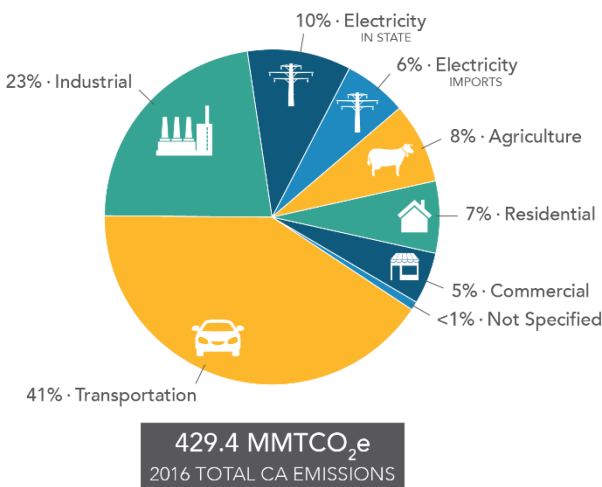


Climate-Smart Dairy

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 (23%) and electrical sectors (16%). 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 4 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 six decades. 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 60 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

Shrinking Carbon Footprint



63% less over 63 years.

— Journal of Animal Science, 2009. 87:2160-2167. Capper et al.


More Milk, fewer cows = greatly reduced emissions

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 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 \$145 million in grants under both programs and recently released a solicitation for up to \$94 million in new projects.

DDRDP

Since 2015, CDFA has awarded more than \$114 million to 64 projects under the DDRDP. These funds are being matched by an additional \$204 million in private investment (matching funds by grant awardees). **The DDRDP projects to date have an anticipated GHG reduction of 25.6 million metric tons of carbon dioxide equivalent (MMTCO₂e) over 20 years or approximately 1.3 MMTCO₂e annually.** ¹ **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.** ² By comparison, heavy-duty transportation sector investments are providing just 1 ton of CO₂e reduction for every \$600 invested by the state. ³



*One ton of GHG
reduction for every
\$9 invested ³*

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 \$31.2 million to 57 projects. These funds are being matched with \$4.8 million provided by project proponents. **The AMMP projects have an anticipated GHG reduction of over 2.845 MMTCO₂e over 20 years or approximately**

¹ CDFA, Report of Funded Projects, January 2019

² California Climate Investments, 2019 Annual Report, March 2019

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

142,300 MTCO₂e annually.⁴ The AMMP follows the DDRDP as one of the most cost-effective programs (ranked seventh of 60 climate programs), providing one ton of GHG reduction (CO₂e) for every \$43 invested by the state.⁵

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, eight 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 over \$319 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.

⁴ CDFA, Report of Funded Projects, January 2019

⁵ 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.

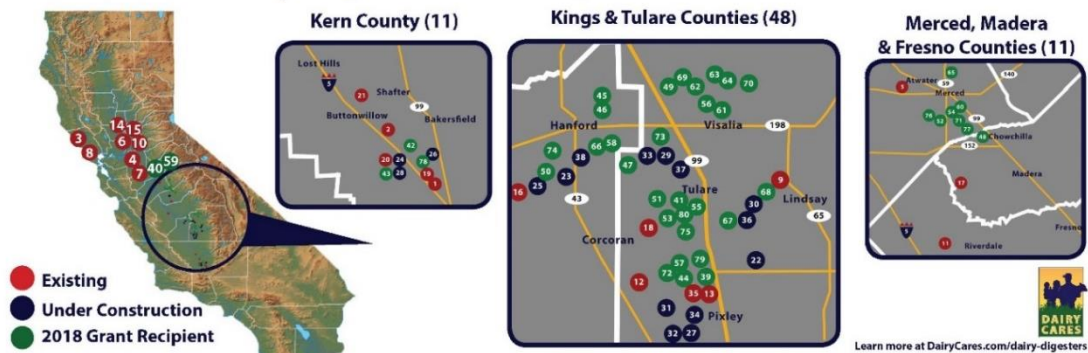
Biomethane Procurement Program (SB 1440)

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 120 dairy methane reduction projects across the state. **These projects have an anticipated combined GHG reduction benefit of more than 28 MMTCO₂e over the next 20 years, or 1.4 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 in 2019, 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.

California Dairy Digester Development



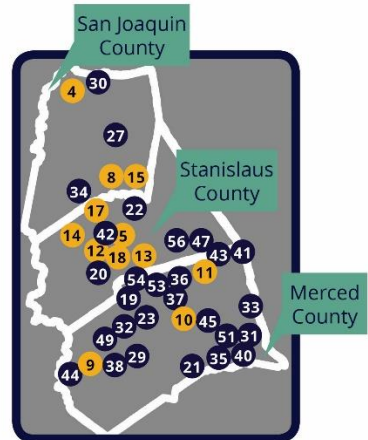
1. Bidart- Old River	16. Verwey Dairy- Hanford	33. Moonlight Dairy	50. Double L Dairy	67. Riverbend Dairy
2. Bidart- Stockdale	17. Verwey Dairy- Madera	34. Robert Vander Eyk Dairy	51. Dykstra Dairy	68. Riverview Dairy
3. Blakes Landing Farms/ Straus Family Creamery	18. GJ TeVelde Ranch	35. Circle A Dairy	52. 5H Dairy	69. Rob Van Grouw Dairy
4. Castelanelli Brothers Dairy	19. Carlos Echeverria & Sons	36. Bos Farms	53. FM Jerseys Dairy	70. Rocking Horse Dairy
5. Cottonwood Dairy/ Joseph Gallo Farms	20. Lakeview Dairy	37. Hamstra Dairy	54. Hoogendam Dairy	71. Rockshar Dairy
6. Denier Dairy*	21. West Star Dairy	38. Hollandia Farms	55. Horizon Jersey Dairy	72. Sousa & Sousa Dairy
7. Fiscalini Farms	22. Van Beek Dairy	39. 4k Dairy	56. Jacobus De Groot #2 Dairy	73. Udder Dairy
8. Giacomini Dairy	23. Wreden Ranch	40. Ackerman Dairy	57. Little Rock Centralized Dairy	74. Valadao Dairy
9. Hilarides Dairy	24. Trilogy Dairy	41. Aukeman Farms	58. Lone Oak #1 Dairy	75. Vander Poel Dairy
10. New Hope Dairy*	25. Cloverdale Dairy	42. Belonave Dairy	59. Double D Dairy	76. Vander Woude Dairy
11. Open Sky Ranch	26. T & W Farms	43. BV Dairy	60. Meirinho Dairy	77. Vista Verde Dairy
12. Pacific Rim Dairy	27. K & M Visser	44. Cornerstone Dairy	61. Mellema Dairy	78. Western Sky Dairy
13. Pixley Biogas	28. Maple Dairy	45. De Groot Dairy (North)	62. Milky Way Dairy	79. El Monte Dairy
14. Van Steyn Dairy	29. S & S Dairy	46. De Groot Dairy (South)	63. Mineral King Dairy	80. Scheenstra Dairy
15. Van Warmerdam Dairy	30. Rancho Teresita Dairy	47. Decade Centralized Dairy	64. Rancho Sierra Vista Dairy	*Temporarily Offline
	31. Pixley Dairy	48. DJ South Dairy	65. Red Rock Dairy	Updated December 31, 2018
	32. Legacy Ranch	49. Double J Dairy	66. River Ranch Dairy	

Alternative Manure Management in California

Fifty-eight California dairy farms have been awarded grants to reduce methane through the California Department of Food and Agriculture (CDFA) Alternative Manure Management Program (AMMP). Dairies across the state continually work to improve manure management using a variety of technologies and strategies.



Learn more at DairyCares.com/alternative-manure-management



1. Lafranchi Ranch	13. Robert Gioletti and Sons Dairy	24. Bordessa Family Dairies	36. GM Silva Dairies #1	48. SBS AG Dairy
2. Sierra View Dairy	14. Rivercrest Cattle Co.	25. Bosma Milk Company	37. GM Silva Dairies #2	49. Silva Dairy Farms
3. Alexandre Family EcoDairy	15. Manuel DaSilva Dairy	26. Brodt Dairy	38. Godinho Dairy, Inc	50. Silveira Dairy
4. De Snayer Dairy	16. Cal-Denier Dairy LLC	27. BWC Weststeyn Dairy LP	39. Henry A Garcia Dairy	51. T & C Louters Dairy
5. Double D Dairy	17. Martins Farm LP	28. Deniz Dairy	40. J Troost Dairy, LP	52. Thommen Dairy
6. Milk River Dairy	18. Alamo Dairy	29. Den-K Holsteins, Inc.	41. JB Dairy	53. Vierra Dairy Farms
7. Regli Jerseys	19. AJ Borba Holsteins	30. Dewit Dairy Inc	42. Joe Meirinho & Son Dairy LP	54. Vierra Dairy Farms #3
8. DaSilva Dairy Farms LP	20. Andrew Zylstra Dairy, Inc.	31. Diamond J Dairy, LLC	43. John Machado Dairy	55. Wilgenburg West LLC
9. Correia Family Dairy Farms	21. Antonio Brasil Dairy	32. Dias Family Dairy	44. Jose V Silveira Dairy	56. Willem Postma Dairy #1
10. Matos Dairy	22. Art Silva Dairy	33. Double B Dairy	45. Manuel Oliveira	57. Zuppan Dairy
11. Magneson Dairy	23. Arthur Oliveira Dairy	34. F&S Brasil Dairy	46. McClelland Dairy	
12. Alamo Farms		35. Frank Coelho & Sons	47. Ray-Lin Dairy	

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

Click here for [CARB Dairy Digester Emissions Matrix](#)

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

“Dairy biogas-to-transportation-fuel projects can provide tremendous environmental co-benefits. Replacing diesel fuel with dairy RNG has the potential to significantly reduce transportation emissions in the San Joaquin Valley and other regions of the state.”

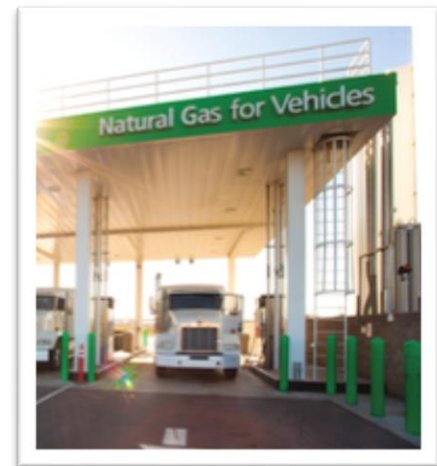
- Samir Sheikh, Executive Director, San Joaquin Valley Air Pollution Control District

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. ⁶

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.⁷ 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

⁶ Assessing California's Climate Policies – Transportation, LAO, December 2018

⁷ 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 115 dairies have implemented solar energy systems. These on-farm solar panel systems produce more than 180 million kWh of energy each year—enough to meet the electricity needs of 30,000 homes.
- **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

Climate-Smart Dairy Video

Watch the video at [YouTube.com/DairyCares](https://www.youtube.com/DairyCares) or by clicking [here](#).