

6. Government Policies and Incentives

The successful development of a California biomethane industry will require supportive government policies and financial incentives. New renewable energy technologies are generally more costly than fossil fuels, although some—such as wind energy—have become cost competitive over time. However, renewable energy resources also provide a variety of uncompensated public benefits. For example, the use of biomethane as a replacement for fossil fuels could provide numerous benefits:

- Reduced GHG emissions
- Potential reduction in criteria air pollutant emissions
- Improved water quality through better manure management
- Less dependence on declining fossil fuel supplies
- Better energy security (through a reduced dependence on imported energy)
- Stimulation of rural economies

These are benefits to society rather than financial benefits for the farmer who produces the biomethane. Consequently, it is appropriate for the government to provide support for the development of the biomethane industry.

This chapter discusses various environmental policy drivers, some of which could be used to promote the biomethane industry. It then focuses on specific government policies and incentives in three areas related to the use of biogas and biomethane: renewable energy (electricity), alternative vehicle fuels, and alternative-fuel vehicles and examines programs that could be tapped for financial support. Finally, it discusses why public support of this industry is not only necessary, but justified.

Unfortunately biomethane does not get as much governmental support as other renewable energy sources. Most federal and state policies that support renewable energy and alternative fuels focus either on renewable electricity, often referred to as renewable energy, or on two specific liquid biofuels: ethanol and biodiesel. With a few exceptions, they do not provide specific support for biomethane production. However, vehicles that can run on biomethane fulfill alternative fuel vehicle mandates and earn alternative fuel vehicle incentives.

If the biomethane industry is to prosper, it must help launch policy initiatives that will provide the same direct financial incentives or tax credits that are now earned by programs that focus on renewable electricity, ethanol, and biodiesel.

Policy Responses to Environmental Issues

Environmental policy has a significant effect on the design of dairy manure management systems and biogas production. The release of biogas to the atmosphere contributes to several environmental problems, notably global warming (from methane), ozone (from volatile organic compounds), and unpleasant odors. Ammonia, which is a particulate matter (PM) precursor, may also be released from undigested dairy wastes. Public policy is moving to address emissions from dairy biogas. Public agencies can respond to concerns over dairy gas emissions in the same manner that they respond to other emissions of environmental concern:

- Regulate criteria air pollutants and GHG emissions.
- Control and reduce emissions through market incentives such as a carbon trading market or an emission reduction credit (ERC) market.
- Develop and promote technologies that will help dairies or other sources voluntarily reduce their emissions. This might include subsidies to dairies to help them reduce the creation of biogas or its release into the environment.

Dairies can reduce their biogas production by changing their manure management systems to eliminate flushing and anaerobic storage (aerobically stored manure creates very little biogas). Alternatively, they can capture the naturally occurring biogas or engineer the system to enhance its production and then capture it. Once captured the biogas can be flared, combusted to generate heat or electricity, or upgraded into pipeline-quality gas (biomethane) for use in vehicles or other applications.

Environmental Regulation

Federal and state policies are already in place to help regulate air quality, however, the application of these policies to agricultural activities such as dairy farming has been minimal to date. Control of vehicle emissions has become more stringent in the past decade or more, and has moved in the direction of using biofuels such as ethanol to help control emissions. The existing federal and state regulatory framework for dairy farm emissions is presented below, followed by a discussion of several proposals that are currently pending that could affect dairy emissions (and thus, indirectly, the biogas/biomethane industry). This is followed by a review of regulatory requirements related to vehicle emissions that could impact the alternative fuel industry.

Regulation of Dairy Farm Emissions

The federal Clean Air Act, codified as 42 U.S.C. 7401 *et seq.*, aims to reduce criteria air pollutants (common air pollutants that can injure human health, harm the environment, and cause property damage) (US EPA, 2002). Criteria air pollutants include NO_x, PM, ozone, and other emissions. Neither VOC nor GHGs are defined as criteria air pollutants under the Act; however, VOCs are often included in lists of criteria air pollutants because efforts to control smog focus on reducing VOCs (US EPA, 2002).

Beginning in 1974, California agriculture was exempted from the Clean Air Act under state law. Several years ago, two environmental organizations sued the US EPA to pressure them into ending this exemption. The lawsuit was settled when the US EPA agreed that the exemption should end. As a result of this settlement, Governor Davis signed SB 700 on September 22, 2003. Among other things, this bill requires that dairies that meet size thresholds set by the various local air districts obtain air quality permits. Although there are 35 local air districts in California, most dairies fall within two air districts: the San Joaquin Valley Air Pollution Control District (San Joaquin Air District) and the South Coast Air Quality Management District (South Coast Air District).

Both the San Joaquin and South Coast Districts are developing suitable regulations to comply with SB 700. The San Joaquin District originally proposed that anaerobic digesters be required as a BACT for VOCs (which are also called ROGs in California) for new dairies that have more than 1,954 cows (SJVAPCD, 2004). This draft BACT was withdrawn in settlement of litigation brought against the San Joaquin District by dairy producers. The South Coast District is currently reviewing the technology under its Proposed Rule 1127 (see <<http://www.aqmd.gov/rules/reg/reg11/r1127.pdf>>).

If these districts require dairies to install anaerobic digesters to control emissions, the commercial production of biogas in anaerobic digesters could receive a needed boost. However, another recent California law, SB 1298, recommends that local air districts require distributed electrical generators to meet central station power plant standards for criteria air emissions by 2007 (CARB, 2002, p. 4). Using current technology, dairy operations that use biogas to generate electricity in internal combustion engines will not be able to meet the 2007 recommended central station power plant standard for NO_x, which is 0.07 lb/MWh or about 1 ppm NO_x.

To deal with this, the South Coast and San Joaquin Districts have proposed a more lenient standard for agricultural engines and waste gas engines. For example, in recently adopted Rule 4702 <http://www.valleyair.org/rules/currnrules/Rule_4702_0605.pdf>, the San Joaquin District established an emission standard of 90 ppm NO_x for rich-burn spark-ignited agricultural engines such as dairy generators; current dairy digester engines are to be retrofitted by 2008. Waste gas engines are limited to 50 ppm NO_x. Although these standards are much more lenient than the central station standard, even this level of emissions will be costly to meet.

Technical solutions that will enable dairies with anaerobic digesters to meet the 90 ppm NO_x standard likely exist, though none has yet been demonstrated to run successfully over time at an actual dairy digester site. If air districts adopt the SB 1298 recommendations, dairies may find themselves forced to collect biogas but unable to combust it to produce electricity, as combustion would produce NO_x in excess of the new standard. In this situation, it may be more advantageous for dairies to collect the biogas and flare it using a low NO_x flare or upgrade it to biomethane and use it as a substitute for natural gas. Flaring produces less NO_x than combustion in an IC engine

because it occurs at a lower temperature, but it may still produce more than the 5 ppm NO_x recommended in the CARB 2007 standard. Biomethane could also be combusted in a microturbine to generate electricity.

Currently there is no regulation of GHG emissions that would affect a dairy anaerobic digester. If such regulation came into force, however, it could provide an additional incentive for the commercial production of dairy biogas or biomethane as an energy source. Greenhouse gas regulations could force dairies to collect and combust their methane emissions. If those costs were already required, the additional cost to generate electricity or create biomethane might be low enough to make energy production worthwhile.

Regulation of Vehicle Fuel Emissions

The Clean Air Act Amendments of 1990 requires gasoline in areas with unhealthy levels of air pollution to contain fuel oxygenates, cleaner burning additives that reduce carbon monoxide emissions. Both ethanol and MTBE are acceptable oxygenates. The oxygenated fuels program began in 1992 and required oxygenates during cold months (winter) in cities that had high levels of carbon monoxide (a criteria pollutant). Most cities that needed to address carbon monoxide in winter used ethanol. In 1995, cities with the worst ozone problems were required to add oxygenates; most chose MTBE. California adopted more stringent gasoline requirements.

Soon, MTBE emerged as a water quality problem. The phase-out of MTBE began in California in 1999 and was pursued by the federal government in 2000. Ethanol has replaced it. While CARB contends that California's reformulated gasoline (RFG3) provides all the air quality benefits of oxygenated gasoline, the US EPA still requires oxygenation of California gasoline in non-attainment regions such as the Central Valley and the South Coast: gasoline in these regions is required to contain at least 2% oxygen by weight. California completed its phase-out of MTBE in 2003 and is now adding ethanol to fuel to meet the oxygenation requirement. Typically, an ethanol content of about 6% is needed (CEC, 2003b, p. 27-28). About 80% of California's gasoline now contains ethanol.

Market-Based Incentives for Emission Control

The regulatory approach, often called the "command-and-control approach," to pollution reduction has been criticized in recent years for various reasons. According to Robert Crandall of the Brookings Institution (2002), one problem is that regulatory agencies may not always get it right—they may decide to control the wrong substances or control some discharges too strictly and others not enough. Also, pollution regulation can make the cost of goods more expensive and, because controls are typically stricter for new sources than for older existing ones, can discourage the building of new, more efficient facilities. Finally, regulations can be difficult to enforce and do not encourage compliance beyond what is mandated. As a result of these problems,

policymakers have begun to include market-based incentives as a means to reduce pollution (Crandall, 2002).

There are two basic types of market incentives: pollution fees and emissions trading. Pollution fees, commonly used in Europe but not in the USA, are taxes that penalize polluters in proportion to the amount they pollute. Emissions permits, allowed by the 1990 Clean Air Act, enable polluters to trade “permits to pollute” so that they can meet the overall control levels set by regulatory authorities. Two types of emission trading permits could impact the biogas/biomethane industry in the USA: carbon trading and ERCs.

Regulatory initiatives affect both carbon trading and emission reduction markets. If ERCs are required under SB 1298 and by local air district regulations, as described above, those reduced emissions would not be tradable on the carbon or emission reduction credit markets.

Carbon Trading

As of early April 2005, the proposed Kyoto Treaty was ratified, accepted, or acceded by 148 nations; the USA is one of six signatory nations that have not ratified the treaty (http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf). The Kyoto Treaty requires signatory countries that ratify the treaty to reduce GHG emissions. In response to the treaty, a market for reduced carbon emissions, commonly called the Carbon Market, has emerged. Under this cap and trade system, firms that are required to reduce their GHG emissions can either control their own emissions or buy reductions from other firms that have been able to reduce emissions at a lower cost.

If the USA were to ratify the Kyoto Treaty, dairy digesters within the country would be well-suited to trade carbon credits. As explained in Chapter 2, the collection and combustion of pre-existing methane destroys the methane while producing a similar amount of carbon dioxide as by-product. Since methane has 21 times the global warming potential, by weight, of carbon dioxide, dairies that combust methane which would otherwise be released into the atmosphere would gain a substantial number of carbon credits.

Because the Carbon Market is undeveloped in the United States, each trade is largely a pioneering effort, and transaction costs are very high. At present, even if a dairy could arrange a carbon trade, it could not begin to recover the transaction costs involved. However, if the USA signs the Kyoto Treaty, or if the Carbon Market develops for other reasons, dairies might be provided with an incentive to collect and use more biogas.

Emission Reduction Markets

California has a market in place for ERCs. New sources of criteria air emissions are required to mitigate emissions by purchasing ERCs from other pollution sources that have already managed to reduce emissions. As currently structured, this market does not allow agricultural enterprises to

participate effectively; however, if such participation were possible, dairies might be provided with an incentive to collect biogas, thus reducing VOC emissions and gaining ERCs. However, the problem of NO_x emissions from biogas combustion might prove to be an expense on the ERC market. Depending on the relative volume and prices of these two pollutants (VOC vs. NO_x) a dairy might show net credits or debits on the ERC market. This, in turn, would affect the dairy's interest in pursuing biogas production for electricity or biogas production for non-electrical energy.

Promotion of Environmentally Beneficial Technologies

In addition to regulation and the promotion of market-based incentives, governments can encourage the development and use of new technologies that provide environmental benefits while meeting demand. There are several approaches that can help encourage new technologies: tax credits or incentives, subsidies through direct funds, and long-term contracts that guarantee market and/or price. For example, in response to concerns about the contribution of methane to climate change, the US EPA set up the AgSTAR program (see <<http://www.epa.gov/agstar/>>) to develop and disseminate information about anaerobic digesters for animal waste. AgSTAR funds research and has sponsored at least one national conference. The California Energy Commission (CEC) has also funded research, through its Public Interest Energy Research (PIER) program on anaerobic digestion for electrical production. The CEC views anaerobic digesters on dairies as a potential source of relatively clean renewable energy. The continued expansion and success of these federal and state efforts will promote the production of commercial dairy biogas.

Government Policies and Incentives for Renewable Energy

The interest in renewable energy in the USA dates from the Arab oil embargo of 1973 and the oil price shock of 1979 that was triggered by the fall of the Shah of Iran. By the late 1970s energy conservation, renewable electricity and alternative fuels were focal points for public policy. The Public Utility Regulatory Policy Act (PURPA) of 1978 began Federal support for renewable electricity and distributed electrical generation. In the same year, the Energy Tax Act initiated support for alternative vehicle fuels (see discussion later in this chapter).

Much federal policy and most renewable energy policy at the state level is directed toward the development of renewable electricity generation from wind, solar, geothermal, and small hydropower sources, as well as from biomass. The following discussion focuses on support for the latter, as it is most pertinent to biogas and biomethane production.

Federal Support for Biomass Energy Sources

Federal support for the production of energy (primarily electricity) from biomass comes primarily from two pieces of legislation: the Biomass Research and Development Act (BRDA) of 2000 and the Farm Security and Rural Investment Act (Farm Bill) of 2002.

Biomass Research and Development Act

The Biomass Research and Development Act of 2000 (BRDA) (Public Law 106-224, as amended through Public Law 108-199 of 2004) committed the federal government to the development of biobased industrial products including fuel, electricity, and heat from biomass. In addition, it established a Biomass Research and Development Board, a Technical Advisory Committee, and a Biomass Research and Development Initiative.

In 2002, the Technical Advisory Committee published a “vision” that calls for biobased transportation fuels. Currently, biobased fuels make up 0.5% of U.S. transportation fuel consumption; BRDA requires this to increase to 4% in 2010, 10% in 2020, and 20% in 2030 (BTAC, 2002, p. 9). Although this vision calls for biobased transportation fuels to increase much more dramatically than biopower (electricity and heat), the accompanying “roadmap” references anaerobic digestion as a source of biopower (electricity and heat). The roadmap does not mention anaerobic digestion as a source of transportation fuel, which it could be if the produced biogas were upgraded to biomethane.

Section 307 of BRDA launched a Biomass Research and Development Initiative. The research is aimed at understanding the conversion of biomass into biobased industrial products such as fuel and electricity, developing new cost-effective technologies to promote commercial production, ensuring that economic viability and environmental benefits of biobased products, and promoting the development and use of agricultural energy crops. Eligible grantees include universities, national laboratories, federal or state research agencies, and private or nonprofit organizations. Grants are awarded competitively. The Farm Bill of 2002 (Title IX, Section 9010), discussed below, appropriated funds for the program and extended its term from 2005 to 2007.

Farm Security and Rural Investment Act Of 2002

The Farm Security and Rural Investment Act of 2002 (Farm Bill) contains a variety of loan and grant programs that support the development of a renewable methane industry from dairy biogas (see USDA Farm Bill website at <http://www.usda.gov/farmbill/>). These programs are discussed in three sections of the bill: Title II, Conservation; Title VI, Rural Development; and Title IX, Energy. Some of the most promising sections in Title IX are either unfunded or have been defined in such a way as to exclude renewable methane.

Programs Authorized Under Farm Bill Title II, Conservation. The following programs have been authorized under Title II of the Farm Bill.

Environmental Quality Incentives Program. The Farm Act of 1996 established the Environmental Quality Incentives Program (EQIP) and Title II, Subtitle D of the 2002 Farm Bill extends this program. The objective of EQIP is to encourage farmers and ranchers to adopt on-farm environmental conservation improvements through the use of five- to ten-year contracts. Eligible improvements include those related to improved soil, water, and air quality, and the program

provides education, technical assistance, cost-share payments, and incentive payments. Because anaerobic digesters that produce biogas (and lead to its subsequent capture and combustion or flaring) provide air and water quality improvements, they are eligible for this program, and have been funded.

Contracts signed under EQIP must be effective for no less than one and no more than ten years. Applications are accepted on a continuous basis. Generally, EQIP payments are limited to 75% of the cost of a project, though in some cases they may cover up to 90%. Payments for an individual farm are limited to a total of \$450,000 in the fiscal year (FY) 2002-to-2007 period. Sixty percent of the funds under the EQIP program target livestock production; there is no cap per animal unit. Livestock operations are required to develop a comprehensive nutrient management plan.

The program is funded through the Commodity Credit Corporation and is mandated at \$1.0 billion in FY 2004, \$1.2 billion each in FY 2005 and 2006, and \$1.3 billion in FY 2007. Since EQIP began in 1997, the USDA has entered into over 100,000 contracts with farmers, covering more than 50 million acres.

Conservation Innovation Grants. The Conservation Innovation Grants program (Section 1240H) provides support to government and nonprofit activities that aim to stimulate innovative approaches to environmental enhancement. Funds can be used to carry out projects that involve EQIP-eligible farmers, but CIG funds are limited to 50% of the total cost of the project. In FY 2003, \$15 million was made available under this program (USDA, 2004b).

Programs Authorized Under Farm Bill Title VI, Rural Development. Section 6013 expanded eligible loan programs under Title VI to specifically include anaerobic digesters as a renewable energy source. No specific funds were earmarked for this technology.

Section 6401 provides funds that can be used for planning grants or for working capital through Value Added Agricultural Product Market Development Grants. The language in this section specifically includes farm- or ranch-based renewable energy as an eligible product. In FY 2003, \$28 million in grants were awarded under this section (USDA, 2004b). In FY 2004, \$13 million has been appropriated. This report was funded by a VAPG grant.

Programs Authorized Under Farm Bill Title IX, Energy. A number of programs related to biobased energy production are funded under this title, but few include biomethane as a fuel source. Nevertheless, some of the programs discussed below could be expanded to include funding for biogas/biomethane production.

Federal Procurement of Biobased Products. Section 9002 of Title IX provides for a federal procurement preference for biobased products; a proposed rule for this program was published in December 2003 (Federal Register Vol. 68, No. 244, December 19, 2003, page 70730). The proposed rule is geared to support new markets for biobased products—both the legislation and

the proposed rule exclude motor vehicle fuels and electricity. There is, however, a category for fuel additives that could be used for vehicles, heating (of buildings), and other similar uses. This category includes both liquid biobased fuels, specifically ethanol and biodiesel, and solid fuels (Federal Register Vol. 68, No. 244, December 19, 2003, page 70738). During a public meeting about the proposed rule held on January 29, 2004, a USDA spokesperson stated that alternative fuels such as ethanol (E100), ethanol 85% (E85), biodiesel (B100) and biodiesel 20% (B20) are ineligible for funding through this program, but mentioned that fuel additives such as ethanol 10% (E10) or biodiesel 2% (B2) are eligible. The spokesperson did not characterize the intermediate cases (USDA, 2004a, p. 41).

Even though compressed biomethane is gaseous and the proposed rules do not mention gaseous fuels, it is unlikely that biomethane, when added to CNG, would be considered a “fuel additive.”

Biorefinery Development Grants. Section 9003 of Title IX assists in the development of new and emerging biomass technologies, and specifically includes transportation fuels. A biorefinery is defined as a process that converts biomass into fuels and chemicals. The Biorefinery Development Grants pay for the development and construction of biorefineries that demonstrate commercial feasibility of a process. Grants cannot exceed 30% of the cost of the project. No federal funds have been appropriated for this section.

Biodiesel Fuel Education Program. Nearly \$1 million in grants were issued in 2003 for the Section 9004 biodiesel fuel education program; this program, however, is not relevant to biomethane.

Energy Audit and Renewable Energy Development Program. Section 9005 of Title IX authorizes a competitive grant program for entities to administer energy audits and renewable energy development assessments for farmers, ranchers, and rural small businesses. No federal funds have been appropriated for this section.

Renewable Energy Systems and Energy Efficiency Improvements. A loan, loan guarantee, and grant program to assist eligible farmers, ranchers, and rural small businesses in purchasing renewable energy systems and making energy efficiency improvements is authorized under Section 9006 of Title IX. In FY 2003, \$22 million in grants was awarded under this program, and \$23 million is appropriated for FY 2004 grants. Grants alone cannot exceed 25% of the cost of the project and grants and loans made or guaranteed are not to exceed 50% of the cost. Renewable energy grants are limited to \$500,000. Financial need must be demonstrated.

Hydrogen and Fuel Cell Technologies. Section 9007 of Title IX instructed the USDA and the US DOE to develop a memorandum of understanding on cooperation among rural communities and agricultural interests relative to hydrogen and fuel cells. Biomethane is a potential feedstock for fuel cell hydrogen (see Chapter 3).

Biomass Research and Development. Section 9008 of Title IX extends the termination date of BRDA to September 30, 2007 and funds the BRDA Section 307 research and development initiative with \$75 million for the period FY 2002 to 2007. In FY 2003, \$16 million of USDA funds under this provision were combined with \$5 million from US DOE to fund a joint solicitation; actual awards totaled \$22 million. In FY 2004, \$25 million was awarded to 22 projects, with \$13 million contributed by USDA and \$12 million from the US DOE. Recipients of funds must share 20% of the costs under this program.

Cooperative Research and Development. Although Title IX, Section 9009 provides discretionary authority for competitive grants to research carbon fluxes and GHG issues, it is not relevant to biomethane.

Continuation of Bioenergy Program. Section 9010 of Title IX provides producer payments for increased production of bioenergy. This provision was funded in the legislation at \$150 million annually from FY 2002 to FY 2006; nearly \$150 million was awarded in 2003. However, as stated in this section of the Farm Bill, “‘bioenergy’ means biodiesel and fuel grade ethanol.” Thus, producers of biomethane are not eligible for payments under this program.

Energy Policy Act Of 2005

Many provisions of the Energy Policy Act of 2005 support biomass energy. At the time of final editing, the bill has just been signed; an analysis of its provisions will not be undertaken in this study. The energy bill should be carefully reviewed to determine its possible impact on biogas and biomethane production.

California Renewable Energy Programs

California has a major commitment to renewable energy, including renewable electricity from biomass. The Public Interest Energy Research (PIER) program, which focuses on electricity, has been funded by ratepayers for nearly ten years. The new California Natural Gas Research and Development Program, described below, provides funds for research and development of natural gas, including renewable natural gas. A number of state programs specifically target renewable energy (primarily electricity); these include the Renewable Portfolio Standard, the Self Generation Incentive Program, and the New Renewables Program. If biogas production is used to generate electricity it could qualify for several of these programs, as discussed below. When biogas or biomethane is used as a gaseous fuel for transportation, heat, or similar uses, however, it is ineligible for these funds.

Natural Gas Research and Development Program

In 2000, California’s Governor signed Assembly Bill (AB) 1002, which created a surcharge on natural gas consumption to fund public-purpose activities. These activities included public interest research and development as authorized by California Public Utility Code Section 740,

which describes electrical and gas research and development and specifically lists “environmental improvement” and “development of new resources and processes, particularly renewable resources” as project objectives. AB 1002 did not propose a specific funding amount.

On August 19, 2004 the California Public Utility Commission (CPUC) released Decision 04-08-010, which established the CEC as the administrator of the research and development program and allowed the CEC to make funding decisions. The funding cap was \$12 million annually, starting on January 1, 2005; this will increase by \$3 million each year through 2009. The maximum cap approved is \$24 million, at which time the CPUC will reexamine the funding cap (CPUC, Rulemaking 02-10-001, Decision D0408010, p. 38. See <http://www.cpuc.ca.gov/word_pdf/FINAL_DECISION/39314.pdf>). Prior to this decision, research was administered by the investor-owned utilities at a statewide level of \$4.5 million per year.

Natural gas generally refers to a fossil fuel, but biogas is also a gas, and is also natural. For example, Pacific Gas and Electric’s Gas Rule 1, a document approved by the CPUC, specifically defines natural gas to include “gas obtained from biomass or landfill” (Pacific Gas and Electric, Gas Rule 1 Definitions).

The CEC has submitted a report to the CPUC that outlines a research plan to be funded through this program, which will be called the Public Interest Natural Gas Energy Research Program (PING); the report specifically mentions “renewable natural gas” as one component of the plan. The inclusion of this language was the result of information submitted by one of the authors of this report. In the same way, supporters of biomethane should work to expand programs intended to promote or research natural gas or alternative vehicles fuels to include biomethane.

Financial Incentives for Anaerobic Digesters

The development of new energy resources, particularly renewable energy resources, typically is supported by federal and state grant programs or tax policies because the environmental benefits from these technologies serve the public good. Anaerobic digesters for electrical generation have received both federal and state subsidies, but these funds are usually not available if the biogas is not used to generate electricity. For example, a program authorized under California’s SB 5X provided \$15 million to support the building of manure digesters for electrical generation, of which \$10 million was directed to on-farm dairy digesters. The program covered up to 50% of the capital costs of the dairy digester, but is now closed to new applicants.

Financial Incentives for Renewable Electricity

The Self Generation Incentive Program, authorized by California AB 970, provides incentives to customers who generate their own clean grid-connected electricity. The program has recently changed. Electrical generators that run on renewable fuel such as biogas can earn a capital grant of \$1.00/watt of installed capacity with no limit as to what proportion of the engine cost is covered. These funds will cover the engine-generator and related items, but not the anaerobic digester itself.

The Renewable Resources Trust Fund provides more than \$1 billion per year for the Existing Renewable Program, the New Renewables Program, and the Emerging Renewables Program. The Existing Renewables and the New Renewables Programs provide incentive payments per kWh for renewable generation, including biomass and biogas. The Emerging Renewables Program does not fund biomass to electricity unless the produced biogas is used in a fuel cell.

California is committed to increasing its use of renewable electricity generation. The Renewable Portfolio Standard, established by SB 1078, mandates the three California investor-owned utilities to increase their use of renewable energy to 20% by 2017 (see <http://info.sen.ca.gov/pub/01-02/bill/sen/sb_1051-1100/sb_1078_bill_20020912_chaptered.pdf>). The Sacramento Municipal Utility District has made a similar commitment, and Los Angeles Department of Water and Power may do the same.

Net Metering For Solar, Wind, and Dairy Biogas Sources of Electricity

Net metering is available for wind and solar electrical generation under AB 58, which allows a self-generator to credit electricity exports against imports. Thus, solar or wind self-generators can eliminate their electrical bills. Dairy biogas has net metering for self-generated electricity under AB 2228, but credits can be applied only to the generation charge, which is only one component of the electricity bill. Net metering for dairies will sunset in January 2006, if proposed new legislation (AB 728) is not approved.

Renewable Electricity Research and Development

California's electricity ratepayers provide \$62 million per year to fund the Public Interest Energy Research (PIER) program, which is administered by the CEC. The PIER program focuses on electricity. Two of the six PIER research and development areas are renewable electricity and the environmental effects of electrical generation. The PIER renewable energy program has funded research on anaerobic digester technology for electricity generation as well as other biomass-to-electricity technologies.

Government Policies and Incentives for Alternative Fuels

Many government policies and incentives that promote the use of natural gas fuels such as CNG and LNG will also serve to promote the adoption and use of biomethane as a vehicle fuel. A number of programs, both at the state and federal levels, are currently in place for this purpose.

Still, the incentives for biomethane use in vehicles are weak overall. A number of California provisions that provided financial incentives for natural gas vehicle usage have recently expired and show no signs of being revived. Other incentives and programs focus on small portions of the automotive market and/or do not contain significant amounts of funding.

Federal Policies and Incentives for Alternative Fuels

Today, much of the focus of federal renewable energy policies and incentives is on two liquid biomass transportation fuels that have large farm state constituencies: ethanol and biodiesel. For example, the Bioenergy Program outlined in the 2002 Farm Bill (Section 9010) provides \$150 million annually to producers of “bioenergy,” which is defined as ethanol and biodiesel. Biomethane is not included in the definition of bioenergy.

Ethanol is predominantly derived from corn, and biodiesel predominantly from soybeans. Both are major crops in the Midwest and have received substantial political support from farm state senators from both parties. There has been a 25-year history of federal support to the ethanol industry, while support for biodiesel is more recent.

Federal support for ethanol dates from 1978 when the Energy Tax Act (P.L. 95-618) provided an exemption to the federal fuel excise tax on gasoline for fuel blended with at least 10 percent ethanol (E10). In 1980, domestic fuel development was promoted in the Energy Security Act of 1980 (P.L. 96-294). The Surface Transportation Assistance Act of 1982 (P.L. 97-424) raised the federal excise tax to \$0.09/gallon and also raised the ethanol exemption to \$0.05/gallon for gasoline fuel that contains E10. The ethanol exemption was raised to \$0.06/gallon in 1984, but then lowered to \$0.054 in 1990 and extended to 2000 (CEC, 2004, p. 6). The Transportation Equity Act for the Twenty First Century of 1998 (TEA-21) (P.L. 105-78) extended the ethanol exemption to 2007, and lowered it to \$0.053 in calendar years 2001 and 2002, to \$0.052 in calendar years 2003 and 2004, and to \$0.051 in calendar years 2005, 2006, and 2007 (Surface Transportation Revenue Act of 1998, Section 9003). Since the incentive is for a gallon of fuel that is 10% ethanol, the current exemption (\$0.051) is effectively \$0.51 per gallon of ethanol used. In addition, an exemption of \$0.04 is allowed for fuel that contains 7.7% ethanol, and \$0.0296 for fuel that contains 5.7% ethanol (CFDC, 2003, p. 24).

The Omnibus Reconciliation Tax Act of 1980 (P.L. 96-499) placed a tariff on imported ethanol; the tariff is currently \$0.54/gallon. The Omnibus Budget Reconciliation Act of 1990 (P.L. 101-508) enacted a small ethanol producer tax credit of \$0.10/gallon

As summed up by the CEC, “The federal ethanol fuel incentives...are generally acknowledged as the driving force for ethanol production and use in the U.S.....This incentive (or subsidy) has made ethanol competitive with gasoline....Without this long-standing federal energy policy it is highly unlikely that ethanol production and use in the U.S. would have reached its current level....And the tariff on most imported ethanol protects domestic producers against a large share of the U.S. ethanol fuel market being captured by lower-cost foreign producers” (CEC, 2004, p.7). Since 1979, U.S. ethanol production has grown from 10 million to 3,000 million gallons per year.

Table 6-1 summarizes existing federal government policies and incentives that could help spur the use of biomethane use in vehicles and shows their relative ranking in this regard. In addition to the policies established by the Farm Bill, there are two major programs, discussed below.

Table 6-1 Federal Policies and Programs that Encourage Alternative Fuels, Ranked According to Presumed Impact on Growth of Biomethane Industry

Policy/Program	Value for Biomethane Industry	Explanation
Energy Policy Act of 2005 (proposed)	High Potential Value	Includes incentives for renewable vehicular fuels including a requirement to increase the use of renewable fuels, including those produced from biomass, in the U.S. motor fuel supply and another that promotes renewable electricity generated from bovine and swine waste.
2002 Farm Bill: Biorefinery Development Grants	High Potential Value	Grants specifically targeting the development of new and emerging biomass transportation fuels.
State Energy Program (SEP)	Medium	Provides direct funding for renewable energy, including biogas, but funding level is low.
Pollution Prevention Grants Program	Low	Supports innovative pollution prevention programs. Wide range of technologies and fuels qualify. No specific incentive for renewable methane.

High = Provides substantial incentives for both natural gas vehicle use and biomethane production.

Medium = Provides adequate incentives for natural gas vehicle use or biomethane production, but not for both.

Low = Provides inadequate incentives for natural gas vehicle use or biomethane production.

State Energy Program

The State Energy Program (SEP) provides US DOE funding for renewable energy and energy-efficient technologies. About \$5,000,000 is available for alternative fuels: nearly \$300,000 for bioenergy and biobased projects and fuels, and over \$525,000 for biomass power.

Pollution Prevention Grants Program

This federal program supports the establishment and expansion of state pollution prevention programs and addresses various topics of concern such as energy, transportation, industrial toxins, and agriculture. Funds available under this grant/cooperative agreement are awarded to support innovative pollution prevention programs that address the transfer of potentially harmful pollutants across all media: air, land, and water. State agencies are required to contribute at least 50% of the total cost of their projects.

California Alternative Fuel Programs

In the early 1980s, California created incentives for ethanol fuel including a state excise tax reduction of \$0.03/gallon for 10% ethanol blends (the excise tax was \$0.07/gallon). This incentive was in place from 1981 to 1984. In 1988, SB 2637 established a \$0.40/gallon incentive for liquid fuels fermented in state from biomass, but this initiative was never funded (California Public Resources Code, Section 25678). In contrast to 22 other states that have ethanol incentive programs, California does not currently have tax incentives in place for ethanol (CEC, 2004, p. 3-4), nor does it have any financial incentives or tax credits for the use of biodiesel, unlike a number of other states (US DOE, 2004).

Table 6-2 ranks California policies and programs that provide incentives for using alternative fuels. Details of the various programs are discussed below.

Excise Tax Options

The excise tax imposed upon CNG, LNG, and LPG as vehicle fuels can be paid through an annual flat-fee rate sticker tax based on vehicle weight. Conversely, owners and operators may pay excise tax on CNG of \$0.07 per 100 ft³, on LNG of \$0.06 per LNG gallon (California Revenue and Taxation Code Section 8651.6), and on LPG of \$0.06 per LPG gallon (California Revenue and Taxation Code Section 8651.5). Excise taxes on ethanol and methanol containing not more than 15% gasoline or diesel fuel are \$0.09 per gallon (California Revenue and Taxation Code Section 8651, and Section 8651.8).

California Natural Gas Research and Development Program

As discussed earlier in this chapter, on August 19, 2004 the CPUC released Decision 04-08-010, its final rule under Rulemaking 02-10-001 implementing AB 1002. This bill uses a surcharge to significantly increase natural gas research and development, including “development of new resources and processes, particularly renewable resources,” in California. Beginning on January 1, 2005, the program funding increased from \$4.5 million to \$12 million; by the fourth year, funding will be ramped up to \$24 million.

Table 6-2 California Policies and Programs that Encourage Alternative Fuels, Ranked According to Presumed Impact on Growth of Biomethane Industry

Policy/Program	Value for Biomethane Industry	Explanation
Excise Tax Options	Low	Flexibility for payment (flat fee or per quantity of fuel) of natural gas excise tax. Very low natural gas vehicle incentive. No specific incentive for renewable methane.
California Natural Gas Research and Development Program	Medium	Significantly increases funding for natural gas R&D. Renewable sources are mentioned, but are not allocated a specified portion of the funding.
Public Transit Bus Rule	Medium	Fleets can choose alternative fuels or clean diesel technologies to satisfy these requirements. No specific incentive for biomethane.
California Assembly Bill 2076	Medium Potential Value	Focus on GTL, natural gas, and increasing alternative fuel use could marginally stimulate biomethane industry.
State Fleet Energy Consumption Reduction Goal	Low	Natural gas vehicles can qualify towards the goal of reduced energy consumption, but so can efficient and low-polluting gasoline vehicles. No specific incentive for biomethane.

GHG = Greenhouse gases.

GTL = Gas-to-liquid, such as the Fischer Tropsch process.

High = Provides substantial incentives for both natural gas vehicle use and biomethane production.

Medium = Provides adequate incentives for natural gas vehicle use or biomethane production, but not for both.

Low = Provides inadequate incentives for natural gas vehicle use or biomethane production.

New Emission Standards for Public Transit Buses

A public transit bus rule adopted by CARB in February 2000 regulates public transit fleets and sets emission reduction standards for new urban transit buses (California Code of Regulations [CCR], Section 1956.1, Title 13). The rule allows transit fleets to choose one of two options in order to reduce their emissions to the required levels: using low-sulfur diesel or using alternative fuels, such as natural gas. As enforcement of the 2007 and 2010 urban bus emission standards approaches, diesel systems become more complicated, and thus more expensive. Consequently, the cost differential between alternative fuel natural gas systems and diesel systems will decrease and alternative fuel may become an increasingly attractive option. To date, however, approximately two-thirds of California transit agencies have chosen to use low-sulfur diesel to meet the required emission levels.

Reduced Automotive Greenhouse Gas Emissions

Assembly Bill 1493, which was passed in 2002, was the first piece of legislation in the world to mandate reductions in automotive GHG emissions. The bill focuses exclusively on the vehicle side of the equation (i.e., tailpipe emissions of GHG). The bill required the CARB to study the cost effectiveness of various technologies to reduce GHG emissions from autos, including the use

of alternative fuels. While natural gas is a lower GHG-emitting fuel the CARB concluded that changes in gasoline engine technologies were more cost effective than alternative use vehicles (see <<http://www.arb.ca.gov/cc/042004workshop/final-draft-4-17-04.pdf>>).

Reduced Petroleum Dependence

Passed in 2000, AB 2076 instructs CARB and the CEC to develop and adopt recommendations for the governor and the legislature about a California strategy to reduce petroleum dependence. In response, CARB and the CEC produced a report that proposed and recommended a strategy to reduce California's demand for on-road gasoline and diesel to 15 percent below the 2003 demand level by 2020, and to maintain that level for the foreseeable future. As part of this strategy, the report identified mid-term options, which could be fully implemented in the 2010 to 2020 timeframe that highlighted natural gas in two ways. First, the report prominently suggested the use of natural gas-derived Fischer-Tropsch fuel as a 33 percent blending agent in diesel to reduce petroleum usage by 6 to 7 percent. Second, although not as prominently, it mentions that the expanded use of LNG and CNG in heavy-duty vehicles appears attractive and could provide reductions in petroleum usage at a net societal benefit.

In addition to recommending a reduction in the state's demand for petroleum, the CARB and CEC report also recommended that, regardless of how petroleum reduction is achieved, a minimum percentage of the fuel used in California should come from non-petroleum sources. It recommends that the governor and legislature establish a goal to increase the use of non-petroleum fuels to 20 percent of on-road fuel consumption by 2020 and to 30 percent by 2030, thereby helping achieve the overall petroleum demand reduction goal.

The California Legislature has yet to take action on the CARB and CEC recommendations. If, however, the recommendations are pursued, there may be a slight incentive for dairy farmers to produce biomethane that could be used as a fuel to help meet the bill's non-petroleum fuel targets.

State Fleet Energy Consumption Reduction Goal

State Bill 1170 (2001) established a policy goal to reduce energy consumption of state fleets. California state fleets are directed to develop and adopt (1) fuel efficiency specifications for the use of state vehicles that will reduce energy consumption of the state fleet at least 10% by 2005 and (2) air pollution emission specifications requiring light-duty vehicles acquired by state fleets to meet or exceed the state's ultra-low-emission vehicle (ULEV) standards, a requirement that can be accomplished through the use of natural gas vehicles.

Government Policies and Incentives for Alternative Fuel Vehicles

As discussed above, there are a number of policies and programs that encourage the use of alternative vehicular fuels, though few of them provide specific incentives for biomethane use and production. In addition, there are both federal and state policies and incentives that mandate or encourage the use of alternate fuel vehicles. These programs could indirectly enhance biomethane production and use as a vehicle fuel, although few would provide direct incentives.

Federal Policies and Incentives for Alternative Fuel Vehicles

The Energy Policy Act (EPAct) of 1992 set a national goal of 30 percent alternative fuel use in vehicles by 2010. It required various public fleets to purchase alternative fuel vehicles, although it does not directly require the purchase of alternative fuel. For example, the State and Alternative Fuel Provider Fleets Program requires fleets covered by the program to purchase alternative fuel vehicles as part of their annual light-duty-vehicle acquisitions.

The EPAct of 1992 provided tax deductions of as much as \$50,000 for a clean-fuel heavy-duty vehicle, \$2,000 for a passenger vehicle, and \$100,000 for a clean-fuel refueling property. Clean fuels are defined as natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, electricity, and any fuel that is at least 85% alcohol (i.e., ethanol) or ester (i.e., biodiesel) (IRS, 2004, p. 48). These deductions and credits ended December 31, 2004.

There are a variety of other federal programs that require or support the purchase of alternative fuel vehicles, including vehicles that will run on natural gas and biomethane. These include the Federal Transit Administration's Clean Fuels Grant Program to accelerate the use of low-emission buses and the US EPA's Clean Fuel Fleet Program that requires fleets in cities with air quality problems to incorporate vehicles that meet clean emission standards (see http://www.eere.energy.gov/cleancities/progs/afdc/search_state.cgi?afdc/US). Alternative fuels include ethanol, E85, natural gas, and "fuels (other than alcohol) derived from biological materials (including neat biodiesel)" and electricity (Federal Register, Vol. 61, No. 51, March 14, 1996, page 10653). After passage of EPAct, the American Soybean Association wanted to add mixtures that include biodiesel to the program. In 1998, the EPAct was amended to allow entities that are required to have alternative fuel vehicles in their fleet get credit for vehicles that use B20. The final rule was issued in 2001. This has been the major factor in the growth of the U.S. biodiesel market, which increased from 500,000 gallons in 1999 to 2,000,000 gallons in 2001 to an estimated 25,000,000 gallons in 2003 (see National Biodiesel Board website <http://www.biodiesel.org/resources/faqs/default.shtm>).

Farm legislation during 1996 to 2001 provided for producer payments for increased bioenergy production in the form of ethanol and biodiesel but did not include biodiesel derived from animal by-products and fats, oils, and greases. The 2002 Farm Bill expanded the definition to include biodiesel from these sources.

Table 6-3 summarizes the existing federal policies and incentives for increased use of alternative fuel vehicles and ranks them according to their estimated value for stimulating growth of the biomethane industry. Each of these policies or programs is described in more detail below.

Table 6-3 Federal Policies and Programs that Encourage Use of Alternative Fuel Vehicles, Ranked According to Presumed Impact on Growth of Biomethane Industry

Policy/Program	Value	Explanation
EPAct: State and Alternative Fuel Provider Rule	Low	Requires states and alternative fuel providers to make AFVs a minimum percentage of vehicle fleet acquisitions. This rule does not provide specific incentives for natural gas vehicle purchases, much less renewable methane use. The majority of vehicles purchased under this program are E85 “flexible fuel” vehicles (65 percent of the state and alternative fuel provider fleets). CNG vehicles make up 24% of the state and alternative fuel provider fleets.
EPAct: Federal Fleet Rule	Low	Requires the federal government to make AFVs a minimum percentage of vehicle fleet acquisitions. It also requires these fleets to reduce their petroleum consumption. This rule does not provide specific incentives for natural gas vehicle purchases or renewable methane use. The majority of vehicles purchased under this program are E85 “flexible fuel” vehicles (78 percent of the federal fleet). CNG vehicles make up 21% of the federal fleet.
Federal Income Tax Deduction	Medium	Tax deduction for clean fuel vehicles. Includes natural gas, but no specific incentive for renewable methane. Expired January 1, 2005.
The Congestion Mitigation and Air Quality Improvement Program	Low	Funding for projects and programs that reduce transportation related emissions. Various fuels and technologies can qualify. No specific incentive for renewable methane.
EPA “Clean School Bus USA” Program	Low	Only 20 buses. Various fuels and technologies can qualify. No specific incentive for renewable methane.

High = Provides substantial incentives for both natural gas vehicle use and biomethane production.

Medium = Gives adequate incentives for either increased natural gas vehicle use or increased biomethane production, but not for both.

Low = Inadequate incentives for increased natural gas vehicle use or increased biomethane production.

Energy Policy Act of 1992

As discussed above, the EPAct was passed by Congress to reduce the nation’s dependence on imported petroleum by requiring state, government, and alternative fuel provider fleets to acquire alternative fuel vehicles, which are capable of operating on non-petroleum fuels. Several rules regarding alternative fuel vehicles have been promulgated under this act.

State and Alternative Fuel Provider Rule

As of 2001, the State and Alternative Fuel Provider Rule requires that 75% of new light-duty vehicles for state fleets and 90% for alternative fuel providers must be alternative fuel vehicles. Compliance with this rule is required of state government and alternative fuel provider fleets that operate, lease, or control 50 or more light-duty vehicles within the USA. Of those 50 vehicles, at least 20 must be used primarily within a single metropolitan statistical area or consolidated metropolitan statistical area. In California, the affected metropolitan areas are Bakersfield, Fresno, Los Angeles/Riverside/Orange County, Modesto, Sacramento, Salinas, San Diego, San Francisco/Oakland/San Jose, Santa Barbara/Santa Maria/Lompoc, and Stockton/Lodi.

Federal Fleet Rule

According to the Federal Fleet Rule, from 1999 forward 75% of a federal fleet's light-duty vehicle acquisitions (in fleets covered by the program) must be alternative fuel vehicles. Furthermore, through a combination of AFV acquisitions, increased alternative fuel use in AFVs, improved efficiency in non-AFV acquisitions, and improvements in overall fleet operating efficiencies, agencies were required to decrease the annual petroleum consumption of federal fleets by 20% from 1999 to 2005.

Federal Income Tax Deduction

A \$2,000 to \$50,000 federal income tax deduction from gross income is available for the incremental cost to purchase or convert qualified clean fuel vehicles. This full federal deduction is allowed for vehicles placed into service after June 30, 1993 and before January 1, 2006. The maximum allowable deductions are as follows, based on vehicle class:

- Truck or van, gross vehicle weight (GVW) 10,000 to 26,000 lb: \$5,000
- Truck or van, GVW more than 26,000 lb: \$50,000
- Bus with seating capacity of 20+ adults: \$50,000
- All other on-road vehicles: \$2,000

Additionally, a tax deduction of up to \$100,000 can be claimed for clean fuel refueling sites (including electricity). This deduction is allowed for sites placed into service after June 30, 1993 and before January 1, 2006.

Vehicles and sites placed in service in 2006 will receive 25% of the amounts indicated above. No clean fuel vehicle or sites deduction is available for vehicles or sites placed in service after December 31, 2006.

Clean School Bus USA Program

In 2004, Congress allocated \$5,000,000 for school bus retrofit and replacement grants through this program, and in June of the same year, the US EPA announced the selection of 20 projects eligible for funding. The program advocates clean diesel technologies and fuels as well as buses that run on CNG.

The Congestion Mitigation and Air Quality Improvement Program

The Congestion Mitigation and Air Quality program funds projects and programs that will reduce transportation-related emissions in non-attainment and maintenance areas. Along with natural gas vehicle projects, funding opportunities exist for diesel engine retrofit projects.

California Programs Alternative Fuel Vehicles

California also has an alternative fuel vehicle program, related to the federal program that encourages the purchase of alternative fuel vehicles. This program focuses on methanol and methanol blends, ethanol and ethanol blends, compressed natural gas, liquefied petroleum gas, and hydrogen. Specifically, the CARB's alternative fuel regulations state that, ". . . 'alternative fuel' means any fuel which is commonly or commercially known or sold as one of the following: M-100 fuel methanol, M-85 fuel methanol, E-100 fuel ethanol, E-85 fuel ethanol, compressed natural gas, liquefied petroleum gas, or hydrogen." (CCR, Title 13, Section 2290 (a) (1)).

Compressed natural gas is defined by its chemical specifications (CCR, Title 13, Section 2292.5). As long as it meets those specifications, compressed biomethane should qualify as compressed natural gas. It is not clear if LNG or LBM qualify. If not, advocates of biomethane that want biomethane to qualify as a clean alternative fuel can petition CARB to get it added to the list (CCR, Title 13, Section 2317).

California has a variety of incentives for super-ultra-low-emission vehicles (SULEV) that run on alternative fuels.¹ For example, single occupants driving SULEV vehicles that use alternative fuels (including, it is assumed, biomethane) are allowed to use car pool lanes. Some localities allow free metered parking (see <<http://www.driveclean.ca.gov/en/gv/incentives/index.asp>>). Public agencies in the San Francisco Bay Area may get as much as \$5,000 from the Air District's Vehicle Incentive Program for the purchase of a SULEV, PZEV (partial zero-emission vehicle) or ZEV (zero-emission vehicle) that runs on natural gas, propane, hydrogen, electricity, or hybrid electricity (see Bay Area Air Quality Management District, Vehicle Incentive Program <http://www.baaqmd.gov/pln/grants_and_incentives/vip/index.asp>). The San Joaquin District

¹ For a general discussion of California incentives see US DOE, Clean Cities Program Review of California Incentives at <http://www.eere.energy.gov/afdc/progs/state_summary.cgi?afdc/CA>.

will provide as much as \$40,000 per vehicle for the purchase of new on-road heavy-duty vehicles such as transit buses that run on compressed natural gas or liquefied petroleum gas (SJAPCD, 2003). Vehicles running on ethanol or biodiesel do not qualify for either the Bay Area or San Joaquin District programs.

Table 6-4 summarizes existing California programs for encouraging alternative fuel vehicles and indicates their probable impact on the development and use of biomethane as an alternative fuel. Individual programs are discussed below.

Table 6-4 California Programs that Promote the Use of Alternative Fuel Vehicles

Program	Value	Reason
Tax Deductions	Medium	Exempts AFVs, including natural gas vehicles, from vehicle license fee. No specific incentive for renewable methane.
Bay Area Programs	Medium	Financial incentives for AFVs. No specific incentive for renewable methane.
Carl Moyer Memorial Air Standards Attainment Program	Low	Natural gas vehicles can qualify towards this program, but so can clean diesel technologies. No specific incentive for renewable methane.
California Alternative Fuel Programs	Low	Encourages the purchase of various alternative fuel vehicles, including compressed natural gas vehicles. No specific incentive for biomethane.
The Lower Emission School Bus Program	Low	Only 36 buses. Various fuels and technologies can qualify. No specific incentive for renewable methane.
HOV Lane Privileges	Medium	Allow single occupant SULEV AFVs to drive in HOV lane. No specific incentive for renewable methane.
San Joaquin Valley District Heavy Duty Engine Incentive Program	Low	Natural gas vehicles can qualify towards this program, but so can clean diesel technologies. No specific incentive for renewable methane.
Sacramento Metro District Heavy Duty Vehicle Incentive Program	Low	Natural gas vehicles can qualify towards this program, but so can clean diesel technologies. No specific incentive for renewable methane.
South Coast District Fleet Rules	Medium	Mandates the purchase of natural gas vehicles. No specific incentive for renewable methane.

HOV = High occupancy vehicle.

SULEV = Super ultra low-emission vehicle.

AFV = Alternative fuel vehicle.

High = Provides substantial incentives for both natural gas vehicle use and biomethane production.

Medium = Gives adequate incentives for either natural gas vehicle use or biomethane production, but not for both.

Low = Inadequate incentives for natural gas vehicle use or biomethane production.

Tax Deductions

To help equalize the vehicle license fee for AFVs and conventional fuel vehicles, the incremental cost of the purchase of an alternative fuel vehicle is exempt from the vehicle license fee (of 2%). This reduction applies towards new, light-duty AFVs that are certified to meet or exceed ULEV standards. This program runs from January 1, 1999 to January 1, 2009 (California Revenue and Taxation Code, Section 10759.5).

Bay Area Air Quality Management District Programs

The Bay Area Air Quality Management District (Bay Area District) offers several programs to provide incentives for clean-fuel vehicles, with an emphasis on public agency fleets. The Vehicle Incentive Program offers incentives to public agencies that purchase alternative fuel vehicles with a GVW of 10,000 lb or less. Qualifying vehicles must be certified as ULEV, SULEV II, or ZEV. Incentives range from \$1,000 to \$5,000 per vehicle. A total of \$500,000 is available in FY 2004/05. Another Bay Area District initiative, the Transportation Fund for Clean Air program, offers incentives to cover the incremental cost of alternative fuel heavy-duty vehicles.

Carl Moyer Memorial Air Standards Attainment Program

By focusing on NO_x and PM emissions, the Carl Moyer program, administered by CARB, provides funds on an incentive basis for the incremental cost of engines that are cleaner than required and certified to meet low NO_x emission standards (this includes natural gas engines). Eligible projects include cleaner on-road, off-road, marine, locomotive, and stationary agricultural pump engines, as well as forklifts, airport ground support equipment, and auxiliary power units. About \$33.1 million in funding was available for FY 2004 through participating air pollution control and air quality management districts. No maximum grant amount per vehicle is specified, but in the first three years of the program's operation, which was established in 1999 by Chapter 923, around 48% of funding was focused on alternative fuels.

Lower-Emission School Bus Program

Assembly Bill 425 (Statutes of 2002, Chapter 379) mandates that 20% of the Proposition 40 funds made available to CARB are allocated for the acquisition of "clean, safe, school buses for use in California's public schools that serve pupils in kindergarten and grades 1 to 12, inclusive." For FY 2003-2004, \$4.6 million was available for the purchase of new school buses, which was enough to purchase about 36 buses statewide.

High-Occupancy Vehicle Lane Privileges

Starting July 1, 2000, certain alternative fuel vehicles were allowed to use high-occupancy vehicle (HOV) lanes, regardless of the number of occupants in the vehicle (California Vehicle Code Sections 5205.5 and 21655.9). To claim this privilege, an identification sticker must first be obtained from the California Department of Motor Vehicles (DMV).

San Joaquin Valley Unified Air Pollution Control District

The San Joaquin District administers the Heavy-Duty Engine Emission-Reduction Incentive Program, which provides incentive funds for the differential cost (up to \$40,000 per vehicle) associated with reduced emission technology (as compared to the cost of conventional technology) for heavy-duty vehicles with a GVW over 14,000 lbs. Eligible funding categories include heavy-duty on-road vehicles, off-road vehicles, locomotives, marine vessels, electric forklifts, electric airport ground support equipment, and stationary agricultural irrigation pump engines. Eligible fuel types include natural gas, among others.

Sacramento Metropolitan Air Quality Management District

The Sacramento Metropolitan Air Quality Management District also has a Heavy-Duty Low-Emission Vehicle Incentive program that offers a variety of financial incentives to entities that lower NO_x emissions from heavy-duty vehicles (both on- and off-road). The incentives include the purchase of new natural-gas and other alternative fuel vehicles. Private businesses and public agencies in the six-county Sacramento federal ozone non-attainment area are eligible to apply for this program

South Coast Air Quality Management District

The South Coast District has many rules that mandate the purchase of cleaner, natural gas vehicles (SCAQMD Fleet Rules 1191-1196, 1186.1). The vehicles covered include on-road light- and medium-duty public fleet vehicles, on-road heavy-duty public fleet vehicles, on-road transit buses, residential and commercial refuse collection vehicles, airport ground access vehicles, school buses, and sweepers. In 2004, however, the U.S. Supreme Court disallowed the portion of the South Coast District fleet rules regarding private fleet purchases of certain kinds of heavy-duty vehicles due to a legal jurisdictional issue. While there is a strong effort underway to effectively reinstate the rules via a state mechanism, the Supreme Court action has at least temporarily removed one of the primary drivers for sales of certain kinds of heavy-duty natural gas fuel vehicles in California. Given the potential instability of the current situation, it is difficult to predict the overall effect on the California natural gas vehicle market.

Summary and Conclusions

Renewable electricity, ethanol, and biodiesel are supported by direct financial incentives and mandates that increase their usage. Biomethane receives no direct financial incentives, however, as an alternative fuel, biomethane can qualify for some of the benefits available to alternative fuels. The federal government has programs to promote farm-based and rural renewable energy, and biomethane projects can compete for such awards. In addition, biomethane research and development funds are available through competitive grant programs.

California is committed to renewable electricity and has a variety of programs that provide direct benefits including the California Self Generation Incentive Program, the Renewable Resources Trust Fund, net metering, and requirements under the Renewable Portfolio Standard to purchase renewable electricity. Both the federal and California governments are committed to research and development programs that support renewable electricity from biomass and renewable fuels from biomass. The federal government's efforts are concentrated in the Farm Bill of 2002. California efforts for biomass electricity are funded through the Public Energy Research Program. California has a new Public Interest Natural Gas Energy Research Program that can fund biogas and biomethane research.

When biogas created by an anaerobic digester system is combusted to generate electricity, the generator can earn incentives under federal, and especially, California renewable electricity programs. When biogas is used to create biomethane that will be used in vehicles or other applications, it is ineligible for this funding. It is also ineligible for alternative fuel incentives that are provided for ethanol and biodiesel. At present, the best opportunities for biomethane projects from dairy manure are found in the federal Farm Bill of 2002. Farm-based biomethane projects can compete for federal support under various provisions of this bill such as Title II (EQIP), and especially Title IX (Energy), Section 9006 and Section 9008.

Ethanol has direct cash incentives in excise tax exemptions that began in 1978 and have been consistently extended, currently running to 2007. Both ethanol and biodiesel are also supported by producer incentive funds under Farm Bill Section 9010. Most of those funds go to ethanol, which is produced in substantially larger volume than biodiesel. Federal taxpayers provide \$250 to \$300 million per year of support under these two programs. The ethanol market is also supported by oxygenation mandates under the Clean Air Act amendments of 1990. Ethanol, biodiesel, and in theory, biomethane receive some market support through the alternative fuel program created by the Energy Policy Act of 1992. These opportunities may be expanded if the Energy Policy Act of 2005 is passed.

Vehicles that run on biomethane fulfill alternative vehicle fleet requirements as mandated in federal, state, and local law and should be able to earn various federal, state, and local incentives.

