessary.

Establish a Market Price Referent for Biogas

While a market price referent exists for renewable electricity, no similar referent exists for biogas. The CPUC should develop a methodology to establish a market price referent for biogas.

Reduce and Standardize Interconnection Cost for Biomethane Injection

The CPUC should assess existing interconnection processes and costs to determine whether they are appropriate for introduction of biomethane into the natural gas transmission system. If purification and injection is a preferred use of biogas, consider subsidizing and standardizing interconnection costs among gas utilities in California. The CPUC should also consider whether it is appropriate to subsidize the gas conditioning equipment.

Assess Potential and Feasibility of Introducing Biomethane into the Gas Distribution System

Currently biomethane cannot be injected into the natural gas distribution system. This could limit the size of the market for biomethane. The CPUC should determine whether and under what conditions it would be feasible to introduce biomethane into natural gas distribution pipelines.

1.2.6. Solid Waste Management

Adopt a Statutory Definition of Anaerobic Digestion

While several references to anaerobic digestion exist in the statutes, there is no specific statutory definition. Also, the existing definition of "conversion" inaccurately includes anaerobic digestion. In a rulemaking related to conversion, CIWMB developed more clear definitions of anaerobic digestion and other related concepts that were never adopted in deference to the legislative process. California should adopt a clear statutory definition to help to clarify which regulatory agencies have jurisdiction over parts of the biogas production and use process.

Clarify CIWMB Jurisdiction over Anaerobic Digestion

Existing CIWMB regulations do not specifically address anaerobic digestion. In the absence of specific regulations, the agency considers anaerobic digestion as a form of composting, which is subject to CIWMB regulations. The legislature or CIWMB should clarify whether and to what extent CIWMB has jurisdiction over certain parts of the anaerobic digestion and co-digestion processes.

Consider Specifically Exempting or Excluding Anaerobic Digestion from Certain CIWMB Regulations

If it is determined that anaerobic digestion does not fit under the purview of part or all of the CIWMB regulations, it might be appropriate to exempt or exclude anaerobic digestion. Several existing exemptions and exclusions in the California Code of Regulations could serve as analogies, including the beneficial use exclusion, biomass conversion exclusion, and the manufacturing exemption.