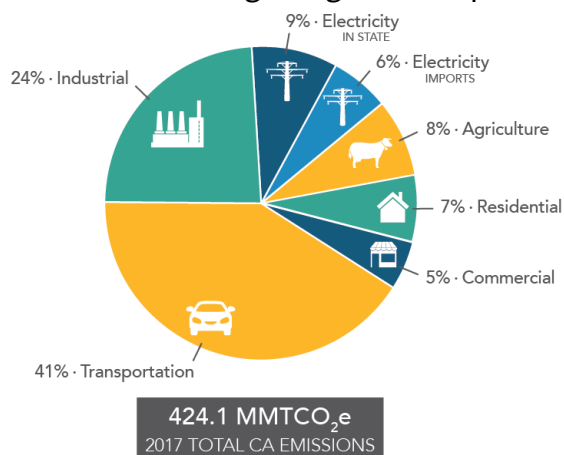


Climate-Smart Dairy

California Leading the World in Dairy Methane Reduction

Overview

California, the fifth largest economy in the world, is responsible for about 1 percent of all global greenhouse gas (GHG) emissions. More than 80 percent of California's emissions come from the transportation (41%), industrial (24%) and electrical sectors (15%). Even though California is the largest agricultural production state—producing fruits, vegetables, nuts,



and other commodities for much of the United States and world—the sector's GHG contribution is roughly **8 percent** of the state's total GHG. Of this, California's largest-in-the-nation dairy sector accounts for 5 percent of the state's total emissions. Roughly half of the dairy sector's GHG emissions come from manure management (storage, handling, and utilization) and half come from enteric emissions (direct emissions from the cow, primarily belching). California's dairy farms have been significantly reducing the carbon

footprint (hoofprint) of milk and other dairy products [over the past 50 years](#). These reductions have occurred largely through improvements in nutrition, cow health and comfort, and farm management practices that have vastly improved efficiency and milk production. **Bottom line: more milk from fewer cows with more than a 45 percent reduction in GHG per gallon of milk produced.**

Despite this tremendous progress, California's dairy farm families are working closely with state agencies to seek further reductions in dairy methane. While significant research is being conducted to identify ways to lessen enteric emissions, cost-effective solutions are not yet available. Significant progress is, however, being made on manure management. California's Short-Lived Climate Pollutant (SLCP) Plan calls for a 40 percent decrease in

Shrinking Carbon Footprint



45% less over 50 years.

(1964 - 2014)

- *Journal of Dairy Science, Naranjo et. al., 2020*


More milk, fewer cows = greatly reduced emissions

dairy manure methane emissions by 2030, and the industry is working diligently to achieve this goal. These efforts are not occurring by accident. California is making significant investments in dairy methane reduction and establishing key incentive programs to facilitate their success. The centerpieces of these efforts are two state-funded incentive programs implemented by the California Department of Food & Agriculture (CDFA).

The Dairy Digester Research and Development Program (DDRDP) and Alternative Manure Management Program (AMMP) are both highly successful programs funded under California's Climate Investment Program (Cap and Trade Auction Proceeds or Greenhouse Gas Reduction Fund). CDFA has already awarded more than \$244 million in grants under both programs. 2020 awards are expected to be announced in October.

DDRDP

Since 2015, CDFA has awarded more than \$183.4 million to 108 projects under the DDRDP. These funds are being matched by an additional \$369.7 million in private investment (matching funds by grant awardees). **The DDRDP projects to date have an anticipated GHG reduction of 39.8 million metric tons of carbon dioxide equivalent (MMTCO₂e) over 20 years or approximately 1.99 MMTCO₂e annually. The DDRDP is the state's most effective investment to date in terms of total investment and the second most cost effective, providing one ton of GHG reduction (CO₂e) for every \$9 invested by the state.¹** By comparison, heavy-duty transportation sector investments are providing just 1 ton of CO₂e reduction for every \$600 invested by the state.¹



One ton of GHG reduction for every \$9 invested³

AMMP

The AMMP Program funds a diverse range of manure management practices, which provide alternatives to and options for dairy operators where digesters may not be operationally or economically feasible. Unlike digesters which capture methane, AMMP projects are designed to avoid methane production. Funded projects include, but are not limited to:

- Improvement of pasture-based management,
- Conversion to dry-scrape or vacuum systems,
- Composting projects,
- Mechanical manure solids-liquid separation systems with rapid drying of solids, and
- Compost-bedded pack barns.

Under the AMMP Program, CDFA has funded \$62.7 million to 106 projects. These funds are being matched with \$8.9 million provided by project proponents. **The AMMP projects have an anticipated GHG reduction of over 4.721 MMTCO₂e over 20 years or approximately 236,094 MT CO₂e annually. The AMMP follows the DDRDP as one of the most cost-effective**

¹ California Climate Investments, 2019 Annual Report, March 2019

² Assessing California's Climate Policies – Transportation, LAO, December 2018

programs (ranked seventh of 60 climate programs), providing one ton of GHG reduction (CO₂e) for every \$43 invested by the state.²

Environmental Performance

All funded projects being developed in California must demonstrate protection of the environment and comply with stringent water and air quality protection standards, including the California Environmental Quality Act (CEQA). The design and construction of digesters must be demonstrated to be protective of surface and groundwater quality.⁴ All digester system design, construction, and operation must minimize emission of air pollutants.⁴ All state funded projects must also comply with SB 859 (2016) which requires CDFA, prior to awarding grant funds from GGRF, to review a comprehensive analysis identifying any and all potential adverse impacts of a proposed project.⁴ SB 859 also requires project proponents to conduct outreach in areas that will potentially be impacted by the projects, determine potential adverse impacts, and commit to measures to mitigate identified impacts. CDFA is also required to prioritize projects based on the criteria pollutant emission benefits achieved by the projects. While the environmental performance of dairy digesters is well researched, informed, and understood, the industry is working closely with state regulators to conduct and fund research to better understand AMMP environmental performance. It is of note that AMMP projects promote dry handling of manure, which can be a significant first step in producing a valuable and exportable source of organic matter for building healthy soils.

Other Incentive Programs

A number of other important programs have been created by the legislature or administration to facilitate development of dairy methane reduction in California, including but not limited to the following:

BioMAT (SB 1122)

The bioenergy market adjusting tariff (BioMAT) was developed by the California Public Utilities Commission (CPUC) to provide competitive market-based contracts for dairy electric generation projects. To date, nine dairy digester projects have received 20-year power purchase agreements under the program. The CPUC is in the process of reviewing and extending the program.

Dairy Pipeline Biomethane Pilot Program (AB 1383)

The CPUC recently identified six dairy pipeline biomethane pilot projects as part of the implementation of SB 1383, including five dairy methane digester clusters. These pilot projects will receive roughly \$200 million in project support over the next 20 years. The pilot projects will initially include as many as 45 dairies and can be expanded to benefit other nearby dairies in the future.

² California Climate Investments, 2019 Annual Report, March 2019

Biomethane Interconnection Incentive Program

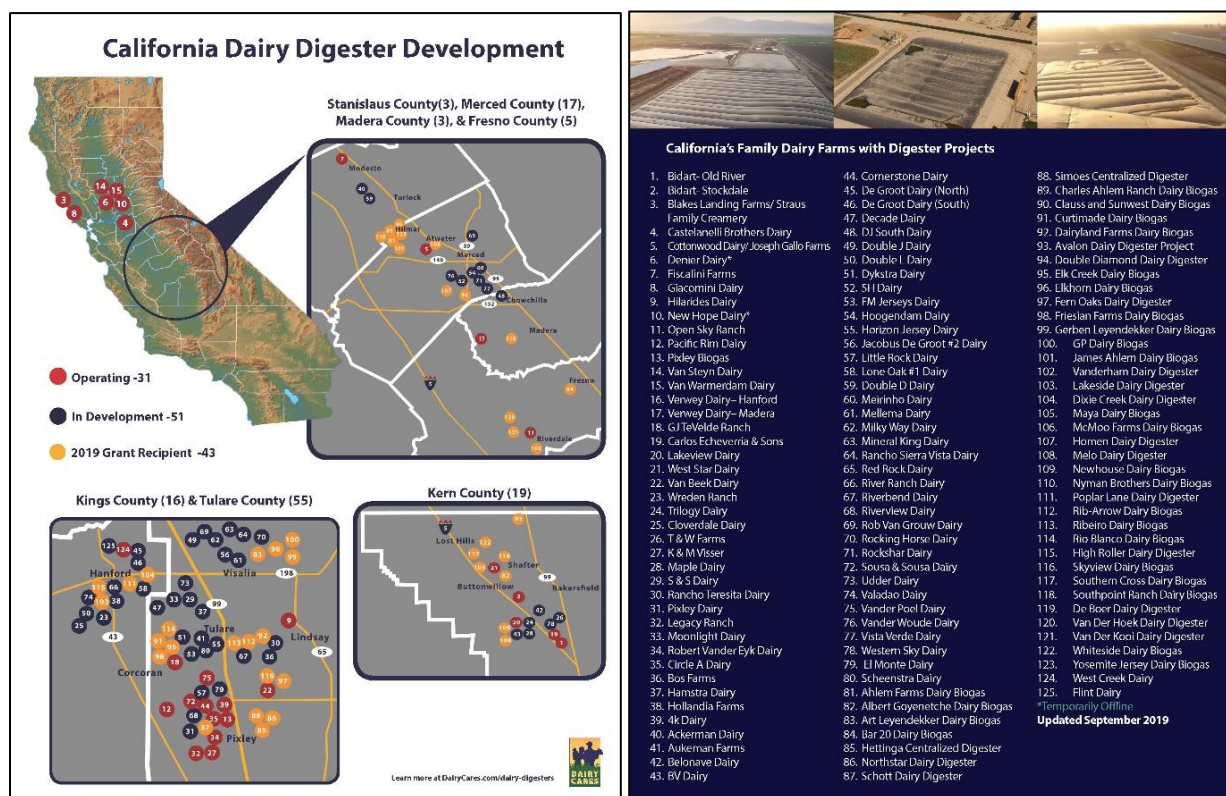
This program was created by the CPUC to incentivize biomethane pipeline interconnection projects and initially funded with \$40 million. Under the program, eligible projects are able to receive up to 50 percent of interconnection costs up to \$3 million per dairy and up to \$5 million for a dairy cluster project. The CPUC is currently considering continuation and expansion of the program.

Biomethane Procurement Program (SB 1440)

The legislature enacted SB 1440 (Hueso) in 2018. SB 1440 seeks to create a limited biomethane procurement program to create long-term contracts for pipeline biomethane from dairy and other projects in the state. The program will be designed and implemented by the CPUC and will provide long-term certainty for project developers to encourage project development.

Cumulative GHG Benefits

California dairy farm families are currently implementing more than 231 dairy methane reduction projects across the state. Many of these projects are already operating and more are being brought online each year. **These projects have an anticipated combined GHG reduction benefit of more than 44 MMTCO₂e over the next 20 years, or 2.2 MMTCO₂e annually, making it the most effective single investment in total GHG reduction in the entire California Climate Investments program (GGRF).** As additional funds are granted, these reductions will continue to grow. CDFA's dairy methane reduction programs are also especially important since all reductions are methane, a Short-Lived Climate Pollutant, meaning the climate protection benefits will accrue to the state more quickly than reductions of carbon dioxide.





Download the digester and AMMP maps:

- DairyCares.com/dairy-digesters
- DairyCares.com/alternative-manure-management

Environmental Co-Benefits

While the GHG reduction benefits of reducing dairy methane are significant and growing, dairy methane reduction projects also provide substantial local environmental co-benefits, including the important reduction of criteria pollutants. A recent analysis conducted by the California Air Resources Board (CARB) as part of the Dairy Methane Reduction Working Group documents the tremendous potential for reductions of other emissions including, but not limited to:

- Nitrogen Oxide (NO_x)
- Particulate Matter (PM_{2.5} & PM₁₀)
- Hydrogen Sulfide (H₂S)
- Nitrous Oxide (N₂O)
- Volatile Organic Compounds (VOCs)
- Ammonia (NH₃)

See the [CARB Dairy Digester Emissions Matrix](#).

“Dairy biogas-to-transportation-fuel projects that replace diesel trucks have the potential to significantly reduce transportation emissions in the San Joaquin Valley and other regions of the state.”

- Samir Sheikh, Executive Director, San Joaquin Valley Air Pollution Control District

Negative Carbon Transportation Fuel

Dairy biomethane is a tremendous source of negative carbon transportation fuel or renewable natural gas (RNG), which is used to replace diesel in heavy-duty freight. **In fact, dairy biomethane is by far the least carbon-intensive transportation fuel currently available in California with a negative carbon intensity (CI) score of -255, making it nearly ten times more effective at reducing carbon than even electric vehicles.** ³

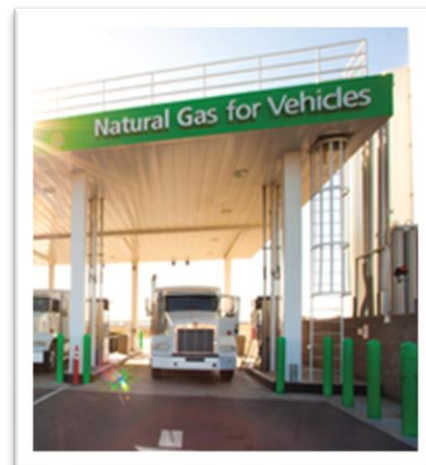
Average 2017 Carbon Intensities (CI) for Different Fuels

In Grams of Carbon Dioxide Equivalent Per Megajoule

Fuel	Average CI
Diesel	102
Gasoline	100
Diesel standard	98
Gasoline standard	95
Fossil natural gas ^a	89
Ethanol	70
Renewable natural gas ^a	44
Biodiesel	34
Renewable diesel	30
Electricity	29
Dairy RNG	-255

^a Compressed natural gas

Negative-Carbon Transportation Fuel



Source: Legislative Analyst's Office

Community Benefits

All dairy digester projects under the CDFA DDRDP are required to conduct community outreach to seek feedback and involve local community groups in the local planning and environmental review process for the project. All project impacts (truck traffic, odor, etc.) and community benefits (jobs, air quality, etc.) are required to be presented and discussed at local community outreach meetings. Applicants are also required to describe how any impacts are being mitigated. Local community engagement has included community-based organizations, environmental justice organizations, as well as local schools, colleges, and universities. Dairy digesters provide significant odor reduction, reduce impacts to groundwater, and are not expected to create local air quality impacts.⁴ AMMP projects also provide local community and environmental co-benefits. In addition to these environmental co-benefits, dairy digesters are creating a good source of local jobs, particularly during construction of projects. Project developers are also partnering with local colleges and universities to provide support, education, and internship opportunities for local residents in disadvantaged communities.⁷

³ Assessing California's Climate Policies – Transportation, LAO, December 2018

⁴ CDFA, Report of Funded Projects, January 2019

Other Climate-Smart Activities

In addition to methane reduction projects, dairies are also taking significant steps to reduce their dependence on fossil fuels and further reduce GHG emissions while benefitting air quality. These efforts include, but are not limited to the following:

- **Energy Efficiency** – Dairies are partnering with local utilities to reduce energy use by up to 20 percent.
- **Water-use Efficiency** – More than 20 dairies across the San Joaquin Valley are experimenting with drip irrigation to grow feed crops, resulting in up to 47 percent water savings.
- **Solar Energy** – More than 120 dairies have implemented solar energy systems. These on-farm solar panel systems produce more than 190 million kWh of energy each year—enough clean, solar energy each year to offset the emissions of 28,000 cars.
- **Electrification Projects** – A growing number of dairy farms have been reducing fossil-fuel use by converting diesel-powered equipment, such as water pumps and feed mixers, to electric use. These projects not only reduce GHG emissions, but also provide tremendous local air quality benefits.
- **Healthy Soils** – Manure is utilized by dairy farms to create healthy soil and nourish feed crops. Manure is also being increasingly composted and utilized as organic fertilizer, replacing conventional fertilizer at other local farms. These practices facilitate carbon sequestration in soils.

“A number of clean air milestones can be largely attributed to efforts and investments made by Valley dairy farmers. Despite significant reductions, more reductions are still needed to meet ever-tightening state and federal air quality standards. Incentive-based programs are critical for achieving further reductions in new attainment strategies.”

- Todd DeYoung, Manager of Strategies and Incentives, San Joaquin Valley Air Pollution Control District

Videos at YouTube.com/DairyCares

- Watch [Climate-Smart Dairy](#)
- Watch [How Can We Reduce Livestock Methane?](#)