

**DAIRY DIGESTER RESEARCH AND  
DEVELOPMENT PROGRAM**



# Report of Funded Projects (2015 – 2023)



## 2023 Report to the Joint Legislative Budget Committee



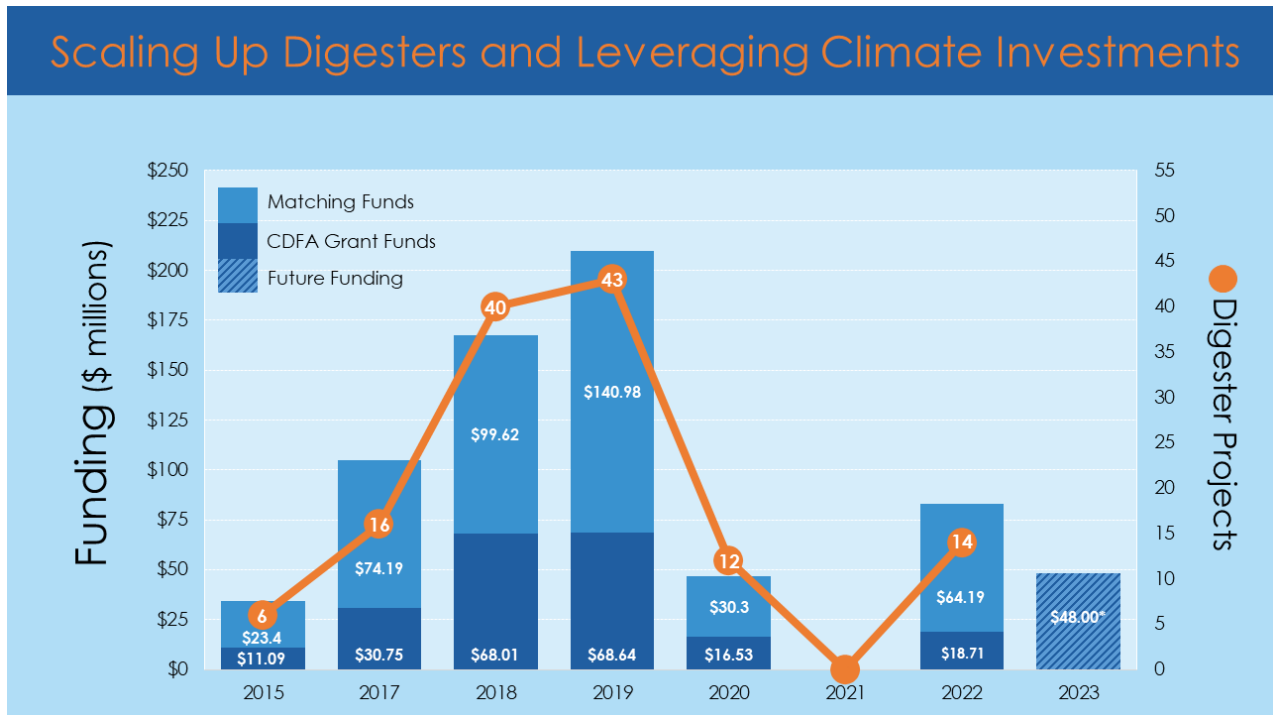
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## Contents

Executive Summary .....	3
I. Program Background and Award Selection Process.....	5
A. DDRDP Eligibility and Application Process.....	10
B. DDRDP Review Process .....	11
II. CDFA Public Outreach for DDRDP .....	12
III. Projects Funded by the CDFA DDRDP .....	14
IV. Community Engagement and Outreach by CDFA DDRDP Award Recipients .....	15
V. DDRDP Project Co-Benefits .....	17
I. Individual Project Information.....	34
Appendix A .....	43

## Executive Summary

The California Department of Food and Agriculture's (CDFA) Dairy Digester Research and Development Program (DDRDP) awards competitive grants to implement dairy digesters that result in long-term methane emission reductions from manure management on California dairies and minimize or mitigate adverse environmental impacts.



**Figure 1.** Number of funded digester projects by year, with total investments from CDFA grants and matching funds\*\* for each grant cycle. \*The Budget Act of 2022 allocated \$48 million to CDFA for its dairy and livestock methane reduction programs for 2023, with priority given to Alternative Manure Management Program (AMMP). This graph does not include an additional \$20 million dollars allocated exclusively to AMMP in the Budget Act of 2022. These funds have not been awarded yet. \*\*Subject to change.

The Budget Act of 2017-18 (Item 8570-101-3228) requires CDFA to provide ongoing updates on the Department's DDRDP projects in January of each year beginning in 2018 and continuing through 2027. This legislative mandate is designed to evaluate the efficiency and cost-effectiveness of strategies to reduce emissions of short-lived climate pollutants, including methane (a greenhouse gas) from dairy operations. This report includes information on all DDRDP projects funded by CDFA.

CDFA has received \$389 million since 2014 for the DDRDP and Alternative Manure Management Program (AMMP). The Budget Act of 2022 (Senate Bill 154, Chapter 43) appropriated \$48 million from California State Budget General Funds to CDFA for dairy methane reduction incentives programs, with priority given to the Alternative Manure Management Program. Furthermore, the 2022 Budget Act (Budget Bill Jr.), Assembly Bill (AB) 179 allocated an additional \$20 million exclusively to the AMMP.

- DDRDP provides financial assistance for the installation of dairy digesters in California, which will result in reduced greenhouse gas emissions from manure management practices.
- AMMP provides financial assistance for the implementation of non-digester manure management practices in California, resulting in reduced greenhouse gas emissions.

CDFA has awarded a total of approximately \$214 million for 131 dairy digester projects, with approximately \$433 million provided in matching funds by grant awardees ([Figure 1](#)). This funding has been awarded to projects that will result in methane emission reductions from manure management practices, as these emissions represent a significant portion of California's agricultural and forestry sector greenhouse gas inventory. In 2020, agriculture and forestry contributed to approximately 31.62 million metric tons of carbon dioxide equivalents (MMTCO<sub>2e</sub>), or 8.6 percent of California's total annual GHG emissions ([Appendix A](#)).

Methane emissions resulting from manure management, a subset of these total statewide agricultural methane emissions, account for approximately 2.7 percent of the total statewide GHG emissions, or approximately 32 percent of the agricultural GHG emissions<sup>1</sup>. The dairy digester projects referenced in this report have a cumulative estimated GHG reduction of 22.95 MMTCO<sub>2e</sub> over ten years, or approximately 2.3 MMTCO<sub>2e</sub> annually. The funded projects equate to addressing approximately 22.7 percent of the methane emissions from manure management in California and 7.3 percent of the total GHG emissions from the agriculture and forestry sector in California ([Figure 3](#)).

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<sup>1</sup> CARB. California Greenhouse Gas Inventory Program.  
<https://ww2.arb.ca.gov/our-work/programs/ghg-inventory-program>

## I. Program Background and Award Selection Process

Methane is a potent greenhouse gas (GHG) that has a global warming potential 25 times that of carbon dioxide (using 100-year global warming potential). It is also a Short-lived Climate Pollutant (SLCP). Short-lived Climate Pollutants are climate gases that remain in the atmosphere for a much shorter period of time than longer-lived GHGs such as carbon dioxide. The SLCPs are powerful climate forcers that have relatively short atmospheric lifetimes. Because SLCP impacts are especially strong over the short term, acting now to reduce their emissions can have an immediate beneficial impact on climate change and public health. In California, the dairy and livestock sector accounts for over half of statewide methane emissions, with half of these emissions coming from enteric fermentation and the rest coming from manure management. Because no viable enteric methane mitigation option is currently available in the marketplace, the state has focused on methane mitigation strategies related to dairy manure management so far. However, new advances in technology and methane reduction measures from enteric and dairy manure management are beginning to come online, and the State is showing interest in incentivizing research and demonstration projects.

- CDFA was appropriated \$12 million in the Budget Act of 2014 to fund dairy digesters; \$11.09 million was awarded to fund six (6) projects in 2015 through the DDRDP competitive grant process. These projects are estimated to reduce 153,870 MTCO<sub>2e</sub> of GHG per year.
- CDFA received an additional \$50 million from the Greenhouse Gas Reduction Fund (GGRF), authorized by the Budget Act of 2016, to fund dairy digesters as well as non-digester practices for methane reduction on California's dairy and livestock operations. Non-digester manure management projects are implemented under a separate program, the Alternative Manure Management Program (AMMP), which provides financial assistance to California dairy and livestock operations.
  - \$30.75 million of the FY 2016-17 allocation was awarded to 16 dairy digester projects, which are estimated to reduce 365,676 MTCO<sub>2e</sub> of GHG per year, and \$9.9 million was awarded to 18 alternative manure management projects in 2017, which are estimated to reduce 65,655 MTCO<sub>2e</sub> of GHG per year.
- The Budget Act of 2017 and the Budget Act of 2018 allocated \$99 million each year to CDFA to support dairy and livestock methane reduction projects.
  - In 2018, \$68 million of the FY 2017-18 allocation was awarded to 40

dairy digester projects, which are estimated to reduce 711,231 MTCO<sub>2e</sub> of GHG per year, and \$18.25 million was awarded to 35 non-digester projects, which are estimated to reduce 59,212 MTCO<sub>2e</sub> of GHG per year.

- In 2019, \$68.64 million of the FY 2018-19 allocation was awarded to 43 dairy digester projects through DDRDP and DDRDP Demonstration Projects (DDRDP Demo), which are estimated to reduce 703,754 MTCO<sub>2e</sub> of GHG per year. Another \$30.97 million was awarded to 49 non-digester projects through AMMP and AMMP Demonstration Projects, which are estimated to reduce 71,574 MTCO<sub>2e</sub> of GHG per year. The latter included AMMP New Technologies and Practices (AMMP Demo - NTP) and AMMP Advancing Practices Farmer-To-Farmer (AMMP Demo – APFF).
- The Budget Act of 2019 allocated \$34 million to CDFA to continue funding DDRDP and AMMP. This allocation was reduced to \$29,058,299 due to a smaller than projected Cap and Trade auction proceeds for 2019-20.
  - In 2020, \$16.53 million of the FY 2019-20 was awarded to 12 dairy digester projects, which are estimated to reduce 167,847 MTCO<sub>2e</sub> of GHG per year, and \$8.93 million was awarded to 13 non-digester projects, which are estimated to reduce 23,513 MTCO<sub>2e</sub> of GHG per year.
- The Budget Act of 2021 allocated another \$32 million to CDFA to continue supporting dairy and livestock methane reduction programs, with priority given to AMMP.
  - In 2022, \$18.71 million was awarded to 14 dairy digester projects, which are estimated to reduce 193,184 MTCO<sub>2e</sub> of GHG per year. Additionally, \$18.94 million was awarded to 27 non-digester projects, which are estimated to reduce 40,209 MTCO<sub>2e</sub> of GHG per year.
- From the Budget Act of 2021, \$5 million is now available to fund research grants that will measure and verify emissions reductions associated with livestock methane reduction projects. Research shall include an assessment of the cost-effectiveness of various livestock methane reduction strategies on a per ton basis, including a comparison of projects funded under AMMP and DDRDP, as well as alternative methane reduction strategies such as dietary modification, and research on manure-based product development. To the extent feasible, these research projects will include measurement of emissions of greenhouse gases and criteria pollutants before and after livestock methane reduction projects are implemented ([SB](#)

[170, Chapter 240](#)).

- Additionally, in the Budget Act of 2022, \$10 million was allocated to CDFA to fund the dairy and livestock sectors for demonstration projects to supplement feed with additives or ingredients, such as seaweed, that have scientifically demonstrated efficacy in reducing methane emissions and research dietary modifications that are intended to reduce methane emissions from livestock ([AB 179, Chapter 249](#)).

A summary of funds allocated to the DDRDP is provided in [Table 1](#).

**Table 1.** Summary of CDFA DDRDP funding to date.

Year	Dollar Allocation (millions)	Dairy Methane Reduction Grant Funds Awarded (millions)*			Administrative Cost not to Exceed 5% (millions)
		Dairy Digesters	Dairy Digester Research or Demonstration Projects	Non-digester Practices (Alternative Manure Management Program)	
2014-15	\$12	\$11.09	\$0.2	Not applicable	\$0.68
2016-17	\$50	\$30.75	Not applicable	\$9.9	\$5
2017-18	\$99	\$68.01	Not applicable	\$18.25	\$4.9
2018-19	\$99	\$66.89	\$1.75	\$30.97	\$4.9
2019-20	\$29.06	\$16.53	Not applicable	\$8.93	\$1.45**
2021-22	\$32	\$18.71	Not applicable	\$18.94	\$1.6**
2022-23	\$48	-	Not applicable	-	\$2.4**

\*Values have changed from previous reports due to the cancellation of some projects.

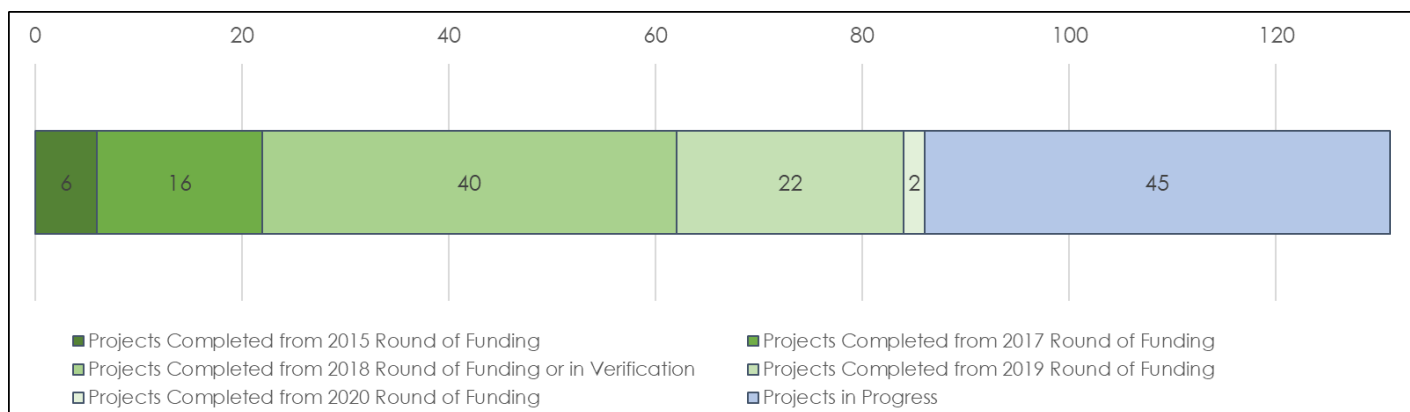
\*\*In 2019-20, \$391,937 of the allocations were utilized to fund Technical Assistance Providers (TAP) under the Climate Smart Agriculture Technical Assistance Grants. In 2021-23, an estimated \$1,330,000 of the allocation is expected to be utilized to fund TAP. AB 2377 (Irwin, 2018) requires CDFA to utilize no less than 5% of the appropriation to provide technical assistance to AMMP applicants and recipients. CDFA funded all applications received by technical assistance providers. Funding allocations for programs other than those reserved for DDRDP are not included in this table.

CDFA has awarded a total of \$214 million for 131 dairy digester projects from 2015 through 2022 ([Figure 2](#)). Dairy digesters remain one of the most efficient GHG programs in terms of the cost of each ton of GHG reduced.<sup>2</sup>

<sup>2</sup> CARB. 2021 Annual Report on Cap and Trade Auction Proceeds.

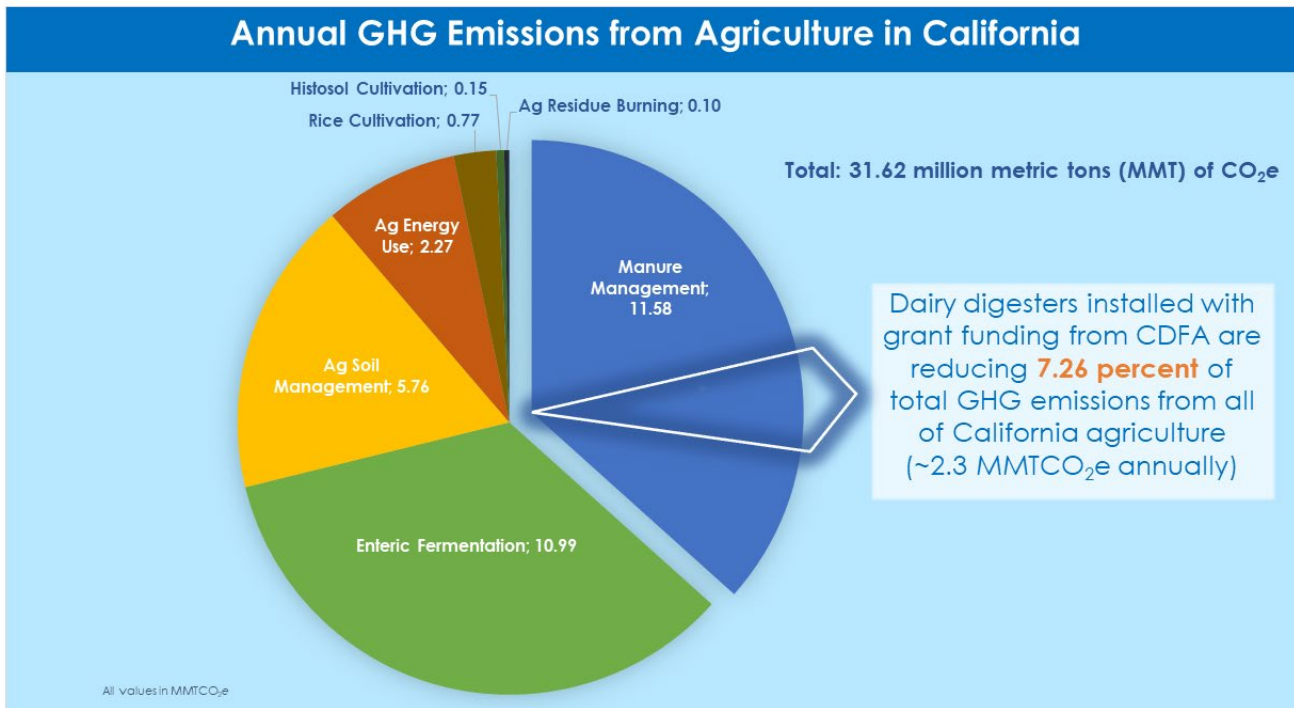
[https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/2021\\_cci\\_annual\\_report.pdf](https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/2021_cci_annual_report.pdf)

- All 6 funded projects in 2015 are completed and operational.
- All 16 funded projects in 2017 are completed and operational.
- Of the 40 funded projects in 2018, 37 are completed and operational, and 3 are in the process of verification. Due to delays from COVID constraints, the legislature granted extensions to encumbrance and liquidation deadlines.
- Of the 43 funded projects in 2019, 24 are complete and operational, and 21 are under construction. In September 2019, CDFA awarded \$1.75 million in one competitive grant to a California dairy operation and digester developer for the implementation of a dairy digester demonstration project that demonstrates innovative technology to achieve long-term methane emission reductions on California dairies and minimize or mitigate adverse environmental impacts.
- Of all the 12 funded projects in 2020, 2 are complete and operational, and 10 are under construction.
- All the 14 funded projects in 2022 are under construction.



**Figure 2.** Number of DDRDP funded projects that are complete and in progress since 2015.





**Figure 3.** Agriculture and Forestry sector GHG emissions inventory in California in 2020 divided by sectors, and the impact of DDRDP projects in terms of GHG emission reductions. Source: [California Greenhouse Gas Inventory Program](#).

All funded projects since 2017 must comply with SB 859 ([2016 Budget Bill, Chapter 368](#)), which requires CDFA to review the applicant's analysis identifying potential adverse impacts of a proposed project prior to awarding grant funds from the GGRF. The requirements specified in the bill prohibit a project from receiving funding from CDFA, unless the applicant has conducted outreach in areas that will potentially be adversely impacted by the project, has determined potential adverse impacts of the project, and has committed to measures to mitigate impacts. The bill requires CDFA to prioritize projects based on the criteria pollutant emission benefits achieved by the project. This is an important component of the program and CDFA has worked diligently to comply with SB 859 requirements even when allocations were appropriated through funding sources other than GGRF (i.e., General Funds).

CDFA has funded \$86.9 million for 142 AMMP projects from 2016 to 2022. Approximately \$20 million in matching funds have been contributed by awardees. These projects achieve a cumulative estimated GHG reduction of 1.3 MMT CO<sub>2</sub>e over five years, or 260,164 MTCO<sub>2</sub>e annually and equate to 2.6 percent of the methane emissions from manure management in California. AMMP funds a diverse

range of manure management practices that provide options to dairy and livestock operations where digesters may not be economically feasible. These practices include pasture-based management (such as the conversion of a non-pasture operation to pasture or increased time spent by animals on pasture), alternative manure storage options (such as compost bedded pack barn or slatted floor pit storage manure collection), separation of manure solids in conjunction with drying or composting of solids, and conversion of a flush-based system to a scrape system in conjunction with drying or composting of solids.

## A. DDRDP Eligibility and Application Process

Under DDRDP, CDFA funds up to 50 percent of the total project cost. The maximum grant award from the 2015-2019 rounds was up to \$3 million per project; it was reduced to up to \$2 million per project for the 2020 round, and it was once again reduced to up to \$1.6 million per project for the 2022 round. Funded projects are expected to be completed within two years of the execution of the grant agreement. To be eligible for funding, the dairy digester project must be located on a commercial California dairy operation. A group of dairy operations may submit one grant application to develop a centralized dairy digester and gas clean-up facilities, known as a “cluster” or “hub and spoke” project. The location of the centralized digester and/or gas clean-up facility can be determined by participating dairy operations. Defunct non-DDRDP digesters that were constructed in the past and have become entirely non-functional for a minimum of 12 months due to technical or other issues are also considered eligible for funding through DDRDP. However, CDFA does not fund upgrades to existing functional dairy digesters to boost emission reductions and energy production. Additionally, projects that propose to switch existing management practices on the dairy operation to those that increase baseline GHG emissions such as the increase in herd size are not eligible for DDRDP funding. Projects selected for funding may not change their herd size beyond the limits established by the dairy operation’s existing state issued permits (e.g., State or Regional Water Resources Control Board permits) at the time of application throughout the project term.

DDRDP applicants are required to use the latest quantification methodology and its associated benefits calculator tool developed by the California Air Resources Board (CARB) to calculate estimated GHG emission reductions achievable from projects and co-benefits linked to the proposed project. The quantification methodology and benefits calculator tool are available on CARB’s [CCI Quantification, Benefits,](#)

[and Reporting Materials](#) website. Any project benefits provided according to [AB 1550 \(Gomez, 2016\) Priority Populations](#) are determined and reported to CARB using the [methodologies](#) developed by CARB and consistent with the [Funding Guidelines for Administering Agencies](#).

Funded projects must demonstrate the protection of water and air quality. The design and construction of digester vessels (e.g., ponds and tanks) under this program must be demonstrated to be protective of surface and groundwater quality. To meet the DDRDP water quality requirements, one of the following is required: double-lined ponds consistent with the Tier 1 specification of the Dairy General Order (R52013-0122) of the Central Valley Regional Water Quality Control Board, above-ground or below-ground digester vessels that are considered protective of water quality provided they are designed to be watertight (i.e., vinyl water seals at joints, proper rebar density to minimize cracking), or built in accordance with a strict construction quality assurance (CQA) program (i.e., any cracks sealed). The digester system design, construction, and operation must minimize the emission of air pollutants. For power production projects, the total NO<sub>x</sub> (mono-nitrogen oxides) emissions must be no greater than 0.50 lb/MW-hr. These represent the most stringent water and air quality protection standards across the state and must be met by a project regardless of its location in California. Funded projects must use commercially available technologies to produce or capture methane for energy production or transportation fuel. Since 2019, DDRDP may reimburse recipients for costs related to the implementation of nutrient management technologies in order to help dairy farmers manage the excess of nitrogen and nutrients in their facilities.

## B. DDRDP Review Process

CDFA conducts three levels of review during the grant submission and review process. The first is an administrative review to determine if all grant application requirements are met. The second is a comprehensive financial review to evaluate the merits of the grant applications based on the scoring criteria, conducted by the CDFA Audits Office. The third is a technical review by subject matter experts and the Technical Advisory Committee (TAC). The TAC is a sub-committee of the [California-Federal Dairy Digester Working Group](#). The scoring criteria for the review process are listed in [Table 2](#). The TAC review process is assisted by the following:

- (i) The evaluation of the GHG emission reductions calculations and

technical soundness of the project by academic experts associated with California (University of California and California State University systems) and other U.S. universities, and

- (ii) The assessment of financial information submitted with the grant application by CDFA's Audit Office.

**Table 2.** CDFA DDRDP Scoring Criteria for Project Selection.

<b>Criteria</b>	<b>Points</b>
Digester Project Plan and Long-term Viability	20
Budget Worksheet and Financials	10
Estimated Greenhouse Gas Emissions Reduction	35
Project Readiness	10
Environmental Performance	15
Community Impact	10
<b>Total</b>	<b>100</b>

Since 2020, the scoring criteria were modified to award five extra points in addition to the criteria listed in [Table 2](#) to new submitting organizations in order to incentivize the distribution of funds to organizations that were not awarded in previous rounds.

## II. CDFA Public Outreach for DDRDP

The development of the DDRDP framework and grant solicitation (Request for Grant Applications) involves a stakeholder and public engagement process. Additionally, during the application period, CDFA provides application assistance workshops as well as guidance on conducting community outreach about the projects. A summary of these workshops is provided in [Table 3](#).

**Table 3.** Summary of CDFA DDRDP Outreach.

<b>Program Development Outreach Public Meetings</b>			
<b>Meeting</b>	<b>Date</b>	<b>Location</b>	<b>Number of Attendees</b>
2015 Digester Grant Development - Stakeholder Input	11/6/2014	Modesto	12
2015 Digester Grant Development - Stakeholder Input	11/10/2014	Tulare	7
2015 Digester Grant Development - Stakeholder Input	11/13/2014	Sacramento	14
2015 Digester Research Development – Stakeholder Input	3/4/2015	Sacramento	0
2016 Environmental Justice Listening Session	11/9/2016	Tulare	9
2017 Digester Grant Development - Stakeholder Input	11/17/2016	Clovis	23
2017 Digester Grant Development - Stakeholder Input	11/21/2016	Sacramento	13
2017 Digester Grant Development - Stakeholder Input	11/22/2016	Modesto	10
2017 Digester Grant Development - Stakeholder Input	11/30/2016	Webinar	40
2017 Digester Grant Development - Stakeholder Input on Draft Solicitation	2/6/2017	Webinar	42
2019 Digester Grant Development – Expanding Access and Enhancing Competitiveness	9/17/2018	Tulare	6
2019 Digester Grant Development – Expanding Access and Enhancing Competitiveness	9/18/2018	Modesto	3
2019 Digester Grant Development – Expanding Access and Enhancing Competitiveness	9/19/2018	Webinar	28
2019 Digester Grant Development – Stakeholder Input	10/23/2018	Tulare	2
2019 Digester Grant Development – Stakeholder Input	10/24/2018	Modesto	2
2019 Digester Grant Development – Stakeholder Input	10/26/2018	Webinar	20
2020 Digester Grant Development – Stakeholder Input	09/17/2019	Tulare/Webinar	19
2020 Digester Grant Development – Stakeholder Input	09/18/2019	Petaluma/ Webinar	16
2020 Digester Grant Development – Stakeholder Input	09/19/2019	Sacramento/ Webinar	24
2020 Digester Grant Development – Expanding Access and Enhancing Competitiveness	01/06/2020	Sacramento/ Webinar	14
2020 Digester Grant Development – Expanding Access and Enhancing Competitiveness	01/09/2020	Sacramento/ Webinar	10
2022 Digester Grant Development – Stakeholder Input	12/08/2021	Webinar	14
<b>Application Assistance Outreach Public Meetings</b>			
<b>Meeting</b>	<b>Date</b>	<b>Location</b>	<b>Number of Attendees</b>
2015 Digester Grant - Application Workshop	1/21/2015	Tulare	13
2015 Digester Grant - Application Workshop	1/27/2015	Webinar	26
2015 Digester Grant - Application Workshop	1/28/2015	Sacramento	12

2015 Digester Research - Application Workshop	4/23/2015	Webinar	8
2017 Digester Grant - Application Workshop	5/12/2017	Sacramento	15
2017 Digester Grant - Application Workshop	5/15/2017	Tulare	20
2017 Digester Grant - Application Workshop	5/16/2017	Webinar	22
2017 Digester Grant – Community Outreach Assistance through UC Davis	May 2017	One-on-one Assistance and Consultation	9
2018 Digester Grant – Application Workshop	1/3/2018	Modesto	9
2018 Digester Grant – Application Workshop	1/4/2018	Tulare	14
2018 Digester Grant – Application Workshop	1/8/2018	Webinar	35
2019 Digester Grant – Application Workshop	1/23/2019	Tulare/ Webinar	12
2019 Digester Grant – Application Workshop	1/24/2019	Modesto/ Webinar	10
2020 Digester Grant – Application Workshop	2/18/2020	Modesto/ Webinar	16
2020 Digester Grant – Application Workshop	2/19/2020	Petaluma/ Webinar	9
2020 Digester Grant – Application Workshop	2/20/2020	Fresno/ Webinar	9
2022 Digester Grant – Application Workshop	03/16/2022	Webinar	31
2022 Digester Grant – Application Workshop	03/25/2022	Webinar	30

### III. Projects Funded by the CDFA DDRDP

A summary of the 131 projects funded to date by CDFA's DDRDP is provided in [Table 4](#). The collective GHG emission reduction estimated from the 131 projects is 22.95 million MTCO<sub>2e</sub> over 10 years, and the approximate cost to achieve one MTCO<sub>2e</sub> (10-year) reduction is approximately \$28.16. Of this cost, the share of the GGRF or General Funds (i.e., the CDFA grant) is approximately \$9.31 or 33 percent, and the remainder is achieved through matching funds provided by the grant recipient. A map showing the locations of the funded projects can be found in [Figure 4](#). As evident from [Figure 4](#), funded projects are primarily located in California's Central Valley, which is home to the majority of large-scale dairy operations in the state. The cost-effectiveness summary of the DDRDP is presented in [Table 5](#). In the case of canceled projects (see [Table 4](#)), no amount of the grant award funds were allocated to projects and/or grant award funds expended were returned to CDFA. CDFA awarded these funds to next-in-line ranked projects when possible, or awarded them in the following rounds of the program.

## IV. Community Engagement and Outreach by CDFA DDRDP Award Recipients

California Government Code Section 16428.86(a) (i.e., SB 859 Section 6) requires CDFA to review the applicant's analysis of potential adverse impacts of the proposed project, including a net increase in criteria pollutants, toxic air contaminants, and hazardous air pollutants; groundwater and surface water impacts; and truck traffic and odor. This must occur prior to awarding DDRDP grant funds. Additionally, the statute states that:

- (i) A digester project shall not receive funding unless the applicant has demonstrated to CDFA that the applicant has done all the following:
  - a. Conducted outreach in areas that will potentially be adversely impacted by the project.
  - b. Determined potential adverse impacts of the project.
  - c. Committed to measures to mitigate impacts.
- (ii) In making awards, CDFA shall prioritize projects based on the criteria pollutant emission benefits achieved by the digester project.
- (iii) A digester project funded by CDFA that results in localized impacts in disadvantaged communities shall not be considered to provide a benefit to disadvantaged communities for the purposes of Section 39713 of the Health and Safety Code.

To meet these requirements, DDRDP applicants are required to conduct community outreach actions and describe community needs. Additionally, they are required to describe how the community was involved in the local planning and environmental review processes for this project, including how neighbors were contacted, public meeting dates and times, the material presented to the community, and whether translation was needed and provided. Applicants are required to summarize the results of this outreach; identify the community's concerns, questions, or comments and how they will be addressed, and provide up to three letters of support from community members demonstrating that outreach was conducted.

Applicants are encouraged to (a) approach residents, community leaders, elected officials, advocacy organizations, local businesses, members of vulnerable or underserved populations (e.g., elderly, youth, physically and/or mentally disabled, members from disadvantaged communities), and government departments, agencies, jurisdictions, etc. potentially impacted by the project such as local health

department, schools/school districts, emergency services, law enforcement, metropolitan planning organization, etc., and (b) use various methods to notify the community of outreach efforts, such as local newspapers, county websites, radio and television. The topics of discussion during outreach efforts must include potential adverse impacts of digester projects, including a net increase in criteria pollutants, toxic air contaminants, hazardous air pollutants, groundwater and surface water impacts, truck traffic, and odor. Additionally, applicants are required to describe what, if any, mitigation measures will be included in the project. This includes, but is not limited to, mitigating the potential impacts mentioned above. Mitigation measures committed to by the applicant must be specific to the digester project and be included in the project work plan.

Applicants are also required to explain the economic benefits that will be provided to the community (or communities) where a project is located, such as the number and duration of temporary or permanent jobs, approximate salaries, training provided for these positions, benefits for each job classification and trade, how long these jobs will last, and how they improve on local unemployment rates.

In order to provide guidance on quantification methods and reporting to administering agencies, CARB developed the [Community Engagement Co-benefit Assessment Methodology](#) in 2018-19. Questions as part of this methodology have been included on the DDRDP application since the 2019 round.

Further, CDFA contracted with the University of California, Davis Extension Collaboration Center in 2017 and 2018, and with California State University, Sacramento in 2019 to assist applicants with planning and executing their community outreach efforts. Since 2020, CDFA has provided applicants with guidelines for community outreach and engagement during the solicitation process.

Among the 14 applications selected for awards in 2022, 23 letters (supporting projects across 6 clusters) from educational institutions and community-based organizations such as counties, Farm Bureaus, the California Women for Agriculture – Stanislaus Chapter, the San Joaquin Valley Air Pollution Control District, and Self-Help Enterprises were submitted in support of these projects. Within these letters, there is support from institutions of higher education such as University of California in Merced (UC Merced), and other educational institutions such as College of the Sequoias, Modesto Junior College, as well as local employment, labor, training, and business organizations, including Proteus Inc. These support letters categorically



noted the activities and outreach that were conducted in their local community and highlighted the positive impact of these future projects. The applicant for 3Machados Dairy, CDF Howard Dairy, Couco Creek Dairy, Grand View Dairy, Lakeshore Dairy, LegenDairy Farms, Mattos Bros Dairy, Meirinho West Dairy, and River Rock Dairy projects have partnered with the University of California in Merced (UC Merced) and the Center for Information Technology Research in the Interest of Society (CITRIS) to provide 6 need-based scholarships with paid internships leading to potentially long-term careers in renewable energy. Additionally, this same applicant will contract with UC Merced student laboratories for additional field research opportunities for their students. Similarly, the applicant for P&M Dairy and VP Farms, Top O'The Morn Farms, Martins View Jersey Dairy, Bar Mac Dairy, and Lerda-Goni Farms are advancing its educational initiatives with the College of the Sequoias by expanding the scholarship program in a new Community Benefits Agreement (CBA). This new agreement will provide scholarship funds (for a total of \$21,000 for two years) to students in financial need, from SB 535 disadvantaged communities, in the agricultural and STEM fields.

The community outreach activities conducted by applicants ranged from conducting public meetings that provided opportunities to learn about the advantages and disadvantages of construction in the community, engagement with local schools and universities to educate students and faculty on dairy digesters, providing paid internships to local students, facilitating interaction with local environmental and other non-profit organizations for feedback on projects, and the facilitation of public digester tours for interested local residents.

## **V. DDRDP Project Co-Benefits**

Dairy digesters have the potential to provide several environmental and agronomic co-benefits, notably reduction in odor and flies due to the elimination of open uncovered manure storage lagoons. Additionally, manure solids after digestion can be easier to handle, contain fewer pathogens, and provide a more stabilized form of nutrients for plant uptake, relative to raw manure. The DDRDP requirements below, as noted previously in [Section 1. A.](#), have set the precedent for dairy digester projects to follow the highest air and water quality protection standards across the state, which in many cases are more stringent than local Air District or Water Board requirements:

1. Double-lined ponds consistent with the Tier 1 specification of the Dairy General Order (R52013-0122) of the Central Valley Regional Water Quality

Control Board, above-ground or below-ground digester vessels that are considered protective of water quality provided they are designed to be watertight (i.e., vinyl water seals at joints, proper rebar density to minimize cracking) and built-in accordance with a strict construction quality assurance (CQA) program (i.e., any cracks sealed).

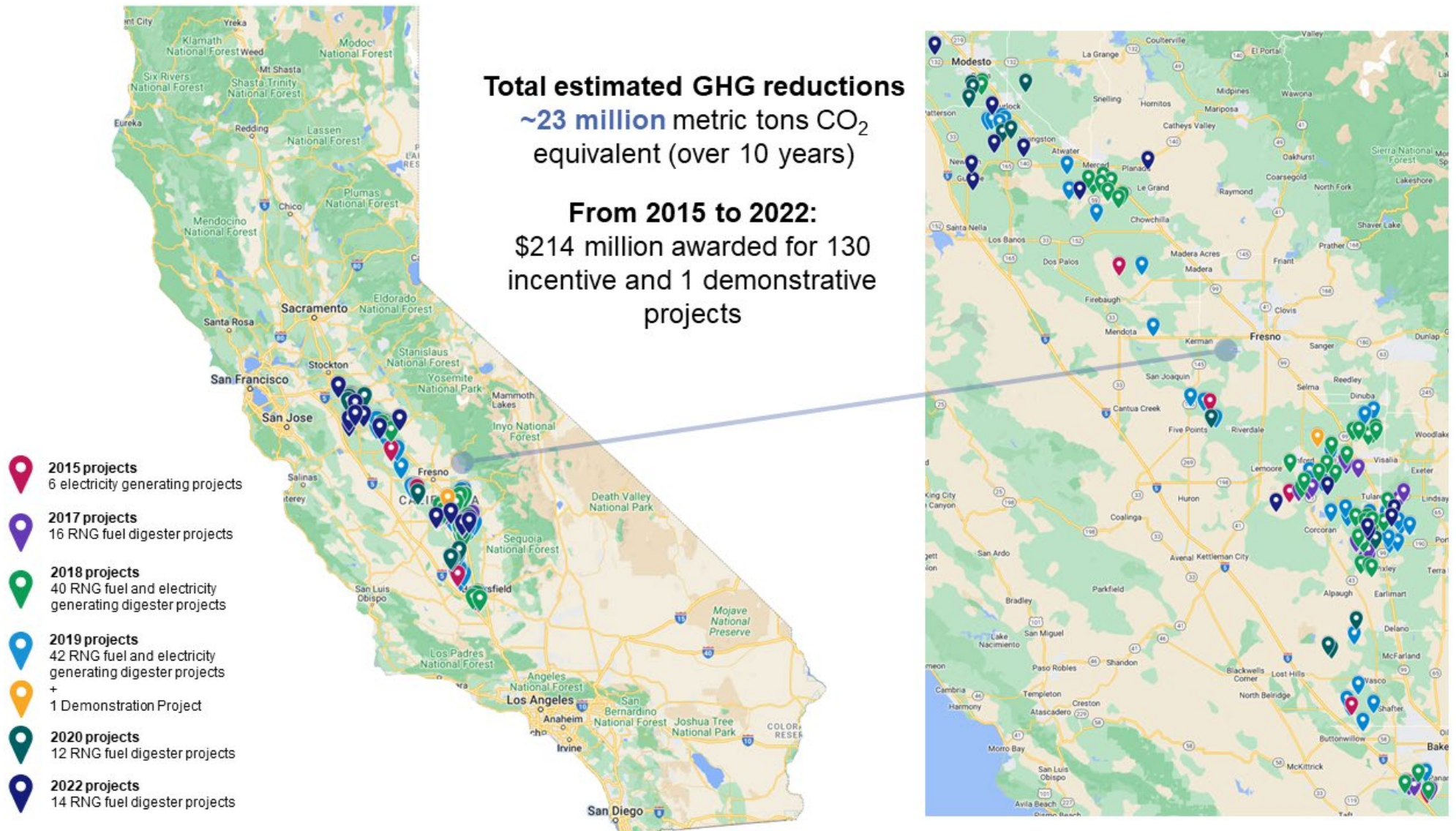
2. For power production projects, the total NO<sub>x</sub> (mono-nitrogen oxides) emissions must be no greater than 0.50 lb/MW-hr.

Of the 131 DDRDP funded projects, 9 projects are generating electric power. Of these, six projects funded in 2015 involved internal combustion engines and met the criteria stated above. Three remaining projects have been funded in 2018 and 2019 and propose to employ fuel cells, a technology with much lower criteria pollutant emissions than internal combustion engines. Projects awarded in 2016-17, 2017-18, 2018-19, 2019-20, and 2021-22 did not include electricity generation end-use through internal combustion engines. Instead, these projects involve end-uses such as renewable natural gas (RNG) production and electricity generation to power electric vehicles through fuel cells. These technologies have minimal local air quality impacts relative to internal combustion engines.

Since the 2019 round of DDRDP, the CARB methodology for calculation of GHG emission reductions has been revised to include quantification of co-benefits such as fossil fuel use reduction; energy and fuel cost savings; renewable fuel and energy generation; compost production; and reductions in local and remote emissions of Reactive Organic Gases (ROG), NO<sub>x</sub>, PM 2.5, and diesel PM.

All funded projects are also evaluated for benefits to disadvantaged communities based on the criteria provided in [Funding Guidelines for Administering Agencies](#).

As noted in [Section IV](#), DDRDP grant recipients report economic benefits, including job creation. Since 2019, CARB has developed the [Job Co-Benefit Assessment Methodology and Modeling Tool](#), which was utilized to estimate jobs benefits provided by projects at the time of application. These estimates will be updated with data provided by grant recipients through the term of the grant agreement and reported to CARB for inclusion in the [CARB's CCI Annual Report to the Legislature](#). Using the CARB Job Co-Benefit Assessment Methodology and Modeling Tool, the DDRDP has generated since 2019 approximately 4,379 full-time jobs, where approximately 2,267 are direct jobs, 643 are indirect jobs, and 1,467 are induced jobs.



**Figure 4.** Geographical Distribution of CDFA funded Dairy Digesters in California.

**Table 4.** Summary of Dairy Digester Projects Funded by CDFA.

Year of Award	Applicant Organization	Project Title	Submitting Organization	Project Location	Cluster	Project Type	Biogas End-Use	Estimated 10 year GHG reductions (MTCO <sub>2e</sub> )*	Grant Funds	Matching Funds**	Total Project Cost	Status
2015	ABEC #4 LLC, dba Carlos Echeverria & Sons Dairy Biogas	Carlos Echeverria & Sons Dairy Biogas Project	California Bioenergy LLC	Bakersfield, Kern Co.	NA	New covered lagoon digester	Combined heat and electrical power generation	201,200	\$1,000,000	\$5,560,375	\$6,560,375	Complete
2015	ABEC #3 LLC, dba Lakeview Farms Dairy Biogas	Lakeview Dairy Biogas Digester	California Bioenergy LLC	Bakersfield, Kern Co.	NA	New covered lagoon digester	Electrical power generation and RNG	144,090	\$2,000,000	\$5,128,324	\$7,128,324	Complete
2015	Open Sky Ranch Inc.	Open Sky Ranch Dairy Digester	Maas Energy Works Inc	Riverdale, Fresno Co.	NA	Retrofit covered lagoon digester*	Electrical power generation	258,911	\$973,430	\$990,486	\$1,963,916	Complete
2015	Philip Verwey Farms	Verwey-Hanford Dairy Digester	Maas Energy Works Inc	Hanford, Kings Co.	NA	New covered lagoon digester	Electrical power generation	535,770	\$3,000,000	\$3,011,595	\$6,011,595	Complete
2015	Philip Verwey Farms	Verwey-Madera Dairy Digester	Maas Energy Works Inc	Madera, Madera Co.	NA	New covered lagoon digester	Electrical power generation	240,000	\$2,281,091	\$2,331,935	\$4,613,026	Complete
2015	ABEC #2 LLC dba West-Star North Dairy Biogas	West-Star North Dairy Digester	California Bioenergy LLC	Buttonwillow, Kern Co.	NA	New covered lagoon digester	Electrical power generation	158,730	\$1,837,005	\$6,381,069	\$8,218,074	Complete
2017	Bos Farms Dairy Biogas	Bos Farms Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	Kern	New covered lagoon digester	RNG	168,398	\$1,500,000	\$5,199,492	\$6,699,492	Complete
2017	Calgren Dairy Fuels LLC	Circle A Dairy Digester Fuel Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	West Visalia	New covered lagoon digester	Cogeneration (ethanol) and RNG	138,745	\$1,050,000	\$1,429,945	\$2,479,945	Complete
2017	Cloverdale Dairy Biogas	Cloverdale Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	Hanford	New covered lagoon digester	RNG	360,851	\$3,000,000	\$5,955,939	\$8,955,939	Complete
2017	Hamstra Dairy Biogas	Hamstra Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	Kern	New covered lagoon digester	RNG	205,115	\$2,000,000	\$6,630,543	\$8,630,543	Complete
2017	Hollandia Farms Dairy Biogas	Hollandia Farms Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	Calgren	New covered lagoon digester	RNG	178,426	\$1,500,000	\$6,264,272	\$7,764,272	Complete
2017	Calgren Dairy Fuels LLC	K&M Visser Dairy Digester Fuel Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	Cogeneration (ethanol) and RNG	205,553	\$1,500,000	\$1,902,047	\$3,402,047	Complete
2017	Calgren Dairy Fuels LLC	Legacy Dairy Digester Fuel Pipeline	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	Cogeneration (ethanol) and RNG	207,209	\$1,550,000	\$1,887,320	\$3,437,320	Complete

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2017	Maple Dairy Biogas	Maple Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	342,587	\$3,000,000	\$6,568,257	\$9,568,257	Complete
2017	Moonlight Dairy Biogas	Moonlight Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	South Tulare	New covered lagoon digester	RNG	154,834	\$1,500,000	\$6,440,123	\$7,940,123	Complete
2017	Calgren Dairy Fuels LLC	Pixley Dairy Digester Fuel Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	Cogeneration (ethanol) and RNG	215,321	\$1,600,000	\$1,675,681	\$3,275,681	Complete
2017	Calgren Dairy Fuels LLC	R Vander Eyk Dairy Digester Fuel Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	NA	New covered lagoon digester	Cogeneration (ethanol) and RNG	132,586	\$1,000,000	\$1,604,440	\$2,604,440	Complete
2017	Rancho Teresita Dairy Biogas	Rancho Teresita Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	Hanford	New covered lagoon digester	RNG	236,251	\$2,100,000	\$5,500,336	\$7,600,336	Complete
2017	Aligned Digester Cooperative LLC	Red Top Madera Dairy Digester Project	Aligned Digester Cooperative LLC	Chowchilla, Madera Co.	Hanford	New covered lagoon digester	RNG	282,475	\$3,000,000	\$3,046,875	\$6,046,875	Canceled ****
2017	S&S Dairy Biogas	S&S Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	West Visalia	New covered lagoon digester	RNG	167,417	\$1,600,000	\$5,238,833	\$6,838,833	Complete
2017	T & W Dairy Biogas	T & W Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	South Tulare	New covered lagoon digester	RNG	294,982	\$2,600,000	\$6,147,941	\$8,747,941	Complete
2017	Trilogy Dairy Biogas	Trilogy Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Calgren	New covered lagoon digester	RNG	254,577	\$2,250,000	\$6,528,090	\$8,778,090	Complete
2017	Calgren Dairy Fuels LLC	Williams Family Dairy Digester Fuel Pipeline	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	Cogeneration (ethanol) and RNG	201,208	\$1,500,000	\$2,524,659	\$4,024,659	Canceled ****
2017	Wreden Ranch Dairy Biogas	Wreden Ranch Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	South Tulare	New covered lagoon digester	RNG***	393,915	\$3,000,000	\$5,215,483	\$8,215,483	Complete
2018	Calgren Dairy Fuels LLC	4K Dairy Digester Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	RNG	192,143	\$1,780,588	\$1,875,566	\$3,656,154	Complete
2018	Aemetis Advanced Fuels Inc	Ackerman Dairy Digester Pipeline Project	Maas Energy Works Inc	Ceres, Stanislaus Co.	Aemetis	New covered lagoon digester	RNG	89,574	\$1,331,291	\$1,581,769	\$2,913,060	Complete
2018	Aukeman Farms Dairy Biogas	Aukeman Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	207,701	\$1,765,457	\$3,072,438	\$4,837,895	Complete
2018	Belonave Dairy Biogas LLC	Belonave Dairy Biogas LLC	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	225,659	\$1,918,099	\$3,561,605	\$5,479,704	Complete
2018	BV Dairy LLC	BV Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	205,835	\$1,749,596	\$5,130,445	\$6,880,041	Complete

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2018	Calgren Dairy Fuels LLC	Cornerstone Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	185,238	\$1,266,053	\$1,275,663	\$2,541,716	Complete
2018	De Groot North Dairy Biogas	De Groot North Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	West Visalia	New covered lagoon digester	RNG	169,699	\$1,442,440	\$2,401,778	\$3,844,218	Canceled ****
2018	De Groot South Dairy Biogas	De Groot South Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	West Visalia	New covered lagoon digester	Electric Vehicle - Fuel Cell	199,477	\$1,542,697	\$1,581,310	\$3,124,007	Verification in Progress
2018	Decade Energy LLC	Decade Centralized Dairy Digester Pipeline Project	Maas Energy Works Inc	Tulare, Tulare Co.	Hanford-Lakeside	New covered lagoon digester	RNG	192,558	\$1,773,587	\$2,176,364	\$3,949,951	Complete
2018	DJ South Dairy Biogas LLC	DJ South Dairy Digester Pipeline Project	Maas Energy Works Inc	Chowchilla, Madera Co.	Merced-South	New covered lagoon digester	RNG	150,175	\$1,810,526	\$1,859,833	\$3,670,359	Verification in Progress
2018	Aemetis Advanced Fuels Inc	Double D Dairy Digester Pipeline Project	Maas Energy Works Inc	Ceres, Stanislaus Co.	Aemetis	New covered lagoon digester	RNG	189,850	\$1,822,668	\$2,225,662	\$4,048,330	Complete
2018	Double J Dairy Biogas	Double J Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	285,496	\$2,426,716	\$5,051,199	\$7,477,915	Complete
2018	Double L Dairy Biogas LLC	Double L Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Hanford-Lakeside	New covered lagoon digester	RNG	136,148	\$1,762,347	\$1,767,556	\$3,529,903	Complete
2018	Dykstra Dairy Biogas	Dykstra Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	265,936	\$2,260,454	\$3,276,239	\$5,536,693	Complete
2018	The El Monte Dairy Biogas	El Monte Dairy Biogas	California Bioenergy LLC	Tipton, Tulare Co.	South Tulare	New covered lagoon digester	RNG	118,903	\$1,010,674	\$3,026,715	\$4,037,389	Complete
2018	5H Dairy Biogas LLC	Five H Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	122,183	\$1,851,297	\$1,859,722	\$3,711,019	Complete
2018	FM Jersey Biogas LLC	FM Jerseys Dairy Digester Virtual Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	161,960	\$2,010,747	\$2,017,330	\$4,028,077	Complete
2018	Hoogendam Dairy Biogas LLC	Hoogendam Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	142,354	\$1,809,452	\$1,820,121	\$3,629,573	Complete
2018	Horizon Jersey Dairy Biogas	Horizon Jersey Dairy Biogas	California Bioenergy LLC	Tipton, Tulare Co.	South Tulare	New covered lagoon digester	RNG	335,398	\$2,850,886	\$3,788,728	\$6,639,614	Complete
2018	Jacobus De Groot Biogas LLC	Jacobus De Groot #2 Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	61,616	\$523,736	\$2,624,086	\$3,147,822	Complete
2018	Calgren Dairy Fuels LLC	Little Rock Centralized Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	146,839	\$2,096,578	\$2,268,895	\$4,365,473	Complete

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2018	Lone Oak Energy LLC	Lone Oak #1 Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Hanford-Lakeside	New covered lagoon digester	RNG	247,703	\$1,869,269	\$2,395,596	\$4,264,865	Complete
2018	Meirinho Dairy Biogas LLC	Meirinho Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	147,352	\$1,832,358	\$1,975,914	\$3,808,272	Complete
2018	Mellema Dairy Biogas	Mellema Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	152,057	\$1,292,485	\$3,342,228	\$4,634,713	Complete
2018	Milky Way Dairy Biogas	Milky Way Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	347,462	\$2,953,427	\$4,244,734	\$7,198,161	Canceled ****
2018	Mineral King Dairy Biogas	Mineral King Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	194,751	\$1,655,384	\$3,078,995	\$4,734,379	Complete
2018	Rancho Sierra Vista Dairy Biogas	Rancho Sierra Vista Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	172,958	\$1,470,143	\$3,045,546	\$4,515,689	Complete
2018	Red Rock Dairy Biogas LLC	Red Rock Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	156,242	\$2,031,126	\$2,039,438	\$4,070,564	Complete
2018	River Ranch Farms LLC	River Ranch Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Hanford-Lakeside	New covered lagoon digester	RNG	187,884	\$1,994,860	\$2,115,158	\$4,110,018	Complete
2018	Riverbend Dairy Biogas	Riverbend Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	245,930	\$2,090,404	\$2,664,638	\$4,755,042	Complete
2018	Calgren Dairy Fuels LLC	Riverview Dairy Digester Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	RNG	90,093	\$1,332,070	\$1,386,350	\$2,718,420	Complete
2018	Rob Van Grouw Dairy Biogas	Rob Van Grouw Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	140,442	\$1,193,757	\$3,366,012	\$4,559,769	Complete
2018	Rocking Horse Dairy Biogas	Rocking Horse Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	Hanford	New covered lagoon digester	RNG	119,540	\$1,016,091	\$1,172,419	\$2,188,510	Verification in Progress
2018	Rockshar Dairy Biogas LLC	Rockshar Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	124,664	\$1,679,093	\$1,679,620	\$3,358,713	Complete
2018	Scheenstra Dairy Biogas	Scheenstra Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	220,360	\$1,873,064	\$3,393,707	\$5,266,771	Complete
2018	Calgren Dairy Fuels LLC	Sousa & Sousa Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	68,700	\$886,934	\$892,931	\$1,779,865	Complete
2018	Udder Dairy Biogas	Udder Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	West Visalia	New covered lagoon digester	RNG	135,706	\$1,153,459	\$2,126,156	\$3,279,615	Complete

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2018	Valadao Dairy Biogas	Valadao Dairy Biogas	California Bioenergy LLC	Hanford, Kings Co.	Hanford	New covered lagoon digester	RNG	121,005	\$1,028,545	\$2,061,008	\$3,089,553	Complete
2018	Calgren Dairy Fuels LLC	Vander Poel Dairy Digester Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgren	New covered lagoon digester	RNG	290,060	\$1,972,485	\$2,222,073	\$4,194,558	Complete
2018	Vander Woude Dairy	Vander Woude Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced-South	New covered lagoon digester	RNG	188,575	\$1,863,562	\$1,863,864	\$3,727,426	Complete
2018	Vista Verde Dairy Biogas LLC	Vista Verde Dairy Digester Pipeline Project	Maas Energy Works Inc	Chowchilla, Madera Co.	Merced-South	New covered lagoon digester	RNG	140,653	\$1,594,109	\$1,643,656	\$3,237,765	Complete
2018	Western Sky Dairy Biogas	Western Sky Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	352,595	\$2,820,762	\$5,315,518	\$8,136,280	Complete
2019	Ahlem Farms Dairy Biogas	Ahlem Farms Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	153,151	\$1,546,738	\$4,557,504	\$6,104,242	In Progress
2019	Albert Goyenette Dairy Biogas	Albert Goyenette Dairy Biogas	California Bioenergy LLC	Buttonwillow, Kern Co.	Buttonwillow	New covered lagoon digester	RNG	199,706	\$1,609,316	\$3,588,642	\$5,197,958	Complete
2019	Art Leyendekker Dairy Biogas	Art Leyendekker Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	77,697	\$769,784	\$2,612,103	\$3,381,887	Complete
2019	DG Energy LLC	Avalon Dairy Digester Project	Maas Energy Works Inc	Wasco, Kern Co.	Calgren	New covered lagoon digester	RNG	159,758	\$1,917,757	\$1,917,757	\$3,835,514	In Progress
2019	Bar 20 Dairy Biogas, LLC	Bar 20 Dairy Biogas	California Bioenergy LLC	Kerman, Fresno Co.	NA	New covered lagoon digester	Electric Vehicle - Fuel Cell	374,390	\$3,000,000	\$6,345,131	\$9,345,131	Complete
2019	Charles Ahlem Ranch Dairy Biogas	Charles Ahlem Ranch Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	136,018	\$1,373,697	\$5,758,275	\$7,131,972	In Progress
2019	Clauss and Sunwest Dairy Biogas	Clauss and Sunwest Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	155,682	\$1,572,301	\$4,780,296	\$6,352,597	In Progress
2019	Curtimade Dairy Biogas	Curtimade Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	174,734	\$1,747,336	\$3,025,858	\$4,773,194	In Progress
2019	Dairyland Farms Dairy Biogas	Dairyland Farms Dairy Biogas	California Bioenergy LLC	Tipton, Tulare Co.	South Tulare	New covered lagoon digester	RNG	177,475	\$1,760,347	\$3,140,466	\$4,900,813	In Progress
2019	Tipton Pipeline LLC	De Boer Dairy Digester Pipeline Project	Maas Energy Works Inc	Tulare, Tulare Co.	Calgren	New covered lagoon digester	RNG	191,647	\$1,825,261	\$1,825,262	\$3,650,523	In Progress
2019	Lone Oak Energy LLC	Dixie Creek Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	271,176	\$2,436,030	\$2,473,632	\$4,909,662	Complete



CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2019	El Nido Biogas LLC	Double Diamond Dairy Digester Pipeline Project	Maas Energy Works Inc	El Nido, Merced Co.	Merced	New covered lagoon digester	RNG	290,633	\$2,037,766	\$2,578,783	\$4,616,549	Complete
2019	Elk Creek Dairy Biogas	Elk Creek Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	59,555	\$512,706	\$2,247,274	\$2,759,980	Complete
2019	Elkhorn Dairy Biogas	Elkhorn Dairy Biogas	California Bioenergy LLC	Dinuba, Tulare Co.	North Visalia	New covered lagoon digester	RNG	211,940	\$2,125,882	\$4,520,035	\$6,645,917	In Progress
2019	Tipton Pipeline LLC	Fern Oaks Dairy Digester Pipeline Project	Maas Energy Works Inc	Porterville, Tulare Co.	Calgryn	New covered lagoon digester	RNG	169,370	\$1,688,894	\$1,688,894	\$3,377,788	In Progress
2019	ENV-TWO LLC	Flint Dairy Biogas Project (Demonstration Project)	ENV-TWO LLC	Hanford, Kings Co.	NA	Demonstration Project: New up flow anaerobic sludge blanket digester	RNG	126,990	\$1,750,000	\$3,374,782	\$5,124,782	In Progress
2019	Friesian Farms Dairy Biogas	Friesian Farms Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	63,145	\$639,602	\$3,175,183	\$3,814,785	In Progress
2019	Gerben Leyendekker Dairy Biogas	Gerben Leyendekker Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	85,419	\$845,589	\$2,320,839	\$3,166,428	Complete
2019	GP Dairy Biogas	GP Dairy Biogas	California Bioenergy LLC	Visalia, Tulare Co.	North Visalia	New covered lagoon digester	RNG	50,722	\$502,554	\$2,915,623	\$3,418,177	Canceled ****
2019	Calgryn Dairy Fuels LLC	Hettinga Centralized Dairy Digester Pipeline Project	Maas Energy Works Inc	Pixley, Tulare Co.	Calgryn	New covered lagoon digester	RNG	167,339	\$2,352,909	\$2,576,784	\$4,929,693	Complete
2019	River Ranch Farms LLC	High Roller Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	105,257	\$1,412,136	\$1,412,136	\$2,824,272	In Progress
2019	Merced Pipeline LLC	Homen Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced	New covered lagoon digester	RNG	124,000	\$1,640,419	\$1,640,420	\$3,280,839	In Progress
2019	James Ahlem Dairy Biogas	James Ahlem Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	82,216	\$830,349	\$4,861,351	\$5,691,700	In Progress
2019	Lakeside Energy LLC	Lakeside Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	218,679	\$2,213,063	\$2,738,518	\$4,951,581	Complete
2019	Maya Dairy Biogas	Maya Dairy Biogas	California Bioenergy LLC	Buttonwillow, Kern Co.	Buttonwillow	New covered lagoon digester	RNG	250,090	\$2,015,393	\$2,938,894	\$4,954,287	Complete
2019	McMoo Farms Dairy Biogas	McMoo Farms Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	164,384	\$1,598,893	\$3,013,668	\$4,612,561	Complete
2019	Merced Pipeline LLC	Melo Dairy Digester Pipeline Project	Maas Energy Works Inc	Merced, Merced Co.	Merced	New covered lagoon digester	RNG	272,690	\$2,910,554	\$2,910,555	\$5,821,109	In Progress

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2019	Newhouse Dairy Biogas	Newhouse Dairy Biogas	California Bioenergy LLC	Bakersfield, Kern Co.	Kern	New covered lagoon digester	RNG	171,098	\$1,665,037	\$3,982,045	\$5,647,082	Complete
2019	Calgren Dairy Fuels LLC	Northstar Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	170,658	\$1,576,438	\$1,638,113	\$3,214,551	Complete
2019	Nyman Brothers Dairy Biogas	Nyman Brothers Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	68,026	\$687,006	\$4,654,902	\$5,341,908	In Progress
2019	Poplar Lane Dairy Biogas LLC	Poplar Lane Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	131,195	\$1,756,966	\$1,756,966	\$3,513,932	In Progress
2019	Rib-Arrow Dairy Biogas	Rib-Arrow Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	76,343	\$657,231	\$3,069,649	\$3,726,880	Complete
2019	Ribeiro Dairy Biogas	Ribeiro Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	132,348	\$1,124,962	\$1,613,882	\$2,738,844	Complete
2019	Rio Blanco Dairy Biogas	Rio Blanco Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	100,886	\$1,002,797	\$2,556,018	\$3,558,815	In Progress
2019	Calgren Dairy Fuels LLC	Schoff Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	129,082	\$1,444,592	\$1,527,538	\$2,972,130	Complete
2019	Calgren Dairy Fuels LLC	Simoës Centralized Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	161,275	\$2,036,460	\$2,043,922	\$4,080,382	Complete
2019	Skyview Dairy Biogas	Skyview Dairy Biogas	California Bioenergy LLC	Shafter, Kern Co.	Buttwillow	New covered lagoon digester	RNG	85,174	\$686,620	\$3,799,476	\$4,486,096	Complete
2019	Southern Cross Dairy Biogas	Southern Cross Dairy Biogas	California Bioenergy LLC	Buttwillow, Kern Co.	Buttwillow	New covered lagoon digester	RNG	125,872	\$1,019,121	\$4,601,953	\$5,621,074	Complete
2019	Southpoint Ranch Dairy Biogas	Southpoint Ranch Dairy Biogas	California Bioenergy LLC	Madera, Madera Co.	NA	New covered lagoon digester	Electric Vehicle - Fuel Cell	484,999	\$3,000,000	\$13,642,393	\$16,642,393	In Progress
2019	Van Der Hoek Dairy Biogas LLC	Van Der Hoek Dairy Digester Pipeline Project	Maas Energy Works Inc	Helm, Fresno Co.	Five Points	New covered lagoon digester	RNG	168,447	\$2,061,968	\$2,061,968	\$4,123,936	In Progress
2019	Van Der Kooi Power LLC	Van Der Kooi Dairy Digester Pipeline Project	Maas Energy Works Inc	Riverdale, Fresno Co.	Five Points	New covered lagoon digester	RNG	170,089	\$1,897,438	\$2,052,493	\$3,949,931	Complete
2019	L&J Vanderham Dairy	Vanderham Dairy Digester Pipeline Project	Maas Energy Works Inc	Riverdale, Fresno Co.	Five Points	New covered lagoon digester	RNG	186,037	\$1,984,951	\$2,090,233	\$4,075,184	Complete
2019	Whiteside Dairy Biogas	Whiteside Dairy Biogas	California Bioenergy LLC	Wasco, Kern Co.	Buttwillow	New covered lagoon digester	RNG	119,137	\$960,043	\$3,773,726	\$4,733,769	Complete

CDFA Dairy Digester Research and Development Program  
Funded Projects Report

2019	Yosemite Jersey Dairy Biogas	Yosemite Jersey Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	93,734	\$946,644	\$4,097,690	\$5,044,334	In Progress
2020	Denair Biogas LLC	Ahlem Farms Dairy Digester Project	Maas Energy Works Inc	Denair, Stanislaus Co.	Merced	New covered lagoon digester	RNG	167,761	\$1,195,000	\$3,130,536	\$4,325,536	In Progress
2020	Aemetis Biogas LLC	Ahlem Farms Jerseys - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Crows Landing, Stanislaus Co.	Aemetis Central	New covered lagoon digester	RNG	113,979	\$1,592,287	\$1,672,003	\$3,264,290	In Progress
2020	Aemetis Biogas LLC	Albert Mendes Dairy - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Crows Landing, Stanislaus Co.	Aemetis Central	New covered lagoon digester	RNG	99,372	\$1,388,241	\$1,735,754	\$3,123,995	In Progress
2020	Boschma Biogas LLC	Boschma Dairy Biogas	California Bioenergy LLC	Wasco, Kern Co.	NA	New covered lagoon digester	RNG	189,947	\$1,723,302	\$4,819,704	\$6,543,006	In Progress
2020	Maas Energy Works Inc	JDS Ranch Digester Project	Maas Energy Works Inc	Wasco, Kern Co.	Calgren	New covered lagoon digester	RNG	159,082	\$1,600,000	\$3,044,536	\$4,644,536	In Progress
2020	Calgren Dairy Fuels LLC	JR Dairy Digester Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	191,049	\$1,300,000	\$1,567,224	\$2,867,224	Complete
2020	Aemetis Biogas LLC	Oliveira Dairy - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Hilmar, Merced Co.	Aemetis Central	New covered lagoon digester	RNG	80,857	\$1,056,977	\$2,103,160	\$3,160,137	In Progress
2020	Poso Creek Biogas LLC	Poso Creek Dairy Biogas	California Bioenergy LLC	Wasco, Kern Co.	NA	New covered lagoon digester	RNG	171,854	\$1,464,930	\$5,344,556	\$6,809,486	In Progress
2020	Aemetis Biogas LLC	S&S Dairy - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Ceres, Stanislaus Co.	Aemetis Central	New covered lagoon digester	RNG	90,946	\$1,271,396	\$1,988,964	\$3,260,360	In Progress
2020	Aemetis Biogas LLC	Trinkler Dairy - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Ceres, Stanislaus Co.	Aemetis Central	New covered lagoon digester	RNG	85,529	\$1,194,840	\$1,451,336	\$2,646,176	In Progress
2020	Aemetis Biogas LLC	Wickstrom Jersey Farms - AAFK Central Dairy Digester Cluster	Aemetis Biogas LLC	Hilmar, Merced Co.	Aemetis Central	New covered lagoon digester	RNG	121,350	\$1,342,980	\$1,383,737	\$2,726,717	In Progress
2020	Wilson Dairy Biogas LLC	Wilson Dairy Digester Project	Maas Energy Works Inc	Riverdale, Fresno Co.	Five Points	New covered lagoon digester	RNG	206,745	\$1,400,000	\$2,060,714	\$3,460,714	Complete
2022	3Machado Dairy Biogas LLC	3 Machados Dairy Digester Project	Maas Energy Works Inc	Merced, Merced Co.	Merced	New covered lagoon digester	RNG	158,441	\$1,200,000	\$3,527,795	\$4,727,795	In Progress
2022	Bar Mac Dairy Biogas LLC	Bar Mac Dairy Biogas	California Bioenergy LLC	Gustine, Merced Co.	Gustine	New covered lagoon digester	RNG	91,235	\$912,352	\$6,844,732	\$7,757,084	In Progress

2022	San Joaquin Valley Energy LLC	CDF Howard Dairy Digester Project	Maas Energy Works Inc	Livingston, Merced Co.	Merced	New covered lagoon digester	RNG	316,585	\$1,600,000	\$8,102,501	\$9,702,501	In Progress
2022	Couco Creek Biogas LLC	Couco Creek Dairy Digester Project	Maas Energy Works Inc	Turlock, Stanislaus Co.	Merced	New covered lagoon digester	RNG	155,255	\$1,600,000	\$4,275,216	\$5,875,216	In Progress
2022	Grand View Dairy	Grand View Dairy Digester Project	Maas Energy Works Inc	Le Grand, Merced Co.	Merced	New covered lagoon digester	RNG	132,103	\$1,600,000	\$4,414,535	\$6,014,535	In Progress
2022	Egbert J DeGroot DBA Lakeshore Dairy	Lakeshore Dairy Digester Project	Maas Energy Works Inc	Hanford, Kings Co.	Merced	New covered lagoon digester	RNG	159,224	\$1,600,000	\$3,972,072	\$5,572,072	In Progress
2022	Calgren Dairy Fuels LLC	Legen Dairy Digester Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	113,934	\$1,200,000	\$3,940,407	\$5,140,407	In Progress
2022	Lerda-Goni Farms Biogas LLC	Lerda-Goni Farms Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	45,677	\$502,448	\$3,988,935	\$4,491,383	In Progress
2022	Martins View Jersey Dairy Biogas LLC	Martins View Jersey Dairy Biogas	California Bioenergy LLC	Gustine, Merced Co.	Gustine	New covered lagoon digester	RNG	81,822	\$818,216	\$5,905,782	\$6,723,998	In Progress
2022	Mattos Bros Dairy, L.P.	Mattos Bros Dairy Digester Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	119,017	\$1,600,000	\$2,732,819	\$4,332,819	In Progress
2022	Meirinho West Dairy Biogas LLC	Meirinho West Dairy Digester Project	Maas Energy Works Inc	Modesto, Stanislaus Co.	Merced	New covered lagoon digester	RNG	166,952	\$1,600,000	\$3,816,266	\$5,416,266	In Progress
2022	P&M Dairy and VP Farms Biogas	P&M Dairy and VP Farms Biogas	California Bioenergy LLC	Tipton, Tulare Co.	South Tulare	New covered lagoon digester	RNG	154,656	\$1,546,564	\$4,626,524	\$6,173,088	In Progress
2022	Second Street Energy LLC	River Rock Dairy Digester Project	Maas Energy Works Inc	Stevinson, Stanislaus Co.	Merced	New covered lagoon digester	RNG	104,835	\$1,600,000	\$4,115,962	\$5,715,962	In Progress
2022	Top O' The Morn Farms Biogas LLC	Top O' The Morn Farms Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	132,103	\$1,332,252	\$3,923,771	\$5,256,023	In Progress
<b>Totals</b>								<b>22,955,633</b>	<b>\$213,737,716</b>	<b>\$432,690,148</b>	<b>\$646,427,864</b>	

\*Estimated reductions calculated using the CARB Quantification Methodology and calculator tool. MTCO<sub>2e</sub>: Metric tonnes of carbon dioxide equivalent.

\*\*Matching funds are subject to change.

\*\*\*RNG: Renewable Natural Gas

\*\*\*\*Project canceled due to substantive changes to project scope.

\*Defunct digester was non-functional for a minimum of 12 consecutive months.

**Table 5.** Cost Effectiveness Summary of Dairy Digester Projects Funded by CDFA.

<b>Year Awarded</b>	<b>Project Title</b>	<b>Total cost of 1 MTCO<sub>2e</sub> GHG reduction (Grant + Matching Funds)</b>	<b>Grant cost per 1 MTCO<sub>2e</sub> GHG reduction</b>	<b>% of 1 MTCO<sub>2e</sub> reduction supported cost by Grant</b>
2015	Carlos Echeverria & Sons Dairy Biogas Project	\$32.61	\$4.97	15
2015	Lakeview Dairy Biogas Digester	\$49.47	\$13.88	28
2015	Open Sky Ranch Dairy Digester	\$7.59	\$3.76	50
2015	Verwey-Hanford Dairy Digester	\$11.22	\$5.60	50
2015	Verwey-Madera Dairy Digester	\$19.22	\$9.50	49
2015	West-Star North Dairy Digester	\$51.77	\$11.57	22
2017	Bos Farms Dairy Biogas	\$39.78	\$8.91	22
2017	Circle A Dairy Digester Fuel Pipeline Project	\$17.87	\$7.57	42
2017	Cloverdale Dairy Biogas	\$24.82	\$8.31	33
2017	Hamstra Dairy Biogas	\$42.08	\$9.75	23
2017	Hollandia Farms Dairy Biogas	\$43.52	\$8.41	19
2017	K&M Visser Dairy Digester Fuel Pipeline Project	\$16.55	\$7.30	44
2017	Legacy Dairy Digester Fuel Pipeline	\$16.59	\$7.48	45
2017	Maple Dairy Biogas	\$27.93	\$8.76	31
2017	Moonlight Dairy Biogas	\$51.28	\$9.69	19
2017	Pixley Dairy Digester Fuel Pipeline Project	\$15.21	\$7.43	49
2017	R Vander Eyk Dairy Digester Fuel Pipeline Project	\$19.64	\$7.54	38
2017	Rancho Teresita Dairy Biogas	\$32.17	\$8.89	28
2017	Red Top Madera Dairy Digester Project	\$21.41	\$10.62	50
2017	S&S Dairy Biogas	\$40.85	\$9.56	23
2017	T & W Dairy Biogas	\$29.66	\$8.81	30
2017	Trilogy Dairy Biogas	\$34.48	\$8.84	26
2017	Williams Family Dairy Digester Fuel Pipeline	\$20.00	\$7.45	37
2017	Wreden Ranch Dairy Biogas	\$20.86	\$7.62	37
2018	4K Dairy Digester Pipeline Project	\$19.03	\$9.27	49

2018	Ackerman Dairy Digester Pipeline Project	\$32.52	\$14.86	46
2018	Aukeman Dairy Biogas	\$23.29	\$8.50	36
2018	Belonave Dairy Biogas LLC	\$24.28	\$8.50	35
2018	BV Dairy Biogas	\$33.43	\$8.50	25
2018	Cornerstone Dairy Digester Pipeline Project	\$13.72	\$6.83	50
2018	<del>De Groot North Dairy Biogas</del>	<del>\$22.65</del>	<del>\$8.50</del>	<del>38</del>
2018	De Groot South Dairy Biogas	\$28.94	\$7.73	27
2018	Decade Centralized Dairy Digester Pipeline Project	\$20.51	\$9.21	45
2018	DJ South Dairy Digester Pipeline Project	\$24.44	\$12.06	49
2018	Double D Dairy Digester Pipeline Project	\$21.32	\$9.60	45
2018	Double J Dairy Biogas	\$26.19	\$8.50	32
2018	Double L Dairy Digester Pipeline Project	\$25.93	\$12.94	50
2018	Dykstra Dairy Biogas	\$20.82	\$8.50	41
2018	El Monte Dairy Biogas	\$33.96	\$8.50	25
2018	Five H Dairy Digester Pipeline Project	\$30.37	\$15.15	50
2018	FM Jerseys Dairy Digester Virtual Pipeline Project	\$24.87	\$12.42	50
2018	Hoogendam Dairy Digester Pipeline Project	\$25.50	\$12.71	50
2018	Horizon Jersey Dairy Biogas	\$19.80	\$8.50	43
2018	Jacobus De Groot #2 Dairy Biogas	\$51.09	\$8.50	17
2018	Little Rock Centralized Dairy Digester Pipeline Project	\$29.73	\$14.28	48
2018	Lone Oak #1 Dairy Digester Pipeline Project	\$17.22	\$7.55	44
2018	Meirinho Dairy Digester Pipeline Project	\$25.84	\$12.44	48
2018	Mellema Dairy Biogas	\$30.48	\$8.50	28
2018	<del>Milky Way Dairy Biogas</del>	<del>\$20.72</del>	<del>\$8.50</del>	<del>41</del>
2018	Mineral King Dairy Biogas	\$24.31	\$8.50	35
2018	Rancho Sierra Vista Dairy Biogas	\$26.11	\$8.50	33
2018	Red Rock Dairy Digester Pipeline Project	\$26.05	\$13.00	50
2018	River Ranch Dairy Digester Pipeline Project	\$21.88	\$10.62	49
2018	Riverbend Dairy Biogas	\$19.33	\$8.50	44
2018	Riverview Dairy Digester Pipeline Project	\$30.17	\$14.79	49
2018	Rob Van Grouw Dairy Biogas	\$32.47	\$8.50	26

2018	Rocking Horse Dairy Biogas	\$31.69	\$8.50	27
2018	Rockshar Dairy Digester Pipeline Project	\$26.94	\$13.47	50
2018	Scheenstra Dairy Biogas	\$23.90	\$8.50	36
2018	Sousa & Sousa Dairy Digester Pipeline Project	\$25.91	\$12.91	50
2018	Udder Dairy Biogas	\$24.17	\$8.50	35
2018	Valadao Dairy Biogas	\$25.53	\$8.50	33
2018	Vander Poel Dairy Digester Pipeline Project	\$14.46	\$6.80	47
2018	Vander Woude Dairy Digester Pipeline Project	\$19.77	\$9.88	50
2018	Vista Verde Dairy Digester Pipeline Project	\$23.02	\$11.33	49
2018	Western Sky Dairy Biogas	\$23.08	\$8.00	35
2019	Ahlem Farms Dairy Biogas	\$39.86	\$10.10	25
2019	Albert Goyenette Dairy Biogas	\$43.08	\$8.06	19
2019	Art Leyendekker Dairy Biogas	\$47.43	\$9.91	21
2019	Avalon Dairy Digester Project	\$24.01	\$12.00	50
2019	Bar 20 Dairy Biogas	\$24.96	\$8.01	32
2019	Charles Ahlem Ranch Dairy Biogas	\$52.43	\$10.10	19
2019	Clauss and Sunwest Dairy Biogas	\$40.80	\$10.10	25
2019	Curtimade Dairy Biogas	\$27.32	\$10.00	37
2019	Dairyland Farms Dairy Biogas	\$27.61	\$9.92	36
2019	De Boer Dairy Digester Pipeline Project	\$19.05	\$9.52	50
2019	Dixie Creek Dairy Digester Pipeline Project	\$18.11	\$8.98	50
2019	Double Diamond Dairy Digester Pipeline Project	\$14.02	\$7.01	50
2019	Elk Creek Dairy Biogas	\$69.00	\$8.61	12
2019	Elkhorn Dairy Biogas	\$31.36	\$10.03	32
2019	Fern Oaks Dairy Digester Pipeline Project	\$19.94	\$9.97	50
2019	Flint Dairy Biogas Project (Demonstration Project)	\$40.36	\$13.78	34
2019	Friesian Farms Dairy Biogas	\$60.41	\$10.13	17
2019	Gerben Leyendekker Dairy Biogas	\$43.88	\$9.90	23
2019	GP Dairy Biogas	<del>\$67.39</del>	<del>\$9.91</del>	15
2019	Hettinga Centralized Dairy Digester Pipeline Project	\$28.12	\$14.06	50
2019	High Roller Dairy Digester Pipeline Project	\$26.83	\$13.42	50

2019	Homen Dairy Digester Pipeline Project	\$26.46	\$13.23	50
2019	James Ahlem Dairy Biogas	\$69.23	\$10.10	15
2019	Lakeside Dairy Digester Pipeline Project	\$20.24	\$10.12	50
2019	Maya Dairy Biogas	\$35.87	\$8.06	22
2019	McMoo Farms Dairy Biogas	\$28.06	\$9.73	35
2019	Melo Dairy Digester Pipeline Project	\$21.35	\$10.67	50
2019	Newhouse Dairy Biogas	\$33.00	\$9.73	29
2019	Northstar Dairy Digester Pipeline Project	\$18.47	\$9.24	50
2019	Nyman Brothers Dairy Biogas	\$78.53	\$10.10	13
2019	Poplar Lane Dairy Digester Pipeline Project	\$26.78	\$13.39	50
2019	Rib-Arrow Dairy Biogas	\$54.69	\$8.61	16
2019	Ribeiro Dairy Biogas	\$20.69	\$8.50	41
2019	Rio Blanco Dairy Biogas	\$35.28	\$9.94	28
2019	Schott Dairy Digester Pipeline Project	\$22.38	\$11.19	50
2019	Simoes Centralized Digester Pipeline Project	\$25.25	\$12.63	50
2019	Skyview Dairy Biogas	\$98.30	\$8.06	8
2019	Southern Cross Dairy Biogas	\$72.23	\$8.10	11
2019	Southpoint Ranch Dairy Biogas	\$34.31	\$6.19	18
2019	Van Der Hoek Dairy Digester Pipeline Project	\$24.48	\$12.24	50
2019	Van Der Kooi Dairy Digester Pipeline Project	\$22.31	\$11.16	50
2019	Vanderham Dairy Digester Pipeline Project	\$21.34	\$10.67	50
2019	Whiteside Dairy Biogas	\$68.41	\$8.06	12
2019	Yosemite Jersey Dairy Biogas	\$53.82	\$10.10	19
2020	Ahlem Farms Dairy Digester Project	\$25.78	\$7.12	28
2020	Ahlem Farms Jerseys - AAFK Central Dairy Digester Cluster	\$28.64	\$13.97	49
2020	Albert Mendes Dairy - AAFK Central Dairy Digester Cluster	\$31.44	\$13.97	44
2020	Boschma Dairy Biogas	\$34.45	\$9.07	26
2020	JDS Ranch Digester Project	\$29.20	\$10.06	34
2020	JR Dairy Digester Project	\$16.61	\$6.80	41
2020	Oliveira Dairy - AAFK Central Dairy Digester Cluster	\$39.08	\$13.07	33
2020	Poso Creek Dairy Biogas	\$39.62	\$8.52	22



2020	S&S Dairy - AAFK Central Dairy Digester Cluster	\$35.85	\$13.98	39
2020	Trinkler Dairy - AAFK Central Dairy Digester Cluster	\$30.94	\$13.97	45
2020	Wickstrom Jersey Farms - AAFK Central Dairy Digester Cluster	\$22.47	\$11.07	49
2020	Wilson Dairy Digester Project	\$16.74	\$6.77	40
2022	3 Machados Dairy Digester Project	\$29.84	\$7.57	25
2022	Bar Mac Dairy Biogas	\$85.02	\$10.00	12
2022	CDF Howard Dairy Digester Project	\$30.65	\$5.05	16
2022	Couco Creek Dairy Digester Project	\$37.84	\$10.31	27
2022	Grand View Dairy Digester Project	\$45.53	\$12.11	27
2022	Lakeshore Dairy Digester Project	\$35.00	\$10.05	29
2022	LegenDairy Digester Project	\$45.12	\$10.53	23
2022	Lerda-Goni Farms Biogas	\$98.33	\$11.00	11
2022	Martins View Jersey Dairy Biogas	\$82.18	\$10.00	12
2022	Mattos Bros Dairy Digester Project	\$36.40	\$13.44	37
2022	Meirinho West Dairy Digester Project	\$32.44	\$9.58	30
2022	P&M Dairy and VP Farms Biogas	\$39.91	\$10.00	25
2022	River Rock Dairy Digester Project	\$54.52	\$15.26	28
2022	Top O' The Morn Farms Biogas	\$39.79	\$10.08	25

## I. Individual Project Information

This section only contains information on individual projects funded through the CDFA DDRDP in 2022. Information on previous projects listed in past reports can be found as an addendum and posted on the DDRDP webpage.

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*Bar Mac Dairy Biogas*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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The project is committed to building a tier 1 double-lined, covered lagoon digester, a biogas conditioning system, a biogas to biomethane upgrader, and a high-pressure tube trailer truck loading station. The produced RNG will be tube-trailer down to the CalBioGas South Tulare interconnection location, or alternatively other nearby CalBio facilities, for off-loading and metering into the SoCalGas pipeline.

- Location – Gustine, California (Merced County)
- CDFA DDRDP Funding - \$ 912,352
- Matching funds - \$6,844,732.06
- Total Projects costs – \$7,757,084.06
- Estimated 10-year GHG reductions - 91,235 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar – 0.10 MTCO<sub>2e</sub>
- GHG reduction per total project dollars – 0.12 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$85.02

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*CDF Howard Dairy Digester Project*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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CDF Howard Dairy Digester Project is a new covered lagoon digester at the CDF Howard Dairy. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central

Valley and the state.

- Location - Livingston, California (Merced County)
- CDFA DDRDP Funding - \$ 1,600,000
- Matching funds - \$8,102,501
- Total Projects costs – \$9,702,501
- Estimated 10-year GHG reductions – 316,585 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar – 0.20 MTCO<sub>2e</sub>
- GHG reduction per total project dollars – 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$ 30.65

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*Couco Creek Dairy Digester Project*

*Funded: 2022*

*Status: In Progress*

*Expected Completion Date: December 2024*

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Couco Creek Dairy Digester Project is a new covered lagoon digester at the Couco Creek Dairy. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location - Turlock, California (Stanislaus County)
- CDFA DDRDP Funding - \$ 1,600,000
- Matching funds - \$4,275,216
- Total Projects costs – \$5,875,216
- Estimated 10-year GHG reductions – 155,255 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar – 0.10 MTCO<sub>2e</sub>
- GHG reduction per total project dollars – 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$ 37.84

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*Grand View Dairy Digester Project*

*Funded: 2022*

*Status: In Progress*

*Expected Completion Date: December 2024*

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Grand View Dairy Digester Project is a new covered lagoon digester at the Grand View Dairy in Merced County, California. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location - Le Grand, California (Merced County)
- CDFA DDRDP Funding - \$1,600,000
- Matching funds – \$4,414,535
- Total Projects costs - \$6,014,535
- Estimated 10-year GHG reductions – 132,103 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar – 0.08 MTCO<sub>2e</sub>
- GHG reduction per total project dollars – 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$12.12

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*Lakeshore Dairy Digester Project*

*Funded: 2022*

*Status: In Progress*

*Expected Completion Date: December 2024*

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Lakeshore Dairy Digester Project is a new covered lagoon digester at the Lakeshore Dairy. The project is owned by Lakeshore Dairy and will be trucking biomethane to the Merced Pipeline Cluster. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location - Hanford, California (Kings County)
- CDFA DDRDP Funding- 1,600,000
- Matching funds - \$3,972,072
- Total Projects costs - \$ 5,572,072
- Estimated 10-year GHG reductions - 159,224 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.099 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$34.99

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*LegenDairy Digester Project*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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LegenDairy Digester Project is a new covered lagoon digester at LegenDairy Farms in Tulare County. The project is owned by Calgren Dairy Fuels and will be a part of the Calgren Dairy Fuels Cluster. The biogas from this new digester will be transported via the cluster's private, low-pressure pipeline to the gas upgrading hub. At the upgrading facility, the biogas will be upgraded to biomethane and injected into the SoCalGas pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state. The project is developed by Maas Energy Works.

- Location - Tipton, California (Tulare County)
- CDFA DDRDP Funding - \$ 1,200,000
- Matching funds - \$ 3,940,407
- Total Projects costs - \$ 5,140,407
- Estimated 10-year GHG reductions - 113,934 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.094 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$45.11

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*Lerda-Goni Farms Biogas*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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Lerda-Goni Farms is part of the established South Tulare dairy biogas to fuel cluster in Tulare County, CA. The dairy will install a Tier 1 designed manure-only covered lagoon digester with integrated gas storage and pre-treatment. An on-dairy biogas conditioning and compressor will remove hydrogen sulfide and moisture and then meter and move the clean biogas into a gathering line connecting to centralized biogas upgrading and interconnection facility. The project's biomethane will be delivered as R-CNG to fleets and CNG fueling stations in California.

- Location- Tulare, California (Tulare County)
- CDFA DDRDP Funding - \$502,448
- Matching funds - \$3,988,935
- Total Projects costs - \$ 4,491,382
- Estimated 10-year GHG reductions - 45,677 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.091MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.01 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub>- \$98.33

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*3 Machados Dairy Digester Project*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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3 Machados Dairy Digester Project is a new covered lagoon digester at 3 Machados Dairy. The biogas from this new digester will be transported via the cluster's private, low-pressure pipeline to the gas upgrading facility. At the hub facility, the biogas will be upgraded into biomethane and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location – Merced, California (Merced County)
- CDFA DDRDP Funding - \$1,200,000
- Matching funds - \$3,527,795
- Total Projects costs – \$4,727,795
- Estimated 10-year GHG reductions – 158,441 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar – 0.13 MTCO<sub>2e</sub>
- GHG reduction per total project dollars – 0.04 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$ 29.84

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*Martins View Jersey Dairy Biogas*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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The project is committed to building a tier 1 double-lined, covered lagoon digester, a biogas conditioning system (iron sponge and activated

carbon based H<sub>2</sub>S scrubber), a biogas to biomethane upgrader (skid mounted and located on-site) and a high-pressure tube trailer truck loading station. The produced RNG will be tube-trailer down to the CalBioGas South Tulare interconnection location, or alternatively other nearby CalBio facilities, for off-loading and metering into the SoCalGas pipeline.

- Location - Gustine, California (Merced County)
- CDFA DDRDP Funding - \$ 818,216
- Matching funds - \$ 5,905,782
- Total Projects costs - \$ 6,723,997
- Estimated 10-year GHG reductions - 81,822 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.10 MTCO<sub>2e</sub>
- GHG reduction per total project dollars -0.01 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$82.18

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*Mattos Bros Dairy Digester Project*

*Funded: 2022*

*Status: In Progress*

*Expected Completion Date: December 2024*

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Mattos Bros Dairy Digester Project is a new covered lagoon digester at the Mattos Bros Dairy. The project is owned by Mattos Bros Dairy L.P. and will be a part of the Lakeside Pipeline Cluster. The biogas from this new digester will be transported via the cluster's private, low-pressure pipeline to the gas upgrading facility. At the hub facility, the biogas will be upgraded into biomethane and injected into the SCG pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location- Hanford, California (Kings County)
- CDFA DDRDP Funding - \$ 1,600,000
- Matching funds - \$ 2,732,819
- Total Projects costs - \$ 4,332,819
- Estimated 10-year GHG reductions - 119,017 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.07 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$36.41

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*Meirinho West Dairy Digester Project*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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Meirinho West Dairy Digester Project is a new covered lagoon digester at the Meirinho West Dairy. The project is owned by Meirinho West Dairy Biogas LLC and will be trucking biomethane to the Merced Pipeline Cluster. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location - Modesto, California (Stanislaus County)
- CDFA DDRDP Funding - \$ 1,600,000
- Matching funds - \$ 3,816,266
- Total Projects costs - \$ 5,416,266
- Estimated 10-year GHG reductions - 166,952 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.104 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.031 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$32.44

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*P&M Dairy and VP Farms Biogas*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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P&M Dairy and VP Farms are two neighboring dairies within the established South Tulare dairy biogas to fuel cluster in Tulare County, CA. The dairies will install a shared Tier 1 designed manure-only covered lagoon digester with integrated gas storage and pre-treatment. The dairies will also share an on-dairy biogas conditioning and compressor which will remove hydrogen sulfide and moisture and then meter and move the clean biogas from both dairies into a gathering line connecting to centralized biogas upgrading and interconnection facility. The



project's biomethane will be delivered as R-CNG to fleets and CNG fueling stations in California.

- Location - Tipton, California (Tulare County)
- CDFA DDRDP Funding - \$ 1,546,564
- Matching funds - \$ 4,626,524
- Total Projects costs - \$ 6,173,088
- Estimated 10-year GHG reductions - 154,656 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.10 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$39.91

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*River Rock Dairy Digester Project*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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River Rock Dairy Digester Project is a new covered lagoon digester at the River Rock Dairy. The project is owned by Second Street Energy LLC and will and will be trucking biomethane to the Merced Pipeline Cluster. The biogas from this new digester will be upgraded to biomethane onsite at the dairy and then transported via truck to the Merced upgrading facility and utility interconnection. At the Merced facility, the biomethane will be offloaded and injected into the utility pipeline for delivery to contracted CNG fueling stations in the Central Valley and the state.

- Location - Stevinson, California (Stanislaus County)
- CDFA DDRDP Funding - \$ 1,600,000
- Matching funds - \$ 4,115,962
- Total Projects costs - \$ 5,715,962
- Estimated 10-year GHG reductions - 104,835 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.07 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.02 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$54.52

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*Top O' The Morn Farms Biogas*  
*Funded: 2022*  
*Status: In Progress*  
*Expected Completion Date: December 2024*

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Top O' The Morn Farms is part of the established South Tulare dairy biogas to fuel cluster in Tulare County, CA. The dairy will install a Tier 1 designed manure-only covered lagoon digester with integrated gas storage and pre-treatment. An on-dairy biogas conditioning and compressor will remove hydrogen sulfide and moisture and then meter and move the clean biogas into a gathering line connecting to centralized biogas upgrading and interconnection facility. The project's biomethane will be delivered as RCNG to fleets and CNG fueling stations in California.

- Location - Tulare, California (Tulare County)
- CDFA DDRDP Funding - \$ 1,332,251
- Matching funds - \$ 3,923,771
- Total Projects costs - \$ 5,256,023
- Estimated 10-year GHG reductions - 132,103 MTCO<sub>2e</sub>
- GHG reductions per CDFA grant dollar - 0.099 MTCO<sub>2e</sub>
- GHG reduction per total project dollars - 0.03 MTCO<sub>2e</sub>
- Total cost per MTCO<sub>2e</sub> - \$39.79

## Appendix A

### Greenhouse Gas Calculations– Report of Funded Projects (2015 – 2023) for the Dairy Digester Research and Development Program (DDRDP)

All emissions data were extracted from the CARB Greenhouse Gas Emission Inventory – Query Tool for years 2000 to 2020(15<sup>th</sup> Edition) available at <https://ww2.arb.ca.gov/applications/greenhouse-gas-emission-inventory-0>

#### 1) Greenhouse Gas (GHG) Emissions from California Agriculture as a portion of California’s Total Annual GHG Emissions

In 2020, agriculture contributed approximately **31.62 million metric tons** of carbon dioxide equivalents (MMT<sub>CO<sub>2</sub>e</sub>), or **8.6 percent** of California’s total annual GHG emissions.

- California Total GHG emissions (all GHGs) in 2020 = 369.231 MMT<sub>CO<sub>2</sub>e</sub>
- CA Agriculture GHG emissions (all GHGs) in 2020 = 31.626 MMT<sub>CO<sub>2</sub>e</sub>
- Thus,

$$\left( \frac{\text{CA Agriculture GHG Emission}}{\text{CA Total GHG Emission}} \right) \times 100 = \left( \frac{31.626}{369.231} \right) \times 100 = 8.565 \approx \mathbf{8.6\%}$$

#### 2) Methane Emissions from Manure Management relative to California’s Total Annual GHG Emissions (A), and California’s Agricultural GHG Emissions (B)

Methane emissions resulting from manure management, a subset of these total statewide agricultural methane emissions, account for approximately **2.7 percent of the total statewide GHG emissions**, or approximately **32 percent of the agricultural GHG emissions**.

- In 2020, manure management methane emissions from all livestock were equivalent to 10.118 MMT<sub>CO<sub>2</sub>e</sub>
- Thus,

$$\mathbf{(A)} \left( \frac{\text{Manure Methane Emission (livestock)}}{\text{CA Total GHG Emission}} \right) \times 100 = \left( \frac{10.118}{369.231} \right) \times 100 \approx \mathbf{2.7\%}$$

of all California GHG emissions come from the methane emissions from manure management and;

$$\mathbf{(B)} \left( \frac{\text{Manure Methane Emission (livestock)}}{\text{CA Agriculture GHG Emission}} \right) \times 100 = \left( \frac{10.118}{31.626} \right) \times 100 \approx \mathbf{32\%}$$

of all agricultural GHG emissions in CA comes from the methane emissions from manure management.

### 3) Estimated GHG Emissions Reductions Achieved by DDRDP Funded Projects relative to California's Methane Emissions from Manure Management (in 2020, C and 2013, D), and California's Agricultural GHG Emissions (in 2020, E)

The projects referenced in the report have a cumulative estimated GHG reduction of **21.95 MMTCO<sub>2</sub>e over ten years**, or approximately **2.3 MMTCO<sub>2</sub>e annually**. The funded projects equate to addressing approximately **22.7 percent** of the methane emissions from manure management in California and **7.3 percent** of the total GHG emissions from the agriculture sector in California.

- DDRDP has 131 funded digester projects (complete and in progress) and those are equivalent to 22.95 MMTCO<sub>2</sub>e (over 10 years) or 2.3 MMTCO<sub>2</sub>e/year. This value does not include Alternative Manure Management Program (AMMP) funded projects, which is approximately 0.26 MMTCO<sub>2</sub>e/year.
- Methane emissions from manure management in 2020 = 10.118 MMTCO<sub>2</sub>e
- Methane emissions from manure management in 2013 = 10.545 MMTCO<sub>2</sub>e.
- Thus,

$$(C) \left( \frac{\text{DDRDP GHG Annual Emission Reduction}}{\text{Manure Methane Emission (livestock) in 2019}} \right) \times 100 = \left( \frac{2.3}{10.118} \right) \times 100 = 22.7\%$$

and

$$(D) \left( \frac{\text{DDRDP GHG Annual Emission Reduction}}{\text{Manure Methane Emission (livestock) in 2013}} \right) \times 100 = \left( \frac{2.3}{10.545} \right) \times 100 = 21.8\%$$

Therefore,  $\approx$  more than **22 percent** of methane emissions reduction from manure management are achieved by DDRDP projects.

and,

$$(E) \left( \frac{\text{DDRDP GHG Annual Emission Reduction}}{\text{CA Agriculture GHG Emission}} \right) \times 100 = \left( \frac{2.3}{31.626} \right) \times 100 = 7.27 \approx 7.3\%$$

of GHG emissions reduction from agriculture are achieved by DDRDP projects.