# Attachment “1”

## 2019 Annual Report

# TULARE COUNTY
# RESOURCE MANAGEMENT AGENCY

5961 South Mooney Boulevard
Visalia, CA 93277

# 2019 ANNUAL REPORT

OF TOTAL GREENHOUSE GAS EMISSIONS FROM
DAIRIES AND FEEDLOTS FOR FISCAL YEAR 2019

June 2020

Prepared by

Tulare County Resources Management Agency
Planning Branch

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# I. INTRODUCTION

The 2019 Annual Report of total Greenhouse Gas ("GHG") emissions from dairies and feedlots for Fiscal Year 2019 is a requirement of a Stipulated Settlement ("Settlement"). The Settlement became effective August 2, 2019, completely resolving Case No. 272380 - Petition for Writ of Mandate and Complaint for Declaratory and Injunctive Relief, Superior Court, State of California, County of Tulare, Visalia Division, challenging the certification by the County of Tulare of the 2017 Environmental Impact Report for the 2017 Animal Facilities Confinement Plan and related General Plan Amendments Zone Changes, and Dairy and Feedlot Climate Action Plan. The ACFP and Dairy CAP are components of the County's General Plan and are part of the Settlement by and between the Sierra Club, Association of Irritated Residents, and Center for Biological Diversity (collectively "Petitioners" or "Plaintiffs") and the County of Tulare, a political subdivision of the State of California and the Board of Supervisors of the County of Tulare (collectively "County").

## A. BACKGROUND

On November 30, 2011, in accordance with the California Environmental Quality Act ("CEQA"), the County of Tulare filed a Notice of Preparation ("NOP") with the California State Clearinghouse in the Governor's Office of Planning and Research as notification that a Draft EIR would be prepared for the 2017 ACFP and 2017 Dairy CAP. The NOP was distributed to involved public agencies and other interested parties for a 30-day public review period. The purpose of the public review period was to solicit comments on the scope and content of the environmental analysis to be included in the EIR.

On February 3, 2016, a Notice of Completion for a Draft EIR for the 2017 ACFP and 2017 Dairy CAP was filed with the State Clearinghouse, together with the requisite number of copies of the Draft EIR to be mailed to affected public agencies and interested parties, indicating a 45-day review period commencing on February 4, 2016, and ending on March 21, 2016.

On February 4, 2016, a Notice of Availability of a Draft EIR was duly published in the Visalia Times-Delta, Porterville Recorder, and Dinuba Sentinel, which are newspapers of general circulation in Tulare County, as well as the Bakersfield Californian and Delano Record in Kern County.

On February 4, 2016, a Notice of Availability of a Draft EIR was posted in the office of the Tulare County Clerk for a 45-day public review period commencing on February 4, 2016, and ending on March 21, 2016.

On September 8, 2017, a copy of the written responses to the timely public comments on the Draft EIR was sent to the commenting public agencies and interested parties in a manner that public agencies and interested parties received it at least 10 days before the Board of Supervisors meeting where the Board was scheduled to act upon the Planning Commission's recommendation to certify the EIR.

On October 12, 2017, a Notice of Availability of a Draft EIR and Notice of Public Hearing was duly published in the Visalia Times-Delta, Porterville recorder, Dinuba Sentinel, Bakersfield Californian, and Delano Record, newspapers of general circulation, for a Planning Commission meeting set for October 25, 2017.

On October 25, 2017, the Planning Commission held a duly notice meeting where staff presented evidence regarding the Final EIR and the Project to the Planning Commission and answered Planning Commission questions, and the Commission held a duly notice public hearing where public testimony was received and recorded regarding the Project and Final EIR.

On October 25, 2017, the Planning Commission reviewed the Final EIR, Findings of Fact, Statement of Overriding Considerations, and Mitigation Monitoring and Reporting Program ("MMRP") for the Project and recommended by Resolution No. 8358 that the Board of Supervisors certify the Final EIR and adopt the Findings of Fact, Statement of Overriding Considerations, and MMRP.

On December 1, 2017, a Notice of Public Hearing was published in the Visalia Times-Delta for a public hearing before the Board at its regular meeting on December 12, 2017.

On December 12, 2017, public testimony was received and recorded at the Board of Supervisors hearing regarding the Project and Final EIR.

On December 12, 2017, after notice and hearing, the Board adopted the 2017 ACFP as the updated Chapter 12 of the Tulare County 2030 General Plan Update, approved and adopted the 2017 Dairy CAP, and approved and certified a Final Environmental Impact Report ("2017 FEIR") and adopted the CEQA Findings of Fact, Statement of Overriding Considerations, and Mitigation Monitoring and Reporting Program ("MMRP") pursuant to CEQA.

The 2017 FEIR formally evaluated the environmental impacts of the 2017 ACFP and 2017 Dairy CAP. The 2017 FEIR was prepared pursuant to CEQA. On December 12, 2017, after notice and hearing, the Board adopted the 2017 ACFP as the updated Chapter 12 of the Tulare County 2030 General Plan Update, approved and adopted the 2017 Dairy CAP, and approved and certified the 2017 FEIR and adopted the CEQA Findings of Fact, Statement of Overriding Considerations, and Mitigation Monitoring and Reporting Program ("MMRP") pursuant to CEQA.

## B. ANNUAL REPORT SUMMARY

Section IV.B. of the Settlement requires the County of Tulare to prepare an Annual Report of total dairy GHG emissions from Fiscal Year ("FY") 2019-FY2024. The Annual Report (see Attachment No. 1) is required to include:

1. Total estimated dairy GHG emissions reduced to date compared to the 1.05 million MT/yr by 2023 Dairy and Feedlot CAP reduction goal, and the total dairy GHG emissions reduced to date compared to the maximum projected SB 1383 potential target. GHG emissions shall be represented as graphical figures substantially similar to those provided in Attachment B of the Settlement.

The County's Air Quality Consultant has prepared a GHG Emissions Reduction Report (Exhibit "A") with this information. On 4/27/2020 the County's Air Quality Consultant began preparing an Annual Report of total dairy GHG emissions for FY2019. There have been delays due to the current health emergency with the COVID-19 virus, which delayed getting an agreement in place with the Air Quality Consultant and also delayed the completion of the Annual Report. The County's Air Quality consultant completed the Annual Report of total dairy GHG emissions for FY2019 on July 6, 2020. The Annual Report of total dairy GHG emissions for FY2019 presents the 2018 GHG emissions inventory for dairies and cattle feedlots in Tulare County. It also evaluates the voluntary GHG emission reduction projects implemented at dairies and feedlots since 2013 and quantifies the reductions.

Digester installers indicate that bringing a project to full operation has taken longer than originally expected due to several reasons. One reason is that CDFA funding is partial and it has taken time to secure additional funding. Another reason is that permitting is complex and can involve obtaining permits from up to six different agencies. Another reason is that the "hub and spoke" model where several digesters feed digester gas into a central point facility is complex and components are not always built out simultaneously. Although digester installation may be complete, operation may be delayed until downstream components are built out. These reasons point to the fact that digester technology, at the time of grant funding in 2016 through 2018, was still a new and immature technology and operational start-up projections made at that time were inaccurate. Digester installers also indicated that since the time of the award program, the industry has begun to mature, and operation of the 35 projects in the CDFA database is expected in 2021. Although not subject to this report cycle, it should also be noted that a total of 54 digester projects are included in the CDFA database as of 2020 and are expected to be operational within the next several years.

The Annual Report of total dairy GHG emissions for FY2019 shows that there were approximately 170,000 additional metric tons per year of $CO_2e$ reductions from digester and AMMP projects that began operating in 2019, and another 704,000 metric tons per year of $CO_2e$ reductions from digester projects currently planned for 2020 and beyond. The complete dairy digester and AMMP project lists, with project descriptions, are included in Appendix B of the Annual Report of total dairy GHG emissions for FY2019.

2. Report on the State's measures pursuant to SB 1383, including but not limited to digester funding and the Alternative Manure Management Program ("AMMP").

RMA staff completed an AMMP Spreadsheet (Exhibit "B") with this information on April 8, 2020. The AMMP Spreadsheet contains ten (10) facilities and shows that the CDFA has awarded $6,043,120.00 in funding for improvements at dairies and feedlots in Tulare County. Two (2) of those facilities are operational after completing improvements, three (3) facilities have improvements that are under construction, three (3) facilities have not yet applied for Building Permits, and the status is unknown for two (2) of the facilities. Once the ten (10) facilities are all operating for five (5) years after completing improvements, the Greenhouse Gas (GHG) reductions will total 135,703 $MTCO_2e$.

3. Updated Digester Project list for digesters within the County that lists: 1) the operation name, 2) project title, 3) total project cost, 4) CDFA funding award, additional Federal or State public funding awards, 5) project description, 6) project construction state, 7) location, 8) GHG emission reductions over ten years, and 9) how captured methane is used. The report shall also include any reported problems with completed digesters within the County.

   RMA staff completed the Updated Digester Project List (Exhibit "C") with this information on April 8, 2020. The Updated Digester Project List contains fifty-four (54) Digesters and shows that the CDFA has awarded $78,800,265.00 for Digesters at fifty-one (51) dairies in Tulare County. Three (3) Digesters that are currently operating did not receive CDFA funding. Thirteen (13) Digesters are operational, thirty-eight (38) Digesters are under construction, and three (3) Digesters have not yet applied for Building Permits. Once the fifty-four (54) Digesters are all operating for ten (10) years, the Greenhouse Gas (GHG) reductions will total 9,361,494 $MTCO_2e$.

The Settlement requires an Annual Report to be completed by May 1 each year, beginning in 2020, and made available to the public (through the County website). The Settlement requires the County to hold a public meeting on the Annual Report and the Board is required to provide the Annual Report to the public not less than ten (10) calendar days prior to a duly noticed public meeting, where the report is considered by the Board following a staff presentation and opportunity for public comments.

There have been delays due to the current health emergency with the COVID-19 virus, which delayed getting an agreement in place with the Air Quality Consultant. On April 27, 2020 the Air Quality Consultant began preparing the 2019 Annual Report of total dairy GHG emissions for Fiscal Year 2019. The Air Quality Consultant completed the Annual Report of total dairy GHG emissions for Fiscal Year 2019, on July 6, 2020.

## C. CEQA FRAMEWORK ANNUAL REPORT

Common Sense Exemption consistent with CEQA and the Guidelines for Implementation of the California Environmental Quality Act ("CEQA Guidelines") pursuant to Title 14, Cal. Code Regulations Section 15061(b)(3). Section 15061(b)(3) states that a project is exempt from CEQA if "The activity is covered by the common sense exemption that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." Preparing an Annual Report of total dairy GHG emissions from FY 2019 will not make any physical change to the environment because it only involves gathering information to prepare a written report concerning whether or not the County of Tulare is in compliance with the 2017 Animal Confinement Facilities Plan ("2017 ACFP") and the 2017 Dairy and Feedlot Climate Action Plan ("2017 Dairy CAP").

Categorical Exemption consistent with CEQA and the CEQA Guidelines pursuant to Title 14, Cal. Code Regulations Section 15306, Class 6, pertaining to basic data collection, research,

experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. The use of Section 15306 is applicable and appropriate because preparing an Annual Report of total dairy GHG emissions from FY 2019 will not make any physical change to the environment because it only involves gathering information to prepare a written report concerning whether or not the County of Tulare is in compliance with the 2017 ACFP and the 2017 Dairy CAP.

Exhibits: "A" Annual Report of total dairy GHG emissions for FY2019

"B" Alternative Manure Management Program Spreadsheet

"C" Updated Digester Project List

Exhibit "A"

# Tulare County

## Dairy and Feedlot Annual GHG Report, 2018

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July 2020

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# List of Acronyms

| | |
|---|---|
| ACFP | Animal Confined Facilities Plan |
| ACFP DEIR | Draft Environmental Impact Report for the Animal Confinement Facilities Plan, And Dairy and Feedlot Climate Action Plan |
| ACR | annual compliance report |
| AMMP | Alternative Manure Management Program |
| AR4 | IPCC Fourth Assessment Report |
| BAU | business-as-usual |
| CARB | California Air Resources Board |
| CDFA | California Department of Food and Agriculture |
| CEC | State Energy Resources Conservation and Development Corporation |
| CEFM | Cattle Enteric Fermentation Model |
| $CH_4$ | methane |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| County | County of Tulare |
| CSI | California Solar Initiative |
| Dairy CAP or Dairy and Feedlot CAP | Tulare County Dairy and Feedlot Climate Action Plan |
| DDRDP | Dairy Digester Research and Development Program |
| EIR | Environmental Impact Report |
| FY | fiscal year |
| GHG | greenhouse gas |
| HFCs | hydrofluorocarbons |
| IPCC | Intergovernmental Panel on Climate Change |
| kW | kilowatts |
| kWh/yr | kW-hours per year |
| MBtu/hr | thousand British thermal units per hour |
| MT | metric tons |
| $MTCO_2e$/year | metric tons of $CO_2e$ per year |
| $N_2O$ | nitrous oxide |
| NREL | National Renewable Energy Laboratory |
| PUC | Public Utilities Commission |
| RMA | Tulare County Resource Management Agency |
| SB | Senate Bill |
| Settlement | Stipulated Settlement |
| SLCP | short-lived climate pollutants |
| SLCP Plan | Short-Lived Climate Pollutant Reduction Strategy |

# Executive Summary

This report presents the 2018 greenhouse gas (GHG) emissions inventory for dairies and cattle feedlots in the County of Tulare (County). It also evaluates the voluntary GHG emission reduction projects implemented at dairies and feedlots since 2013. The GHG inventory and evaluation of emission reductions were prepared pursuant to the 2019 Settlement Agreement, entered into by the Sierra Club, Association of Irritated Residents, Center for Biological Diversity, and County of Tulare.

The voluntary emission reduction projects operating in 2018 included 58 solar panel projects, 3 solar thermal hot water systems, 4 digester projects, and 1 alternative manure management program (AMMP) project. These projects provided 50,611 metric tons of carbon dioxide equivalent ($CO_2e$) reductions in calendar year 2018. These reductions constituted 5 percent of the annual emission reductions needed to achieve the Dairy and Feedlot Climate Action Plan (CAP) target of 1,050,000 metric tons per year of annual reductions by 2023. At the time of this study, the known additional projects scheduled for post-2018 start-up could provide further reductions of up to 870,000 metric tons per year by the end of 2021.

In 2018, the overall operation of Tulare County dairies and feedlots and their support crops produced an estimated 7.18 million metric tons of $CO_2e$ emissions. This quantity is 4 percent less than the 7.49 million metric tons of $CO_2e$ emissions in the 2013 baseline year, despite a 9 percent increase in the reported total cattle population. Most of the emission reductions were related to lower emission factors for electricity use and support crops.

In 2018, manure management operations at Tulare County dairies and feedlots produced an estimated 6.02 million metric tons of methane $CO_2e$ emissions (these emissions are a subset of the overall emissions discussed in the preceding paragraph). This quantity is 4 percent greater than the 5.78 million metric tons of methane $CO_2e$ emissions in the 2013 baseline year, primarily due to increases in dairy cow and feedlot cattle populations. An additional 2.55 million metric tons of methane $CO_2e$ emission reductions would be needed by 2030 to reach the Senate Bill (SB) 1383 goal of 40 percent below 2013 baseline emissions.

# 1 Introduction

This report presents the 2018 greenhouse gas (GHG) emissions inventory for dairies and cattle feedlots in the County of Tulare. This report also documents the voluntary GHG emission reduction projects initiated at dairies and feedlots since 2013 and quantifies the reductions. The estimated 2018 emission reductions are compared to 2013 base year emissions and emission reduction targets set by the Dairy and Feedlot Climate Action Plan ("Dairy CAP" or "Dairy and Feedlot CAP") (Tulare County RMA, 2017a) and Senate Bill (SB) 1383 (SB 1383, Lara, 2016). This report was prepared pursuant to the 2019 Settlement Agreement, entered into by the Sierra Club, Association of Irritated Residents, Center for Biological Diversity, and County of Tulare.

Section 2 of this report provides background information on the Settlement Agreement as well as the Animal Confined Facilities Plan (ACFP), Dairy CAP, and SB 1383. Section 3 provides information concerning the animal population for dairies and feedlots in Tulare County. Section 4 presents the 2013 base year emissions, which provide the benchmark for measuring progress toward the emission reduction targets. Section 5 presents the 2018 business-as-usual (BAU) emissions, which represent what the dairy and feedlot emissions would have been without implementation of the GHG emission reduction projects. Section 6 identifies the GHG emission reduction projects and presents the estimated emission reductions achieved by those projects. Section 6 also evaluates the progress of the 2018 emission reductions toward meeting the 2023 target set by the Dairy CAP. Section 7 presents the actual 2018 GHG emissions, which result from applying the emissions reductions to the BAU emissions. Section 7 also evaluates the progress of the actual emissions toward meeting the 2030 goal set by SB 1383.

This report presents emissions for four GHGs: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and hydrofluorocarbons (HFCs). For the dairy and feedlot industry, $CO_2$ is a product of fuel combustion by on-road trucks and automobiles, off-road dairy and farming equipment, and power plants providing electricity to the dairies (this report generally uses "dairy" to mean dairies and feedlots). $CH_4$ is primarily produced from anaerobic manure decomposition and enteric digestion (also called enteric fermentation). $N_2O$ is primarily produced from manure decomposition and the use of nitrogen-based fertilizers, including manure, on dairy support crops. HFCs are used in milk refrigeration systems. They are potent GHGs emitted through normal system leakage.

The combined emissions of all four GHGs evaluated in this report are expressed as carbon dioxide equivalent ($CO_2e$) emissions. $CO_2e$ is a common metric used to compare emissions of various GHGs. $CO_2e$ represents the amount of $CO_2$ that would result in an equivalent amount of global warming as another GHG. $CO_2e$ is computed by multiplying the mass of each GHG by its global warming potential (GWP)[1] and summing the products over all GHGs. By definition, $CO_2$ has a GWP of 1. The GWPs of the remaining three GHGs were obtained from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) (IPCC, 2007). Under AR4 guidance, the GWPs for $CH_4$, $N_2O$, and HFCs are 25, 298, and 14,800, respectively.[2] The use of AR4 GWPs is consistent with the CARB California 2000-

[1] GWP is a measurement of how much heat a GHG can trap in the atmosphere, over a specific amount of time, as compared to $CO_2$. $CO_2$ is used as a benchmark for this measurement, so its GWP is 1. All other gases are represented in comparison to this value.

[2] The GWP of 14,800 for HFCs used in this report corresponds to HFC-23. HFC-23 is one of several types of

2017 Greenhouse Gas Emission Inventory Program (CARB, 2020a). The GHG emissions in this report are reported in units of metric tons (MT). One MT is equivalent to 1.1 U.S. (short) tons or 2,205 pounds.

# 2 Background

This section provides background information on the ACFP, Dairy CAP, SB 1383, California's actions related to SB 1383, and the Settlement Agreement.

## 2.1 Animal Confined Facilities Plan

The ACFP, included in the County's General Plan governing dairies and cattle feedlots, was originally adopted in 2001 and updated in 2017 (ACFP, 2017). The 2017 ACFP serves as the guiding document to regulate the County's bovine facilities and projected growth through 2023 in response to statewide climate change regulations and reduction targets. Under the ACFP, the County tracks existing dairies and bovine facilities and defines permitted herd sizes. The ACFP's Conformance Checklist Review serves to streamline the CEQA process for expanding facilities that meet specific eligibility requirements. The ACFP also requires that dairies and feedlots submit Annual Compliance Reports and recommends voluntary, incentivized GHG reduction strategies.

## 2.2 Dairy and Feedlot CAP

When the County revised the General Plan in 2012 (2030 General Plan Update), it retained the ACFP but provided for a subsequent process to update the ACFP with its own CEQA review and Environmental Impact Report (EIR). Under the General Plan Update, the County directed the preparation of a separate climate action plan as part of the ACFP Update to specifically address dairies and feedlots. The Dairy and Feedlot CAP serves that purpose and is used to implement the ACFP Update and its application to new and expanding dairies and feedlots (Tulare County RMA, 2017a; Tulare County RMA, 2017c).

The Dairy and Feedlot CAP includes an inventory of dairy and feedlot GHG emissions for the 2013 baseline year, approaches for reducing GHG emissions in accordance with statewide requirements and reduction targets, and projections through 2023. The CAP sets a reduction target of 1.05 million metric tons of GHG emissions per year by 2023. Section 6.4 tracks the progress of dairy and feedlot GHG reductions made through the reporting year 2018 relative to the CAP target.

## 2.3 Senate Bill 1383

Short-lived climate pollutants (SLCPs) are powerful climate forcers that have relatively short atmospheric lifetimes. These pollutants include $CH_4$, HFCs, and anthropogenic black carbon. SB 1383 authorized the California Air Resources Board (CARB) to set goals for reducing SLCPs and specifically for adopting regulations to reduce $CH_4$ emissions from dairy and livestock manure management operations by 40 percent below 2013 levels by 2030 (SB 1383, Lara, 2016). In adopting such regulations, CARB is directed to coordinate with the Department of Food and Agriculture (CDFA), the Public Utilities Commission (PUC) and the California Energy Commission (CEC). Notably, any regulations to reduce dairy

refrigerants used in industrial refrigeration equipment. HFC-23 was conservatively selected as the refrigerant for quantification purposes because of its high GWP.

emissions cannot take effect sooner than January 1, 2024, and then only if CARB, in consultation with CDFA, determines the regulations to be technologically feasible, economically feasible, and cost-effective. Section 7.1 tracks the progress of dairy and feedlot GHG reductions made through the reporting year 2018 to the SB 1383 goal. Although not the focus of this study, Senate Bill 1383 also specifies a goal of a 40 percent reduction in statewide HFC emissions below 2013 levels by 2030.

## 2.4 California's Actions Pursuant to SB 1383

The Settlement Agreement requires the County to "report on the State's measures pursuant to SB 1383, including but not limited to digester funding and the Alternative Manure Management Program (AMMP). This section describes the State's regulatory framework adopted pursuant to SB 1383 as well as funding and incentive programs.

On March 24, 2017, CARB adopted the Short-Lived Climate Pollutant Reduction Strategy (SLCP Plan), outlining future steps for implementing SB 1383 and the need for cooperation between regulatory agencies (CARB, 2017a). Of note is SB 1383 direction that CARB and CDFA are to evaluate the dairy sector's progress toward meeting the SLCP 2030 reduction goal on a voluntary basis, and, if sufficient progress has not been attained due to insufficient funding or market or technical barriers, CARB may revise the SLCP Strategy's $CH_4$ emission reduction goal for dairies to a less stringent level.

To help the industry meet SLCP reduction goals, California established several incentive programs. The centerpiece of these efforts is two state-funded incentive programs implemented by the CDFA: the Dairy Digester Research and Development Program (DDRDP) and AMMP. Both programs are funded under California's Climate Investment Program through Cap-and-Trade auction proceeds or the Greenhouse Gas Reduction Fund.

Since 2015, CDFA has awarded more than $183 million to 108 dairy digester projects in California under the DDRDP, with $369.7 million provided by matching funds by grant awardees. The DDRDP projects have an anticipated cumulative statewide GHG reduction of 19.9 million metric tons of $CO_2e$ over ten years, or approximately 1.99 million metric tons of $CO_2e$ annually, and equate to a 17 percent reduction in $CH_4$ emissions from manure management in California (CDFA, 2020a).

Since 2015, CDFA has awarded $63.2 million to 108 AMMP projects in California. Approximately $9 million has been provided in matching funds by awardees. The AMMP projects have an anticipated cumulative GHG reduction of approximately 1 million metric tons of $CO_2e$ over five years, or approximately 0.2 metric tons of $CO_2e$ annually, and equate to a 1.8 percent reduction in $CH_4$ emissions from manure management in California. Unlike digesters which capture $CH_4$, AMMP projects are designed to avoid $CH_4$ production. The AMMP funds a diverse range of manure management practices that provide options to dairy and livestock operations where digesters may not be economically feasible (CDFA, 2020b).

## 2.5 Settlement Agreement

On August 2, 2019, a stipulated settlement ("Settlement Agreement") was entered into by the Sierra Club, Association of Irritated Residents, Center for Biological Diversity, and County of Tulare. The Settlement Agreement became effective on August 2, 2019, and completely resolved Case No. 272380 - Petition for Writ of Mandate and Complaint for Declaratory and Injunctive Relief, Superior Court, State

of California, County of Tulare, Visalia Division, challenging the certification by the County of Tulare of the Environmental Impact Report for the Animal Facilities Confinement Plan (Tulare County RMA, 2017b) and related General Plan Amendments Zone Changes, and Dairy CAP.

Section IV.B. of the Settlement Agreement requires the County to prepare annual reports of total dairy GHG emissions from fiscal year (FY) 2019 to FY 2024. The annual reports are required to include:

1. The total estimated dairy GHG emissions reduced to date compared to the 1.05 million metric tons per year Dairy CAP reduction target set for 2023, and the total dairy GHG emissions reduced to date compared to the maximum projected SB 1383 potential goal of 40 percent below 2013 $CH_4$ levels by 2030.

   Sections 6.4 and 7.1 of this report satisfy Item 1.

2. A report on the State's measures pursuant to SB 1383, including but not limited to digester funding and the AMMP.

   Tulare County Resource Management Agency (RMA) staff completed an AMMP List with this information on April 8, 2020. This list, together with Section 2.4 of this report, satisfies Item 2.

3. An updated digester project list for digesters within the County that lists: 1) the operation name, 2) project title, 3) total project cost, 4) CDFA funding award, additional federal or state public funding awards, 5) project description, 6) project construction state, 7) location, 8) GHG emission reductions over ten years, and 9) how captured methane is used. The report must also include any reported problems with completed digesters within the County.

   RMA staff completed the updated digester project list with this information on April 8, 2020. This list, together with Section 6.5 of this report, satisfies Item 3.

# 3 Animal Population

Cattle population data compiled by the Tulare County RMA served as the basis for the GHG emission inventories for both the 2013 baseline year and the 2018 reporting year. The 2013 Tulare County data were used to generate the baseline year emissions in the Dairy CAP and were represented by 330 reporting facilities. The 2018 Tulare County data were used to generate the 2018 BAU emissions in this report. Tulare County RMA compiled the 2018 data from the FY 2019 annual compliance reports (ACRs) prepared by the individual dairies and feedlots. The 2018 data were represented by 283 reporting facilities with non-zero cattle populations. Table 3-1 presents the cattle population data upon which this report is based.

The table shows that the reported populations of dairy cows, dairy heifers (12-24 months), feedlot cattle, and total animals increased in 2018 compared to 2013. The populations of dairy heifers (0-12 months) and dairy calves decreased. Tulare County is presently working to identify facilities that did not submit reports and to fill in missing 2018 data. Any substantial revisions to the 2018 data made after release of this report will be noted in the subsequent year's GHG emission inventory report.

**Table 3-1. Dairy and Feedlot Animal Populations**

| Year | Dairy Cows[3] | Dairy Heifers 0-12 mos. | Dairy Heifers 12-24 mos. | Dairy Calves | Feedlot Cattle | Total Animals |
|---|---|---|---|---|---|---|
| 2013 (baseline year)[1] | 543,431 | 137,985 | 148,928 | 65,770 | 133,886 | **1,030,000** |
| 2018 (reporting year)[2] | 569,140 | 125,636 | 167,099 | 59,636 | 204,272 | **1,125,783** |

*Legend*: mos. = months of age.

*Notes*:

1. Source: Dairy CAP. Appendix A, Tables A-1 and A-3.
2. Source: Tulare County RMA. Annual compliance reports.
3. Includes milk cows and dry cows.

# 4 Baseline Year (2013) Emissions

Table 4-1 presents the dairy and feedlot emissions for the 2013 baseline year. This table matches Table 3.7-1 of the *Draft Environmental Impact Report for the Animal Confinement Facilities Plan, And Dairy and Feedlot Climate Action Plan* (ACFP DEIR) (Tulare County RMA, 2017b) and Table 3 of the Dairy CAP. The 2013 GHG emissions represent the baseline to which the actual 2018 emissions are compared in Section 7.

**Table 4-1. Dairy and Feedlot 2013 Baseline GHG Emissions**

| Source Category | $CO_2$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) | HFCs (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|---|---|---|
| Farm Equipment Exhaust | 38,054 | 3 | 0 | 0.0 | 38,129 |
| Farm Agricultural Soil | 0 | 0 | 2,725 | 0.0 | 812,050 |
| Farm Electricity Consumption | 79,107 | 3 | 1 | 0.0 | 79,480 |
| Dairy Equipment Exhaust | 99,106 | 12 | 0 | 0.0 | 99,406 |
| Truck Trips | 23,137 | 0 | 0 | 0.0 | 23,137 |
| Automobile Trips | 14,882 | 3 | 3 | 0.0 | 15,851 |
| Dairy Electricity Consumption | 144,792 | 6 | 1 | 0.0 | 145,335 |
| Dairy Refrigeration | 0 | 0 | 0 | 4.3 | 63,640 |
| Dairy Manure Decomposition | 0 | 123,329 | 1,385 | 0.0 | 3,496,077 |
| Dairy Enteric Digestion | 0 | 98,523 | 0 | 0.0 | 2,463,071 |
| Feedlot Manure Decomposition | 0 | 388 | 67 | 0.0 | 29,598 |
| Feedlot Enteric Digestion | 0 | 9,083 | 0 | 0.0 | 227,068 |
| **Total Emissions** | **399,078** | **231,350** | **4,182** | **4.3** | **7,492,843** |

*Legend*: $CO_2$ = carbon dioxide; $CH_4$ = methane; $N_2O$ = nitrous oxide; HFCs = hydrofluorocarbons; $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.

*Source*: ACFP DEIR, Table 3.7-1. Consistent with Table 3 of the Dairy CAP.

Table 4-2 presents the 2013 baseline emissions of $CH_4$ from the manure management source categories (i.e., manure decomposition and enteric digestion). These emissions are a subset of the emissions in Table 4-1. They were used to determine the year 2030 SB 1383 goal, which is defined as 40 percent below 2013 $CH_4$ emissions by 2030. Therefore, the 2030 SB 1383 goal for Tulare County dairies and

feedlots is 3,470,000 metric tons per year of methane $CO_2e$ from manure management (the goal is rounded to the nearest thousand).

**Table 4-2. Dairy and Feedlot 2013 Baseline $CH_4$ Emissions from Manure Management**

| Source Category | $CH_4$ (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|
| Dairy Manure Decomposition | 123,329 | 3,083,219 |
| Dairy Enteric Digestion | 98,523 | 2,463,071 |
| Feedlot Manure Decomposition | 388 | 9,710 |
| Feedlot Enteric Digestion | 9,083 | 227,068 |
| **Total Emissions** | **231,323** | **5,783,068** |

*Legend*: $CH_4$ = methane; $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.
*Source*: ACFP DEIR, Table 3.7-1. Consistent with Table 3 of the Dairy CAP.

# 5 Business-As-Usual Emissions in 2018

The development of 2018 BAU emissions was the first step in estimating 2018 actual emissions. In this study, BAU represents a hypothetical operating condition consisting of 2018 animal populations coupled with the continuation of 2013 manure management practices. BAU emissions exclude the emission reductions from the voluntary projects implemented at the dairies and feedlots since 2013. Section 6 describes these voluntary projects and quantifies their emission reductions. Section 7 applies the voluntary emission reductions to the BAU emissions to produce the estimated 2018 actual emissions.

## 5.1 Quantification Methodology

For the 2018 BAU emissions, this report quantified the same emission source categories as the 2013 baseline categories shown in Table 4-1. Where applicable, the quantification of 2018 BAU emissions generally used the same methodologies, and the most recent available equations and variables, that CARB used for the California 2000-2017 Greenhouse Gas Emission Inventory Program (CARB, 2020a). The California Greenhouse Gas Emission Inventory Program used methodologies published by the IPCC (2006) and U.S. EPA (2013). The BAU emission quantification methodologies are described below. Appendix A includes the detailed calculation tables for all source categories.

### 5.1.1 Farm Equipment Exhaust

During farming operations for the dairy and feedlot support crops, diesel-powered equipment is used to perform routine tasks such as plowing and crop harvesting. Annual fuel use for the farm equipment was estimated using a factor of 25 gallons per year per acre, from CARB's *Analysis of California's Diesel Agricultural Equipment Inventory according to Fuel Use, Farm Size, and Equipment Horsepower* (CARB, 2018a). The 2018 cultivated acreage for support crops was estimated by scaling the 2013 acreage by the relative number of animal units.[3] The 2013 acreage was obtained from Appendix E2 of the ACFP DEIR.

[3] Tulare County defines an animal unit as a common animal denominator, based on feed consumption, where one mature Holstein milking cow (1,400 pounds) represents one animal unit.

Year 2018 emissions were calculated by multiplying the 2018 fuel use by $CO_2$, $CH_4$ and $N_2O$ emission factors obtained from The Climate Registry (TCR, 2020a; TCR, 2020b).

### 5.1.2 Farm Agricultural Soil

Various agricultural soil management practices contribute to greenhouse gas emissions. The use of synthetic and organic fertilizers adds nitrogen to soils, thereby increasing natural emissions of $N_2O$. Emissions of $N_2O$ from support crop agricultural soil were calculated using equations published by the IPCC (2019). The equations estimate $N_2O$ emissions due to direct emissions from soils, indirect emissions from runoff, and indirect emissions from volatilization and subsequent conversion to $N_2O$. The emission calculations used the 2018 cultivated acreage described in Section 5.1.1.

### 5.1.3 Farm Electricity Consumption

The use of electricity by agricultural irrigation pumps for support crops generates indirect GHG emissions from regional power plants burning fossil fuels. Appendix E2 of the ACFP DEIR estimated an average electricity usage rate of 1.59 megawatt-hours per acre per year for agricultural irrigation pumps in the San Joaquin Valley. Year 2018 electricity usage was estimated by multiplying this factor by the 2018 cultivated acreage described in Section 5.1.1. Year 2018 GHG emissions were estimated using eGRID (CAMX Subregion) emission factors from The Climate Registry (TCR, 2020c).

### 5.1.4 Dairy Equipment Exhaust

During dairy and feedlot operations, diesel-powered mobile equipment is used to perform routine tasks such as distribution of cattle feed and corral scraping. Annual equipment usage for 2018 was scaled from the 2013 usage in proportion to the relative number of animal units, except for standby generator usage, which was scaled in proportion to the relative number of facilities. The 2013 equipment usage was obtained from Appendix E2 of the ACFP DEIR. Year 2018 emissions were calculated by converting the equipment usage (in horsepower-hours) to fuel use (in gallons) and multiplying by $CO_2$, $CH_4$ and $N_2O$ emission factors obtained from The Climate Registry (TCR, 2020a; TCR, 2020b).

### 5.1.5 Truck and Automobile Trips

Operation of dairies and feedlots generates a variety of truck trips, including silage trucks, hay trucks, concentrated feed trucks, calf milk replacer trucks, and cattle trucks. The facilities also generate light vehicle trips from employees and visitors (veterinarians, breeders, sales, and delivery). Trips in 2018 were scaled from 2013 in proportion to the number of animal units for trucks and the number of facilities for automobiles. The 2013 trips and trip lengths (assumed unchanged in 2018) were obtained from Appendix E2 of the ACFP DEIR. The EMFAC2017 mobile source emission factor program was used to generate truck and automobile emission factors (CARB, 2020e). The emission factors include contributions from running exhaust, idle exhaust, and starting exhaust.

### 5.1.6 Dairy Electricity Consumption

Electricity is used at dairies for lighting, operation of the milking equipment, operation of electric pumps for water supply, and other uses. The use of electricity by dairy facilities generates indirect GHG emissions from regional power plants burning fossil fuels. Appendix E2 of the ACFP DEIR estimated an average electricity usage rate of 0.49 megawatt-hours per cow (dairy cows and heifers) per year for dairies in the San Joaquin Valley. Year 2018 electricity usage was estimated by multiplying this factor by

the 2018 animal population of dairy cows and dairy heifers (0-12 months and 12-24 months) from Table 3-1. Year 2018 GHG emissions were estimated using eGRID (CAMX Subregion) emission factors from The Climate Registry (TCR, 2020c).

### 5.1.7 Dairy Refrigeration

Dairies refrigerate milk prior to pick-up by milk trucks. HFC emissions are produced by normal refrigerant leakage from the refrigeration equipment. The Climate Registry (TCR, 2020d) lists a default upper bound annual refrigerant loss rate of 25 percent for industrial refrigeration. The total 2018 refrigerant charge was scaled from 2013 in proportion to the number of dairy cows as shown in Table 3-1. The total 2013 refrigerant charge was obtained from Appendix E2 of the ACFP DEIR. The 2018 HFC emissions were estimated by multiplying the total refrigerant charge by the 25 percent loss rate. HFC-23 is one of several types of refrigerants used in industrial refrigeration equipment. HFC-23 was conservatively selected as the refrigerant for quantification purposes because of its high GWP of 14,800.

### 5.1.8 Manure Decomposition

Manure is primarily composed of organic material and water. Under anaerobic conditions, the organic material is decomposed by anaerobic bacteria. The primary end products of anaerobic decomposition are $CH_4$ and stabilized organic material. $N_2O$ is also produced during manure storage and treatment.

The key factors affecting $CH_4$ production from livestock manure are the quantity of manure produced, manure characteristics (which in turn depend on the composition and digestibility of the animal diet), the manure management system, and climate. Production of $N_2O$ during manure storage and treatment occurs via combined nitrification-denitrification of nitrogen contained in the manure. The amount of $N_2O$ released depends on the manure management system, duration of waste management, nitrogen concentration, temperature, volatilization fraction, runoff fraction, biochemical oxygen demand, and other variables.

Emissions associated with manure decomposition were calculated using the methodology developed for the CARB statewide 2000-2017 GHG Emission Inventory, which also reflects the 2006 IPCC Guidelines for National Emission Inventories (CARB, 2019a; IPCC, 2006). The methodology takes into consideration the percent distribution of animals in each type of manure management system and specifies the variables used in emission calculations.

The calculation of 2018 BAU emissions assumed a distribution of animals in each type of manure management system that was consistent with the CARB statewide GHG Emission Inventory, 2013 distribution (in terms of percent of animals in each system). This 2013 distribution was chosen to ensure that emissions calculated to describe the BAU conditions do not inadvertently account for any reductions from digester projects, which are project-specific and are calculated and discussed in Section 6. Nevertheless, CARB's statewide distributions of animals in each manure system in years 2013 through 2017 (the most recent available statewide emissions year) have not changed.

$CH_4$ emissions from manure decomposition were estimated using Equation 1.

Equation 1: $CH_{4,man} = V_{ex} \times B_0 \times MCF \times c_1$

$CH_{4,man}$ = methane emissions from manure [kg $CH_4$/yr]
$V_{ex}$ = volatile solids excreted [kg VS/yr]

$B_0$ = maximum methane producing capacity [$m^3$ $CH_4$/kg VS]
MCF = methane conversion factor [%]
$c_1$ = conversion factor representing density of methane at 25°C.

Volatile solids excreted were estimated using Equation 2.

Equation 2: $V_{ex} = VS \times (WMS \times N_{animals})$

VS = volatile solids excreted per animal [kg VS/animal/yr]
$(WMS \times N_{animals})$ = number of animals per waste management system

$N_2O$ emissions from manure decomposition were estimated using Equation 3.

Equation 3: $N_2O = WMS \times N_{aminals} \times N_{excreted} \times [D_{EF} + (V_{frac} \times V_{EF}) + (R_{frac} \times R_{EF})] \times 1.5711$

$N_2O$ = nitrous oxide emissions from manure [kg $N_2O$/yr]
$N_{excreted}$ = nitrogen excreted per animal [kg N/animal/yr]
$D_{EF}$ = direct nitrogen as $N_2O$-N [g $N_2O$-N/g N]
$V_{frac}$ = volatilization fraction of N [fraction]
$V_{EF}$ = indirect nitrogen as $N_2O$-N [g $N_2O$-N/g]
$R_{frac}$ = runoff fraction of nitrogen [fraction]
$R_{EF}$ = indirect nitrogen as $N_2O$-N for runoff N [g $N_2O$-N/g]

The following factors were obtained from CARB's GHG Emissions Inventory from the most recent emissions inventory year available (2017): MCF, $c_1$, $B_0$, VS, $N_{excreted}$, $D_{EF}$, $V_{frac}$, $V_{EF}$, $R_{frac}$, $R_{EF}$.

### 5.1.9 Enteric Digestion

Enteric digestion (also referred to as fermentation) is a natural part of the digestive process in ruminant animals such as cattle. Microbes in the digestive tract, or rumen, decompose and ferment food, producing $CH_4$ as a by-product.

Tulare County $CH_4$ emissions from enteric digestion were estimated by scaling the 2017 CARB statewide enteric $CH_4$ emissions (2017 being the most recent statewide emissions year available) by the 2018 Tulare County animal counts (see Equation 4). Since CARB uses the IPCC methodology as implemented in the Cattle Enteric Fermentation Model (CEFM), it is appropriate to estimate emissions from enteric digestion by assuming that Tulare County emissions are proportional to the California emissions based on animal population.[4]

Year 2017 statewide animal counts and enteric digestion $CH_4$ emissions were obtained from the CARB 2000-2017 GHG Inventory using the web-based Inventory Query Tool (CARB, 2019a). Tulare County animal counts for 2018 were obtained the County's ACR reports (see Table 3-1).

[4] This analysis conservatively does not take into account CARB's proposed 2019 update that would reduce enteric digestion emissions by 5 percent due to differences in diets fed to California cattle compared to cattle in other states (CARB, 2019c).

Equation 4: $CH_4,ent = CH_{4,ent,CA} \times (Pop_{Tulare}/Pop_{CA})$

$CH_{4,ent}$ = 2018 Tulare County $CH_4$ emissions from enteric digestion
$CH_{4,ent,CA}$ = Statewide 2017 $CH_4$ emissions from enteric digestion
$Pop_{Tulare}$ = Tulare County 2018 animal count
$Pop_{CA}$ = Statewide 2017 animal count

## 5.2 Estimated 2018 BAU Emissions

Table 5-1. presents the dairy and feedlot BAU emissions for 2018. As discussed at the beginning of Section 5, the BAU emissions reflect 2018 animal populations but exclude the emission reductions from voluntary projects implemented at the dairies and feedlots since 2013. These BAU emissions were used in the development of the 2018 actual emissions in Section 7.

**Table 5-1. Dairy and Feedlot 2018 Business-as-Usual GHG Emissions**

| Source Category | $CO_2$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) | HFCs (MT/yr) | $CO_2e$ (MT/yr)[(1)] |
|---|---|---|---|---|---|
| Farm Equipment Exhaust | 41,292 | 2 | 0 | 0.0 | 41,434 |
| Farm Agricultural Soil | 0 | 0 | 982 | 0.0 | 292,639 |
| Farm Electricity Consumption | 57,928 | 4 | 0 | 0.0 | 58,167 |
| Dairy Equipment Exhaust | 118,230 | 5 | 1 | 0.0 | 118,635 |
| Truck Trips | 23,340 | 1 | 4 | 0.0 | 24,457 |
| Automobile Trips | 11,175 | 1 | 1 | 0.0 | 11,374 |
| Dairy Electricity Consumption | 95,111 | 7 | 1 | 0.0 | 95,503 |
| Dairy Refrigeration | 0 | 0 | 0 | 5.7 | 84,496 |
| Dairy Manure Decomposition | 0 | 129,306 | 1,430 | 0.0 | 3,658,872 |
| Dairy Enteric Digestion | 0 | 99,443 | 0 | 0.0 | 2,486,066 |
| Feedlot Manure Decomposition | 0 | 554 | 106 | 0.0 | 45,476 |
| Feedlot Enteric Digestion | 0 | 12,714 | 0 | 0.0 | 317,843 |
| **Total Emissions** | **347,077** | **242,035** | **2,525** | **5.7** | **7,234,962** |

*Legend*: $CO_2$ = carbon dioxide; $CH_4$ = methane; $N_2O$ = nitrous oxide; HFCs = hydrofluorocarbons; $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.

*Notes*:

1. BAU emissions reflect 2018 dairy and feedlot cattle populations coupled with baseline year (2013) manure management practices. Emission calculations used methodologies consistent with the CARB California Greenhouse Gas Emission Inventory Program. BAU emissions exclude the voluntary GHG reduction projects implemented since the baseline year (see Table 6-1).

# 6 Emission Reductions Achieved in 2018

This section presents the GHG emission reductions associated with projects implemented at Tulare County dairies and feedlots from 2013 through 2018. The projects consist of solar panels, solar thermal hot water systems, dairy digesters, and AMMP projects.

## 6.1 Emission Reduction Projects

The Tulare County RMA provided a list of 58 solar panel projects and 3 solar thermal hot water systems at dairies for which it issued permits between 2013 and December 2018 (Tulare County RMA, 2020). The list of Tulare County solar projects is included in Appendix B.

CDFA maintains lists of dairy digester projects in California for which it has awarded grant funds annually since 2016 (CDFA, 2020a). The CDFA database shows 35 Tulare County projects since the start of the award program and through the end of 2018, of which 32 had received CDFA funding and an additional 3 had not. Digester installers MAAS and CalBio were contacted to identify which digester projects had begun operating and were providing emission reductions. The digester installers indicated that, of the projects included in the CDFA database, four digester projects were operational as of the end of 2018. These four digester projects are identified in Appendix B.

The CDFA also maintains lists of AMMP projects in California for which it has awarded grant funds annually since 2016. AMMP projects are non-digester manure management practices that result in reduced GHG emissions. For example, converting from flushed feed lanes and anaerobic lagoons to scraped feed lanes and solar dried manure substantially reduces $CH_4$ emissions. The CDFA indicates that since the start of the award program and through the end of 2018, four Tulare County projects had received CDFA funding (CDFA, 2020b). Of those, one project was operational as of the end of 2018. The operational AMMP project is identified in Appendix B.

## 6.2 Quantification Methodology

GHG emission reductions associated with the 58 solar panel projects were quantified using the California Air Resources Board's (CARB's) Benefits Calculator Tool for the Community Solar Pilot (CARB, 2020b). Calculations were made for a single hypothetical 1000 kW project, and the corresponding emission reductions were scaled by actual project size for each of the dairy projects. One of the inputs required by the Benefits Calculator Tool is annual system output in kW-hours per year (kWh/yr). System output was quantified using the National Renewable Energy Laboratory (NREL) PVWatts Calculator (NREL, 2018). The inputs to the Benefits Calculator Tool and PVWatts Calculator were developed in consultation with Tulare County RMA staff (Tulare County RMA, 2020) and CARB's Quantification Methodology for the Department of Community Services and Development Low-Income Weatherization Program Community Solar Pilot (CARB, 2019b). The outputs from the Benefits Calculator Tool and PVWatts Calculator are included in Appendix B.

Emission reductions associated with the three solar thermal hot water systems were determined using CARB's *Greenhouse Gas Quantification Methodology for the Low-Income Weatherization Program: Single-Family Energy Efficiency and Solar Photovoltaics Multi-Family Energy Efficiency and Renewables* (CARB, 2019b). This methodology provides an average annual GHG reduction rate of 0.68 metric tons of CO2e per year (MTCO2e/year) per residential system in California, developed by the California Solar Initiative (CSI)-Thermal Program (CSI, 2020). According to Tulare County RMA staff, the three dairy projects are approximately residential-sized (Tulare County RMA, 2020).

Emission reductions from the four dairy digester projects and one AMMP project that were operational prior to the end of 2018 were estimated by the grant fund award recipients using CARB's CCI Quantification, Benefits, and Reporting Materials (CARB, 2018b).

## 6.3 Estimated Emission Reductions

Table 6-1 summarizes the estimated 5-year, annual, and calendar year 2018 GHG emission reductions at Tulare County dairies and feedlots by project category. Calendar year 2018 reductions are less than the annual reductions because some projects became operational during 2018 and therefore had partial-year reductions. The estimated emission reductions by individual project are presented in Appendix B.

**Table 6-1. Dairy and Feedlot GHG Emission Reductions from Solar, Digester, and AMMP Projects Operating in 2018**

| Project Type | 5-Year $CO_2e$ Reductions (MT/5-yrs)[1] | Annual $CO_2e$ Reductions (MT/yr) | CY 2018 $CO_2e$ Reductions (MT/yr)[2] |
|---|---|---|---|
| Solar Panels | -90,634 | -18,127 | -17,786 |
| Solar Thermal Hot Water Systems | -10 | -2 | -2 |
| Digesters | -333,810 | -66,762 | -25,813 |
| Alternative Manure Management Program | -35,050 | -7,010 | -7,010 |
| **Total** | **-459,504** | **-91,901** | **-50,611** |

*Legend*: $CO_2e$ = carbon dioxide equivalent; MT/5-yrs = metric tons per five years; MT/yr = metric tons per year; CY = calendar year.

*Notes*:

1. Reductions are shown as negative values.
2. CY 2018 reductions are less than the annual reductions because some projects became operational during 2018 and therefore had partial-year reductions.

## 6.4 Progress Toward the Dairy CAP Target

Table 6-2 shows the progress of the voluntary GHG emission reductions from Tulare County dairies and feedlots compared to the Dairy CAP target of 1.05 million metric tons of CO2e reductions by 2023. The first table column shows the year. The second column shows the accumulation of emission reductions needed from 2017 to 2023 to meet the 2023 target, assuming a linear trend. This trajectory is merely a guide to serve as a reference for assessing the rate of progress of the emission reductions.

The third column in Table 6-2 shows the actual calendar year emission reductions achieved by year for the Tulare County dairies and feedlots. The 2018 emission reductions were obtained from Table 6-1. The 2017 emission reductions reflect operation of 53 solar panel projects and one digester project in 2017 (see Appendix B, Tables B.2 and B.4).

The fourth table column shows the deviation of the actual emission reductions from the reference trajectory in the second column. The data show that the actual emission reductions through 2018 are higher than the reference trajectory and therefore behind schedule (hence the negative number). The slow start to the emission reductions is due primarily to delayed startups of numerous digester and AMMP projects for the reasons articulated in Section 6.5. At the time of this analysis, data show that there were approximately 170,000 additional metric tons of annual $CO_2e$ reductions from digester and AMMP projects that began operating in 2019, and another 704,000 metric tons of annual $CO_2e$ reductions from digester projects currently planned for 2020 and beyond.

The fifth table column shows the additional emission reductions needed by 2023 to reach the Dairy CAP target. The last table column shows the percent of the Dairy CAP target that has been achieved. As of 2018, approximately 5 percent of the needed emission reductions have been achieved. Each subsequent version of this annual GHG emissions inventory report will populate an additional year of data in the table.

**Table 6-2. Progress of GHG Emission Reductions in Relation to the 2023 Dairy CAP Target**

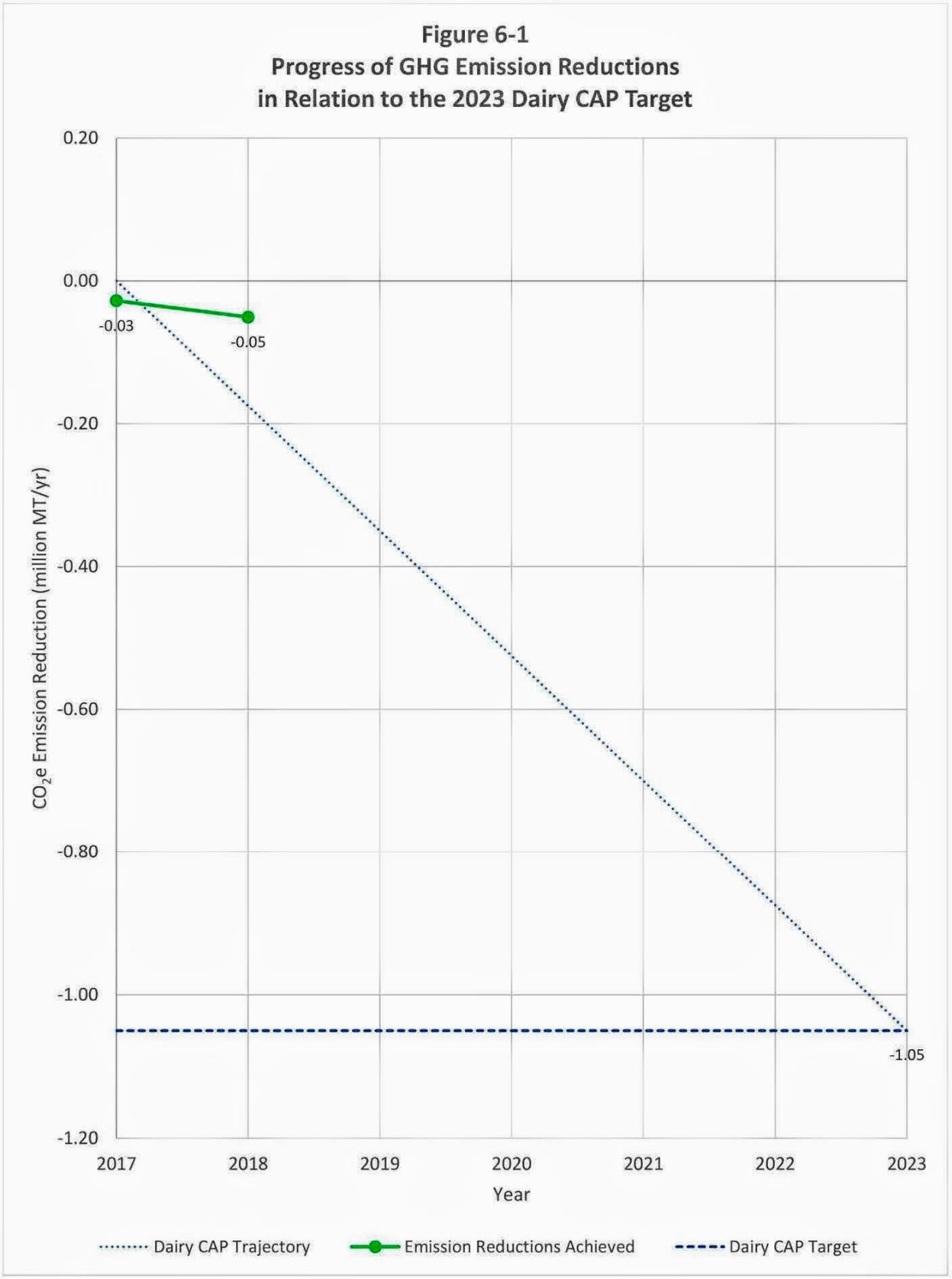
| Year | Dairy CAP Emission Reduction Trajectory (MT $CO_2e$/yr)[1][2] | Actual Emission Reductions Achieved (MT CO2e/yr)[1][3] | Deviation from the Target Trajectory (MT CO2e/yr)[4] | Additional Reductions Needed to Reach the 2023 Target (MT CO2e/yr)[1] | Percent of Target Reached |
|---|---|---|---|---|---|
| 2017 | 0 | -26,379 | 26,379 | -1,023,621 | 3% |
| 2018 | -175,000 | -50,611 | -124,389 | -999,389 | 5% |
| 2019 | -350,000 | TBD | TBD | TBD | TBD |
| 2020 | -525,000 | TBD | TBD | TBD | TBD |
| 2021 | -700,000 | TBD | TBD | TBD | TBD |
| 2022 | -875,000 | TBD | TBD | TBD | TBD |
| 2023 | -1,050,000 | TBD | TBD | TBD | TBD |

*Legend*: MT $CO_2e$/yr = metric tons of carbon dioxide equivalent per year; TBD = to be determined in a future analysis.
*Notes*:

1. Reductions are shown as negative values.
2. The Dairy CAP trajectory assumes a linear path from 2017 to 2023. The value of -1,050,000 MT/yr in year 2023 is the Dairy CAP target.
3. CY 2018 emission reductions were obtained from Table 6-1. CY 2017 emissions were obtained from Appendix B, Tables B.2 and B.4 (53 solar panel projects and one digester project operated in 2017). Emissions for projects that began operating part-way through the year reflect only that portion of the year the projects operated.
4. A positive value means ahead of schedule; a negative value means behind schedule.

Figure 6-1 shows the progress of the Tulare County dairies and feedlots toward meeting the 2023 Dairy CAP target in graphical format. The short line near the top left of the figure shows the actual emission reductions by year. The diagonal dotted line represents the reference trajectory that would meet the target by 2023. The horizontal dashed line across the bottom of the figure represents the Dairy CAP target.

**Figure 6-1**
**Progress of GHG Emission Reductions**
**in Relation to the 2023 Dairy CAP Target**



## 6.5 Emission Reduction Project Impediments

The Settlement Agreement requires that the County identify any reported problems with installed digesters. Although specific problems were not reported on the CDFA database, conversations with digester installers, MAAS and CalBio, indicated that, of the digester projects included in the CDFA database, only four were operational by the end of 2018.

MAAS and CalBio indicated that bringing a project to full operation has taken longer than originally expected due to several reasons. One reason is that CDFA funding is partial and it has taken time to secure additional funding. Another reason is that permitting is complex and can involve obtaining permits from up to six different agencies. Another reason is that the "hub and spoke" model, where several digesters feed digester gas into a central facility, is complex and components are not always built out simultaneously. Although digester installation may be complete, operation may be delayed until downstream components are built out. These reasons point to the fact that digester technology, at the time of grant funding in 2016 through 2018, was still a new and immature technology and operational start-up projections made at that time were inaccurate. Both installers indicated that since the time of the award program, the industry has begun to mature, and operation of the 35 projects in the CDFA database is expected in 2021. Although not subject to this report cycle, it should also be noted that 54 digester projects are included in the CDFA database as of 2020 and are expected to be operational within the next several years.

At the time of this analysis, data show that there were approximately 170,000 additional metric tons per year of $CO_2e$ reductions from digester and AMMP projects that began operating in 2019, and another 704,000 metric tons per year of $CO_2e$ reductions from digester projects currently planned for 2020 and beyond. The complete dairy digester and AMMP project lists, with project descriptions, are included in Appendix B.

# 7 Actual Emissions in 2018

This section presents the 2018 actual emissions and compares the emissions to the 2030 SB 1383 goal. Table 7-1 presents the estimated actual dairy and feedlot GHG emissions for calendar year 2018. The emissions were determined by subtracting the calendar year 2018 emission reductions in Table 6-1 from the 2018 BAU emissions in Table 5-1.

**Table 7-1. Dairy and Feedlot 2018 Actual GHG Emissions**

| Source Category[(1)] | $CO_2$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) | HFCs (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|---|---|---|
| Farm Equipment Exhaust | 41,292 | 2 | 0 | 0.0 | 41,434 |
| Farm Agricultural Soil | 0 | 0 | 982 | 0.0 | 292,639 |
| Farm Electricity Consumption | 57,928 | 4 | 0 | 0.0 | 58,167 |
| Dairy Equipment Exhaust | 118,230 | 5 | 1 | 0.0 | 118,635 |
| Truck Trips | 23,340 | 1 | 4 | 0.0 | 24,457 |
| Automobile Trips | 11,175 | 1 | 1 | 0.0 | 11,374 |
| Dairy Electricity Consumption | 77,323 | 7 | 1 | 0.0 | 77,715 |
| Dairy Refrigeration | 0 | 0 | 0 | 5.7 | 84,496 |
| Dairy Manure Decomposition | 0 | 127,993 | 1,430 | 0.0 | 3,626,049 |
| Dairy Enteric Digestion | 0 | 99,443 | 0 | 0.0 | 2,486,066 |
| Feedlot Manure Decomposition | 0 | 554 | 106 | 0.0 | 45,476 |
| Feedlot Enteric Digestion | 0 | 12,714 | 0 | 0.0 | 317,843 |
| **Total Emissions** | **329,289** | **240,722** | **2,525** | **5.7** | **7,184,351** |

*Legend*: $CO_2$ = carbon dioxide; $CH_4$ = methane; $N_2O$ = nitrous oxide; HFCs = hydrofluorocarbons; $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.

*Notes*:

1. Emission reductions from solar panels and solar thermal hot water systems were subtracted from the BAU dairy electricity consumption $CO_2$ emissions. Emission reductions from digesters and AMMP projects were subtracted from the BAU dairy manure decomposition $CH_4$ emissions.

Table 7-2 compares the 2018 actual GHG emissions to the 2013 baseline emissions. The table shows that, from 2013 to 2018, the total $CO_2e$ emissions decreased by 308,492 metric tons per year. Some source categories increased emissions while others decreased emissions. Some of the emissions changes since 2013 are primarily a result of changes in animal populations. For example, the increases in emissions from manure decomposition and enteric digestion reflect increases in the dairy cow and feedlot populations (see Table 3-1). Other emissions changes are primarily a result of the effects of climate change-related regulations. For example, the decreases in emissions from farm and dairy electricity consumption reflect a decrease in carbon intensity factors from the electric utilities (PG&E and Edison) in response to the California Renewables Portfolios Standard (CPUC, 2020).[5] Additionally, the decreases in automobile emissions reflect the effects of California's Low Carbon Fuel Standard (CARB, 2020c) and Greenhouse Gas Vehicle Emission Standards (CARB, 2020d).

Finally, some emissions changes are primarily a result of changes in quantification methodologies rather than actual emissions changes. Specifically, the 2018 emissions of $N_2O$ from farm agricultural soil are substantially lower than the 2013 emissions because of updated IPCC emission factors for direct emissions, indirect runoff, and indirect volatilization (IPCC, 2019). A portion of the $CO_2e$ increase from dairy refrigeration resulted from a GWP revision for HFC-23 from 11,700 to 14,800 (IPCC, 2007).

[5] The Renewables Portfolio Standard mandates that 20 percent of electricity retail sales must be served by renewable resources by 2017, 60 percent by 2030, and 100 percent from carbon-free resources by 2045 (CPUC, 2020).

**Table 7-2. Comparison of 2018 Actual GHG Emissions to 2013 Baseline GHG Emissions**

| Source Category | 2013 Baseline $CO_2e$ Emissions (MT/yr) | 2018 Actual $CO_2e$ Emissions (MT/yr) | 2018 Actual minus 2013 Baseline $CO_2e$ Emissions (MT/yr) |
|---|---|---|---|
| Farm Equipment Exhaust | 38,129 | 41,434 | 3,305 |
| Farm Agricultural Soil | 812,050 | 292,639 | -519,411 |
| Farm Electricity Consumption | 79,480 | 58,167 | -21,313 |
| Dairy Equipment Exhaust | 99,406 | 118,635 | 19,229 |
| Truck Trips | 23,137 | 24,457 | 1,320 |
| Automobile Trips | 15,851 | 11,374 | -4,477 |
| Dairy Electricity Consumption | 145,335 | 77,715 | -67,620 |
| Dairy Refrigeration | 63,640 | 84,496 | 20,856 |
| Dairy Manure Decomposition | 3,496,077 | 3,626,049 | 129,972 |
| Dairy Enteric Digestion | 2,463,071 | 2,486,066 | 22,994 |
| Feedlot Manure Decomposition | 29,598 | 45,476 | 15,878 |
| Feedlot Enteric Digestion | 227,068 | 317,843 | 90,774 |
| **Total Emissions** | **7,492,843** | **7,184,351** | **-308,492** |

*Legend*: $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.

Table 7-3 presents the estimated dairy and feedlot $CH_4$ emissions for calendar year 2018 from the manure management source categories only. These emissions are a subset of the emissions shown in Table 7-1. They were used in the assessment of progress toward the 2030 SB 1383 goal (see Section 7.1).

**Table 7-3. Dairy and Feedlot 2018 Actual $CH_4$ Emissions from Manure Management**

| Source Category | $CH_4$ (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|
| Dairy Manure Decomposition | 127,993 | 3,199,822 |
| Dairy Enteric Digestion | 99,443 | 2,486,066 |
| Feedlot Manure Decomposition | 554 | 13,853 |
| Feedlot Enteric Digestion | 12,714 | 317,843 |
| **Total Emissions** | **240,703** | **6,017,583** |

*Legend*: $CH_4$ = methane; $CO_2e$ = carbon dioxide equivalent; MT/yr = metric tons per year.

Table 7-4 compares the 2018 actual $CH_4$ emissions to the 2013 baseline $CH_4$ emissions for the manure management source categories only (isolating $CH_4$ from manure management is consistent with SB 1383). The 2018 emissions include the reductions from the four digesters and one AMMP project that were operational in 2018. The table shows that, from 2013 to 2018, $CH_4$ emissions from manure management increased by 234,515 metric tons per year (as $CO_2e$). This emissions increase is primarily a result of the increases the dairy cow and feedlot populations relative to the 2013 population data (see Table 3-1).

**Table 7-4. Comparison of 2018 Actual $CH_4$ Emissions to 2013 Baseline CH4 Emissions from Manure Management**

| Source Categories[1] | 2013 Baseline $CH_4$ Emissions (MT $CO_2e$/yr)[2] | 2018 Actual $CH_4$ Emissions (MT $CO_2e$/yr)[2] | 2018 Actual minus 2013 Baseline $CH_4$ Emissions (MT $CO_2e$/yr)[2] |
|---|---|---|---|
| Dairy Manure Decomposition | 3,083,219 | 3,199,822 | 116,603 |
| Dairy Enteric Digestion | 2,463,071 | 2,486,066 | 22,994 |
| Feedlot Manure Decomposition | 9,710 | 13,853 | 4,143 |
| Feedlot Enteric Digestion | 227,068 | 317,843 | 90,774 |
| **Total Emissions** | **5,783,068** | **6,017,583** | **234,515** |

*Legend*: $CH_4$ = methane; MT $CO_2e$/yr = metric tons of carbon dioxide equivalent per year.

*Notes*:

1. Consistent with SB 1383, this table includes only $CH_4$ emissions from manure decomposition and enteric digestion.
2. $CH_4$ emissions are expressed as $CO_2e$.

## 7.1 Progress Toward the SB 1383 Goal

Table 7-5 shows the progress of the Tulare County dairies and feedlots toward meeting the SB 1383 goal of 40 percent below 2013 $CH_4$ levels by 2030 for manure management operations. The first table column shows the year. The second column shows the progression of year-to-year emissions needed from 2017 to 2030 to meet the 2030 goal of 3,470,000 metric tons, assuming a linear trend. This trajectory is merely a guide to serve as a reference for assessing the rate of progress of the actual emissions. For the purposes of establishing this trajectory, the 2017 starting year was assigned emissions equal to the 2018 BAU emissions (2017 BAU emissions were not quantified in this study).

The third table column in Table 7-5 shows the BAU emissions by year for the Tulare County dairies and feedlots. Its purpose is to show what the dairy and feedlot emissions would be without the voluntary emission reduction projects described in Section 6. For the purposes of establishing two data points for plotting a line, the 2017 BAU emissions (not quantified) were assumed to be equal to the 2018 BAU emissions.

The fourth table column shows the actual emissions by year for the Tulare County dairies and feedlots. The 2018 emissions include the reductions from the four digesters and one AMMP project that operated in that year. For the purposes of establishing two data points for plotting a line, the 2017 actual emissions (not quantified) were assumed to equal the 2018 BAU emissions minus the emissions reduction from one digester project that began operating in 2017 (see Appendix B, Table B.4).

The fifth table column shows the deviation of the actual $CH_4$ emissions from the reference trajectory in the second column. The data show that the actual emissions through 2018 are higher than the reference trajectory and therefore behind schedule (hence the negative number). As discussed in Sections 6.5 and 7.1, the primary reasons for the slow start to the emission reductions are (1) increases in the dairy cow and feedlot populations relative to the 2013 population data; and (2) the delayed startups of numerous digester and AMMP projects for the reasons articulated in Section 6.5. At the time of this analysis, data show that there were approximately 170,000 additional metric tons of annual $CO_2e$ reductions from

digester and AMMP projects that began operating in 2019, and another 704,000 metric tons of annual $CO_2e$ reductions from digester projects currently planned for 2020 and beyond.

The last table column shows the additional $CH_4$ emission reductions needed by 2030 to meet the SB 1383 goal. Each subsequent version of this annual GHG emissions inventory report will populate an additional year of data in the table.

**Table 7-5. Progress of $CH_4$ Emissions in Relation to the 2030 SB 1383 Goal**

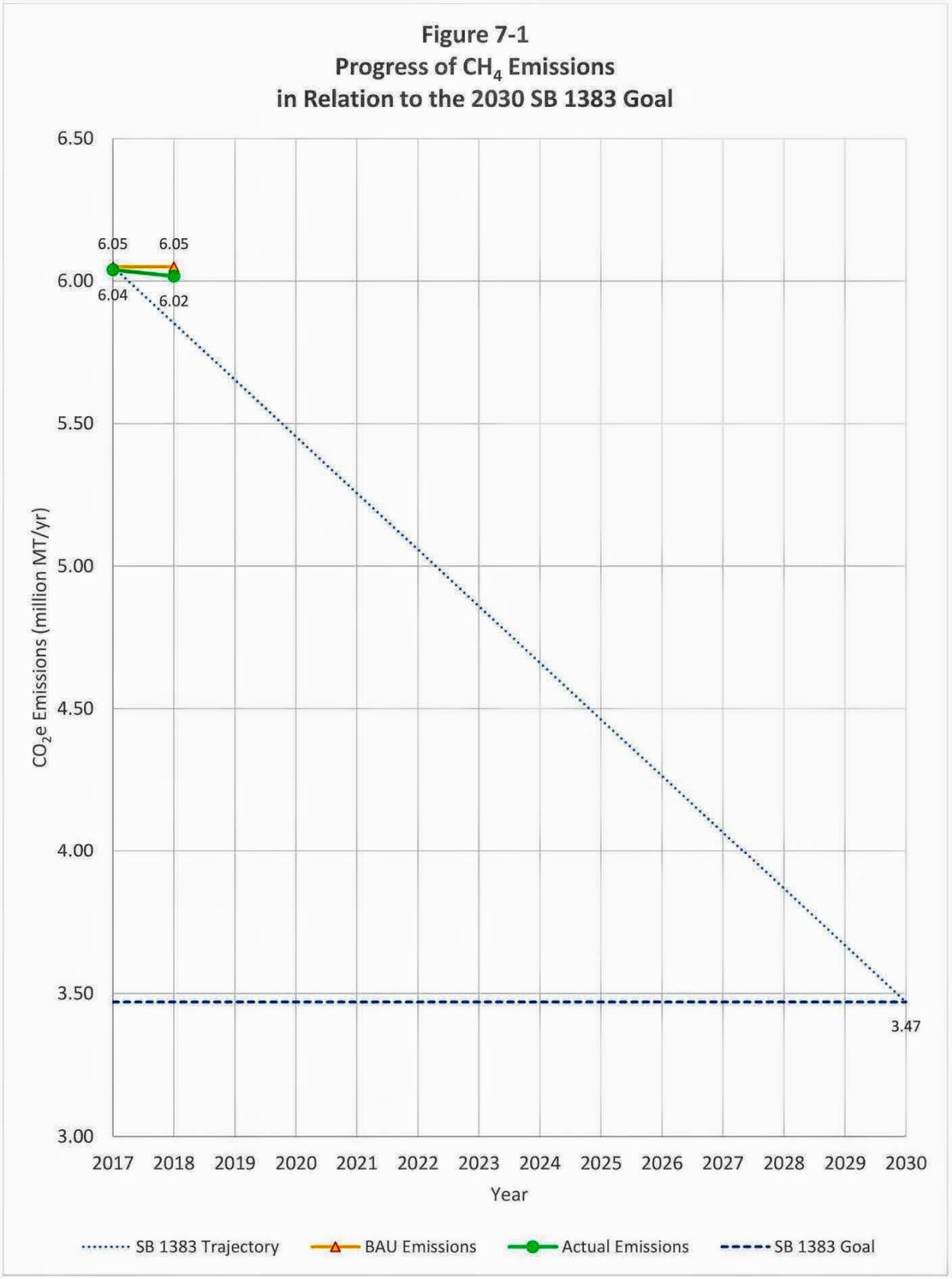
| Year | SB 1383 Emissions Trajectory (MT $CO_2e$/yr)[1][2] | BAU Emissions (MT $CO_2e$/yr)[1][3] | Actual Emissions (MT $CO_2e$/yr)[1][4] | Deviation of Actual from Goal Trajectory (MT $CO_2e$/yr)[5] | Additional Reductions Needed to Reach 2030 Goal (MT CO2e/yr)[6] |
|---|---|---|---|---|---|
| 2017 | 6,050,406 | 6,050,406 | 6,039,528 | 10,879 | -2,569,687 |
| 2018 | 5,852,000 | 6,050,406 | 6,017,583 | -165,682 | -2,547,743 |
| 2019 | 5,653,000 | TBD | TBD | TBD | TBD |
| 2020 | 5,455,000 | TBD | TBD | TBD | TBD |
| 2021 | 5,256,000 | TBD | TBD | TBD | TBD |
| 2022 | 5,058,000 | TBD | TBD | TBD | TBD |
| 2023 | 4,859,000 | TBD | TBD | TBD | TBD |
| 2024 | 4,661,000 | TBD | TBD | TBD | TBD |
| 2025 | 4,462,000 | TBD | TBD | TBD | TBD |
| 2026 | 4,264,000 | TBD | TBD | TBD | TBD |
| 2027 | 4,065,000 | TBD | TBD | TBD | TBD |
| 2028 | 3,867,000 | TBD | TBD | TBD | TBD |
| 2029 | 3,668,000 | TBD | TBD | TBD | TBD |
| 2030 | 3,470,000 | TBD | TBD | TBD | TBD |

*Legend*: MT $CO_2e$/yr = metric tons of carbon dioxide equivalent per year; TBD = to be determined in a future analysis.
*Notes*:

1. Emissions are $CH_4$ presented as $CO_2e$. Manure decomposition and enteric digestion emissions only.
2. The SB 1383 trajectory assumes a linear path from 2017 to 2030. For graphing purposes, the 2018 BAU emissions were used as the 2017 starting point. The value of 3,470,000 MT/yr in year 2030 is the SB 1383 goal (40 percent below the 2013 baseline emissions).
3. BAU 2017 emissions were not directly quantified. For graphing purposes, BAU 2017 emissions were assumed to be equal to BAU 2018 emissions.
4. Actual 2017 emissions were not directly quantified. For graphing purposes, actual 2017 emissions were assumed to equal 2018 BAU emissions minus the reduction from one digester project that began operating in 2017 (see Appendix B, Table B.4; emissions reflect the number of operating days in 2017).
5. A positive value means ahead of schedule; a negative value means behind schedule.
6. Reductions are shown as negative values.

Figure 7-1 shows the progress of the Tulare County dairies and feedlots toward meeting the SB 1383 goal in graphical format. The two short lines near the top left of the figure show the BAU $CH_4$ emissions by year (higher line) and actual $CH_4$ emissions by year (lower line). The diagonal dotted line represents the reference trajectory that would meet the goal by 2030. The horizontal dashed line across the bottom of the figure represents the SB 1383 goal, which is 40 percent below 2013 $CH_4$ emissions.

**Figure 7-1**
**Progress of $CH_4$ Emissions**
**in Relation to the 2030 SB 1383 Goal**



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# Appendix A – 2018 Business-As-Usual Emission Calculations

**Appendix A - Annual GHG Emission Calculations**

Table A.1
Dairy and Feedlot 2018 Business-As-Usual Emissions

| Source Category | $CO_2$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) | HFCs (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|---|---|---|
| Farm Equipment Exhaust | 41,292 | 2 | 0 | 0.0 | 41,434 |
| Farm Agricultural Soil | 0 | 0 | 982 | 0.0 | 292,639 |
| Farm Electricity Consumption | 57,928 | 4 | 0 | 0.0 | 58,167 |
| Dairy Equipment Exhaust | 118,230 | 5 | 1 | 0.0 | 118,635 |
| Truck Trips | 23,340 | 1 | 4 | 0.0 | 24,457 |
| Automobile Trips | 11,175 | 1 | 1 | 0.0 | 11,374 |
| Dairy Electricity Consumption | 95,111 | 7 | 1 | 0.0 | 95,503 |
| Dairy Refrigeration | 0 | 0 | 0 | 5.7 | 84,496 |
| Dairy Manure Decomposition | 0 | 129,306 | 1,430 | 0.0 | 3,658,872 |
| Dairy Enteric Digestion | 0 | 99,443 | 0 | 0.0 | 2,486,066 |
| Feedlot Manure Decomposition | 0 | 554 | 106 | 0.0 | 45,476 |
| Feedlot Enteric Digestion | 0 | 12,714 | 0 | 0.0 | 317,843 |
| **Total Emissions** | **347,077** | **242,035** | **2,525** | **5.7** | **7,234,962** |

Notes:

1. BAU emissions reflect 2018 actual dairy and feedlot cattle populations. BAU emissions also reflect the use of manure management systems in the same proportions as the 2013 baseline year. Emission calculations used methodologies consistent with the most recent available CARB California GHG Emission Inventory (year 2017). BAU emissions exclude the GHG reduction projects implemented since the 2013 baseline year.
2. CO2e was quantified using global warming potentials from the IPCC fourth assessment report (AR4), which are consistent with the CARB California GHG Emission Inventory.

Table A.2
Dairy and Feedlot Emission Reductions from Solar, Digester, and AMMP Projects Operating in 2018

| Project Type | 5-Year $CO_2e$ Reductions (MT/5-yrs) [1] | Annual $CO_2e$ Reductions (MT/yr) | CY 2018 $CO_2e$ Reductions (MT/yr) [2] |
|---|---|---|---|
| Solar Panels | -90,634 | -18,127 | -17,786 |
| Solar Thermal Hot Water Systems | -10 | -2 | -2 |
| Digesters | -333,810 | -66,762 | -25,813 |
| Alternative Manure Management Program | -35,050 | -7,010 | -7,010 |
| **Total** | **-459,504** | **-91,901** | **-50,611** |

Notes:

1. Reductions are shown as negative values.
2. Calendar year (CY) 2018 reductions are less than the annual reductions because some projects became operational during 2018 and therefore had partial-year reductions.

Table A.3
Progress of GHG Emission Reductions in Relation to the 2023 Dairy CAP Target

| Year | Dairy CAP Emission Reduction Trajectory ($MT CO_2e/yr$) [1][2] | Actual Emission Reductions Achieved (MT CO2e/yr) [1][3] | Deviation from Trajectory (MT CO2e/yr) [4] | Additional Reductions Needed to Reach 2023 Target (MT CO2e/yr) [1] | Percent of Target Reached |
|---|---|---|---|---|---|
| 2017 | 0 | -27,825 | 27,825 | -1,022,175 | 3% |
| 2018 | -175,000 | -50,611 | -124,389 | -999,389 | 5% |
| 2019 | -350,000 | TBD | TBD | TBD | TBD |
| 2020 | -525,000 | TBD | TBD | TBD | TBD |
| 2021 | -700,000 | TBD | TBD | TBD | TBD |
| 2022 | -875,000 | TBD | TBD | TBD | TBD |
| 2023 | -1,050,000 | TBD | TBD | TBD | TBD |

Legend: TBD = To be determined in a future analysis.

Notes:

1. Reductions are shown as negative values.
2. The Dairy CAP trajectory assumes a linear path from 2017 to 2023.
3. CY 2018 emissions were obtained from Table XX. CY 2017 emissions were obtained from Appendix B, Tables B.2 (60 solar panel projects operating in 2017) and B.4 (one digester project operating in 2017).
4. A positive value means ahead of schedule; a negative value means behind schedule.

Table A.4
Dairy and Feedlot 2018 Actual GHG Emissions

| Source Category | $CO_2$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) | HFCs (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|---|---|---|
| Farm Equipment Exhaust | 41,292 | 2 | 0 | 0.0 | 41,434 |
| Farm Agricultural Soil | 0 | 0 | 982 | 0.0 | 292,639 |
| Farm Electricity Consumption | 57,928 | 4 | 0 | 0.0 | 58,167 |
| Dairy Equipment Exhaust | 118,230 | 5 | 1 | 0.0 | 118,635 |
| Truck Trips | 23,340 | 1 | 4 | 0.0 | 24,457 |
| Automobile Trips | 11,175 | 1 | 1 | 0.0 | 11,374 |
| Dairy Electricity Consumption | 77,323 | 7 | 1 | 0.0 | 77,715 |
| Dairy Refrigeration | 0 | 0 | 0 | 5.7 | 84,496 |
| Dairy Manure Decomposition | 0 | 127,993 | 1,430 | 0.0 | 3,626,049 |
| Dairy Enteric Digestion | 0 | 99,443 | 0 | 0.0 | 2,486,066 |
| Feedlot Manure Decomposition | 0 | 554 | 106 | 0.0 | 45,476 |
| Feedlot Enteric Digestion | 0 | 12,714 | 0 | 0.0 | 317,843 |
| **Total Emissions** | **329,289** | **240,722** | **2,525** | **5.7** | **7,184,351** |

Notes:
1. Emission reductions from Table XX were applied to the BAU emissions from Table YY to produce the 2018 Actual Emissions. Emissions reductions from solar panels and solar thermal hot water systems were applied to the Dairy Electricity Consumption CO2 emissions. Emission reductions from digesters and AMMP projects were applied to the Dairy Manure Decomposition CH4 emissions.

Table A.5
Dairy and Feedlot 2018 Actual CH4 Emissions from Manure Management

| Source Category | $CH_4$ (MT/yr) | $CO_2e$ (MT/yr) |
|---|---|---|
| Dairy Manure Decomposition | 127,993 | 3,199,822 |
| Dairy Enteric Digestion | 99,443 | 2,486,066 |
| Feedlot Manure Decomposition | 554 | 13,853 |
| Feedlot Enteric Digestion | 12,714 | 317,843 |
| **Total Emissions** | **240,703** | **6,017,583** |

Table A.6
Progress of CH4 Emissions in Relation to the 2030 SB 1383 Target

| Year | SB 1383 Emissions Trajectory (MT $CO_2e/yr$)[1][2] | BAU Emissions (MT $CO_2e/yr$)[1][3] | Actual Emissions (MT $CO_2e/yr$)[1][4] | Deviation from Target Trajectory (MT $CO_2e/yr$)[5] | Additional Reductions Needed to Reach 2030 Target (MT CO2e/yr)[6] |
|---|---|---|---|---|---|
| 2017 | 6,050,406 | 6,050,406 | 6,039,528 | 10,879 | -2,569,528 |
| 2018 | 5,852,000 | 6,050,406 | 6,017,583 | -165,583 | -2,547,583 |
| 2019 | 5,653,000 | TBD | TBD | TBD | TBD |
| 2020 | 5,455,000 | TBD | TBD | TBD | TBD |
| 2021 | 5,256,000 | TBD | TBD | TBD | TBD |
| 2022 | 5,058,000 | TBD | TBD | TBD | TBD |
| 2023 | 4,859,000 | TBD | TBD | TBD | TBD |
| 2024 | 4,661,000 | TBD | TBD | TBD | TBD |
| 2025 | 4,462,000 | TBD | TBD | TBD | TBD |
| 2026 | 4,264,000 | TBD | TBD | TBD | TBD |
| 2027 | 4,065,000 | TBD | TBD | TBD | TBD |
| 2028 | 3,867,000 | TBD | TBD | TBD | TBD |
| 2029 | 3,668,000 | TBD | TBD | TBD | TBD |
| 2030 | 3,470,000 | TBD | TBD | TBD | TBD |

Legend: ND = no data; TBD = To be determined in a future analysis.
Notes:

1. Emissions are CH4 presented as CO2e. Manure decomposition and enteric digestion emissions only.
2. The SB 1383 trajectory assumes a linear path from 2017 to 2030. The 2018 BAU emissions were used as the 2017 starting point. The value of 3,467,000 MT/yr in year 2030 is the SB 1383 target (40 percent below the 2013 baseline emissions). Values after 2017 are rounded to the nearest thousand.
3. BAU 2017 emissions were not directly quantified. For the purposes of graphing the SB 1383 progress, BAU 2017 emissions were assumed to be equal to BAU 2018 emissions.
4. Actual 2017 emissions were not directly quantified. For the purposes of graphing the SB 1383 progress, actual 2017 emissions were assumed to equal 2018 BAU emissions minus the reduction from one digester project that began operating in 2017 (see Appendix B, Table B.4; emissions reflect number of operating days in 2017).
5. A positive value means ahead of schedule; a negative value means behind schedule.
6. Reductions are shown as negative values.

**Table A.7**
**Dairy and Feedlot Animal Population**

| Year | Dairy Cows[3] | Dairy Heifers 0-12 mos. | Dairy Heifers 12-24 mos. | Dairy Calves | Feedlot Cattle | Total Animals |
|---|---|---|---|---|---|---|
| 2013 (baseline year)[1] | 543,431 | 137,985 | 148,928 | 65,770 | 133,886 | **1,030,000** |
| 2018 (reporting year)[2] | 569,140 | 125,636 | 167,099 | 59,636 | 204,272 | **1,125,783** |

Notes:

1. Source: *County of Tulare Dairy and Feedlot Climate Action Plan* . August 2017. Appendix A, Tables A-1 and A-3.
2. Source: Tulare County Resource Management Agency. 2018 ACR and dairy vs feedlot breakdown.
3. Includes milk cows and dry cows.

**Table A.8**
**No. of Active Dairy and Feedlot Animal Confined Facilities**

| Year | No. of Facilities |
|---|---|
| 2013 (baseline year)[1] | 330 |
| 2018 (reporting year)[2] | 283 |

Notes:

1. Source: Tulare County RMA. *Draft EIR for the Animal Confinement Facilities Plan, and Dairy and Feedlot Climate Action Plan* . January 2016. Appendix G, Page 1-2.
2. Source: Tulare County Resource Management Agency. Includes all facilities that reported non-zero herd sizes.

**Table A.9**
**Dairy and Feedlot Animal Units**

| Year | Total Animal Units |
|---|---|
| 2013 (baseline year)[1] | 741,040 |
| 2018 (reporting year)[2] | 745,337 |

Notes:

1. Source: Tulare County RMA. *Draft EIR for the Animal Confinement Facilities Plan, and Dairy and Feedlot Climate Action Plan* . January 2016. Appendix G, Page 1-2.
2. Source: Tulare County Resource Management Agency.

Table A.10
California 2017 Dairy Cattle Population

| Dairy Cows | Dairy Heifers 0-12 mo | Dairy Heifers 12-24 mo | Dairy Calves |
|---|---|---|---|
| 1,731,338 | 216,808 | 510,080 | 886,202 |

Notes:
Used in annual emission calculations for Enteric (dairies and feedlots) and Manure Management (feedlots only).
Source: CA GHG Emissions Inventory, Online Query Tool, Enteric Fermentation, most recent year available (2017).

Table A.11
California 2017 Total Cattle Population

| Cattle Type | Total Population | Dairy Cows Population | Dairy Heifers Population | Feedlot |
|---|---|---|---|---|
| Beef calves | 264,965 | | | 264,965 |
| Beef cows | 655,000 | | | 655,000 |
| Beef replacements 0-12 months | 26,590 | | | 26,590 |
| Beef replacements 12-24 months | 61,676 | | | 61,676 |
| Bulls | 70,000 | | | 70,000 |
| Dairy calves | 886,202 | | 886,202 | |
| Dairy cows | 1,731,338 | 1,731,338 | | |
| Dairy replacements 0-12 months | 216,808 | | 216,808 | |
| Dairy replacements 12-24 months | 510,080 | | 510,080 | |
| Heifer feedlot | 174,028 | | | 174,028 |
| Heifer stockers | 113,678 | | | 113,678 |
| Steer feedlot | 287,478 | | | 287,478 |
| Steer stockers | 260,137 | | | 260,137 |
| Total dairy population: | 3,344,428 | **1,731,338** | **1,613,090** | **1,913,552** |
| Total feedlot population: | 1,913,552 | | | |
| Total population: | 5,257,980 | | | |

Notes:
Used in annual emission calculations for Enteric (dairies and feedlots) and Manure Management (feedlots only).
Source: CA GHG Emissions Inventory, Online Query Tool, Enteric Fermentation, most recent year available (2017).

Table A.12
2018 Tulare Dairy and Feedlot Herd Counts

| Facility Type | Cows in Milk | Mature Bulls[1] | Dry Cows | Heifers/Bulls 1-2 yrs | Heifers/Bulls 3 months - 1 yr | Calves under 3 months | Total |
|---|---|---|---|---|---|---|---|
| Dairies | 433,717 | 0 | 135,423 | 167,099 | 125,636 | 59,636 | 921,511 |
| Feedlots | 7,100 | 2,070 | 7,949 | 15,663 | 55,191 | 116,299 | 204,272 |
| **Total** | **440,817** | **2,070** | **143,372** | **182,762** | **180,827** | **175,935** | **1,125,783** |

Note:
[1] For emission calculation purposes, all mature bulls were assigned to the feedlot category even if the bulls were actually reported on a dairy.

Table A.13
Emission Factors for Diesel Farm Equipment

| Emission Factor (kg/gal) | | |
|---|---|---|
| $CO_2$[1] | $CH_4$[2] | $N_2O$[2] |
| 10.21 | 4.14E-04 | 8.28E-05 |

Notes:
1. The CO2 emission factor is from The Climate Registry, 2020 Emission Factors, Table
2. $CH_4$ and $N_2O$ emission factors were scaled from the $CO_2$ emission factor in proportion to the emission factors from The Climate Registry, 2020 Emission Factors. Table 1.9 for $CH_4$ and $N_2O$.

Table A.14
2018 Emissions Associated with Farm Equipment

| 2013 Cultivated Acres | 2018 Cultivated Acres[1] | Fuel Usage Factor (gal/yr per acre)[2] | 2018 Fuel Use (gal/yr)[1] | 2018 Annual Emissions (metric ton/yr) | | | |
|---|---|---|---|---|---|---|---|
| | | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| 160,839 | 161,772 | 25 | 4,044,289 | 41,292 | 1.7 | 0.3 | 41,434 |

Notes:
1. The 2018 cultivated acreage was scaled from 2013 in proportion to the total number of animal units.
2. Source: CARB, 2018. *Analysis of California's Diesel Agricultural Equipment Inventory according to Fuel Use, Farm Size, and Equipment Horsepower* . October 3. Available: https://ww3.arb.ca.gov/msei/ordiesel/agfuelstudy2018.pdf. Accessed July 2020. Figure 3.3: Fuel per Acre, by Commodity. Hay, Forage, Pasture, Row Crops.

Table A.15
Emissions of $N_2O$ from Agricultural Soil

| Crop Type | 2018 Cultivated Acres | Nitrogen Requirement per Crop (lb/acre/yr) | No. of Crops per Year[1] | $N_f$ Nitrogen in Fertilizer (ton/yr) | CF Conversion Factor N2O-N to N2O[2] | N2O Emission Factor (kg N2O-N/kg N) | | | $F_{leach}$ Fraction of N Lost through Leaching & Runoff[4] | $F_{gasm}$ Fraction of N Volatilization as NH3 and NOx[4] | 2018 Annual GHG Emissions (metric ton/yr)[5] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $EF_1$ Direct from Soils[3] | $EF_5$ Indirect from Runoff[4] | $EF_4$ Indirect from Volatilization[4] | | | $N_2O$ | $CO_2e$ |
| Corn Silage (double) | 161,772 | 250 | 2 | 40,443 | 1.57 | 0.005 | 0.011 | 0.005 | 0.24 | 0.21 | 501 | 149,306 |
| Alfalfa | 161,772 | 480 | 1 | 38,825 | 1.57 | 0.005 | 0.011 | 0.005 | 0.24 | 0.21 | 481 | 143,333 |
| **Total** | -- | -- | -- | **79,268** | -- | -- | -- | -- | -- | -- | **982** | **292,639** |

Notes:

1. Assume the support crop acreage has 2 summer crops of corn and 1 winter crop of alfalfa (alfalfa was conservatively selected over wheat because it has a higher nitrogen requirement).

2. Source: IPCC, 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* . Volume 4, Chapter 11. May 12, 2019. Available: https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html. Accessed 7/1/2020.

3. Source: IPCC, 2019. Table 11.1. Dry climate.

4. Source: IPCC, 2019. Table 11.3. Dry climate.

5. The $N_2O$ emission rate is calculated based on Equations 11.1 (direct), 11.9 (volatilization), and 11.10 (runoff) in IPCC, 2019. The combined equation is:
$$Emission\ Rate = N_f \times CF \times [EF_1 + (EF_5 \times F_{leach}) + (EF_4 \times F_{gasm})] \times 0.9072$$

Table A.16
GHG Emissions Associated with Support Crop Irrigation

| 2018 Cultivated Acres | Usage Factor for Electric Irrigation Pumps (MWh/acre/yr) [1] | 2018 Electricity Usage (MWh/yr) [2] | 2018 Emission Factors (lb/MWh) [3] | | | Annual Emissions (metric ton/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| 161,772 | 1.59 | 257,217 | 496.5 | 0.034 | 0.004 | 57,928 | 4.0 | 0.5 | 58,167 |

Notes:

1. Source: Tulare County RMA. *Draft EIR for the ACFP and Dairy CAP* . January 2016. Appendix E.2.
2. Calculations assume all ACF support crop irrigation pumps are electric.
3. Source: The Climate Registry. *2020 Default Emission Factor Document* . April 2020. Table 3.1. 2018 Emisson Rates. eGRID CAMX Subregion.

Table A.17
Emission Factors for Diesel Dairy Equipment

| Emission Source | Emission Factor (kg/gal) | | |
|---|---|---|---|
| | $CO_2$ [1] | $CH_4$ [2] | $N_2O$ [2] |
| Agricultural Tractor 51-120 hp | 10.21 | 4.14E-04 | 8.28E-05 |
| Rubber Tired Loader 121-175 hp | 10.21 | 4.14E-04 | 8.28E-05 |
| Off-Highway Truck 251-500 hp | 10.21 | 4.14E-04 | 8.28E-05 |
| Generator Set 251-500 hp | 10.21 | 4.14E-04 | 8.28E-05 |

Notes:

1. The CO2 emission factor is from The Climate Registry, 2020 Emission Factors, Table 1.1.

2. $CH_4$ and $N_2O$ emission factors were scaled from the $CO_2$ emission factor in proportion to the emission factors from The Climate Registry, 2020 Emission Factors. Table 1.9 for $CH_4$ and $N_2O$.

Table A.18
2018 Emissions Associated with Dairy Equipment

| Emission Source | 2013 Equipment Annual Work Done (hp-hr/yr) | 2018 Equipment Annual Work Done (hp-hr/yr) [2] | 2018 Fuel Use (gal/yr) [1] | 2018 Annual Emissions (metric ton/yr) | | | |
|---|---|---|---|---|---|---|---|
| | | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Dairy Tractor 51-120 hp | 80,652,507 | 81,120,148 | 4,187,862 | 42,758 | 1.7 | 0.3 | 42,905 |
| Loader 121-175 hp | 54,730,496 | 55,047,835 | 2,841,868 | 29,015 | 1.2 | 0.2 | 29,115 |
| Feed Mixer Truck 251-500 hp | 87,599,377 | 88,107,297 | 4,548,577 | 46,441 | 1.9 | 0.4 | 46,600 |
| Standby Generator 251-500 hp | 33,600 | 28,815 | 1,488 | 15 | 0.0 | 0.0 | 15 |
| **Total** | **223,015,980** | **224,304,095** | **11,579,795** | **118,230** | **4.8** | **1.0** | **118,635** |

Notes:

1. Fuel use (gal/yr) = Annual Work (hp-hr/yr) x BSFC (lb/hp-hr) / Fuel Conversion (lb/gallon)

*Brake specific fuel consumption (BSFC) (lb/hp-hr):* *0.367*

*Diesel Fuel conversion (lb/gallon)* *7.1089*

CARB, MSEI Documentation Off-Road Diesel Equipment, 2017 Off-road Diesel Emission Factors. *ordas_ef_fcf_2017_v7.xlsx.*

Available: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road. Accessed July 2020.

2. Annual work done in 2018 was scaled from 2013 in proportion to the No. of facilities for standby generators and the No. of animal units for all other source categories.

Table A.19
On-Road Vehicle Emissions

| Vehicle Description | Vehicle Type[1] | 2013 Round Trips (trips/yr) | 2018 Round Trips (trips/yr)[2] | One-Way Trip Length (mi/trip) | 2018 Annual VMT (mi/yr) | 2018 Annual Emissions (metric ton/yr)[3] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Silage Truck 3-axle, 10-ton | T6 Ag | 573,151 | 576,474 | 1 | 1,152,949 | 1,315 | 0.0 | 0.2 | 1,377 |
| Silage Truck 5-axle, 20-ton | T7 Ag | 71,644 | 72,059 | 1 | 144,119 | 261 | 0.0 | 0.0 | 273 |
| Hay Truck 3-axle, 10-ton | T6 Ag | 12,882 | 12,957 | 2 | 51,827 | 59 | 0.0 | 0.0 | 62 |
| Hay Truck 5-axle, 20-ton | T7 Ag | 57,972 | 58,308 | 20 | 2,332,325 | 4,221 | 0.2 | 0.7 | 4,423 |
| Concentrated Feed Truck 5-axle, 20-ton | T7 Ag | 202,104 | 203,276 | 20 | 8,131,034 | 14,714 | 0.6 | 2.3 | 15,419 |
| Calf Milk Replacer Truck 2-axle, 10-ton | T6 Ag | 817 | 822 | 20 | 32,869 | 37 | 0.0 | 0.0 | 39 |
| Cattle Truck - baby calves from dairies to calf ranches | T6 Ag | 12,607 | 12,680 | 10 | 253,602 | 289 | 0.0 | 0.0 | 303 |
| Cattle Truck - weaned heifer calves from calf ranches to dairies | T6 Ag | 6,380 | 6,417 | 10 | 128,340 | 146 | 0.0 | 0.0 | 153 |
| Cattle Truck - weaned bull calves from calf ranches to foothill pasture | T6 Ag | 1,418 | 1,426 | 25 | 71,311 | 81 | 0.0 | 0.0 | 85 |
| Cattle Truck - weaned bull calves from calf ranches to background feedl | T7 Ag | 1,588 | 1,597 | 50 | 159,721 | 289 | 0.0 | 0.0 | 303 |
| Cattle Truck - other cattle trips from calf ranches | T7 Ag | 1,418 | 1,426 | 20 | 57,049 | 103 | 0.0 | 0.0 | 108 |
| Cattle Truck - beef cattle from foothill pasture to finishing feedlots | T6 Ag | 4,721 | 4,748 | 75 | 712,256 | 812 | 0.0 | 0.1 | 851 |
| Cattle Truck - dairies to beef processing facilities - gooseneck trailers | T6 Ag | 17,008 | 17,107 | 20 | 684,265 | 780 | 0.0 | 0.1 | 817 |
| Cattle Truck - dairies to beef processing facilities - semi tractor/trailers | T7 Ag | 1,278 | 1,285 | 50 | 128,541 | 233 | 0.0 | 0.0 | 244 |
| **Total - Trucks** | | **964,988** | **970,583** | | **14,040,207** | **23,340** | **1.0** | **3.7** | **24,457** |
| Dairy Employee trips | LDT1-2 | 1,349,040 | 1,156,904 | 10 | 23,138,080 | 9,015 | 0.6 | 0.5 | 9,176 |
| Dairy Visitor trips (vet, breeder, sales, delivery) | LDT1-2 | 161,616 | 138,598 | 20 | 5,543,919 | 2,160 | 0.1 | 0.1 | 2,198 |
| **Total - Automobiles** | | **1,510,656** | **1,295,502** | | **28,681,999** | **11,175** | **0.8** | **0.6** | **11,374** |

Notes:

1. All trucks are assumed to be Medium-Heavy Duty Diesel Agriculture Trucks (T6; 14,000-33,000 lbs GVWR) and Heavy-Heavy Duty Diesel Agriculture Trucks (T7; 33,000-60,000 lbs GVWR). All employees and visitors are conservatively assumed to drive light-duty trucks (LDT1; 0-3,750 lbs and LDT2; 3,751-5,750 lbs).
2. Trips in 2018 were scaled from 2013 in proportion to the number of animal units for trucks and the number of facilities for automobiles.
3. Emissions include running, idle, and starting exhaust.

**Table A.20**
**EMFAC 2017 Output**
EMFAC2017 (v1.0.2) Emissions Inventory
Region Type: County
Region: TULARE
Calendar Year: 2018
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption. Note 'day' in the unit is operation day.

| Region | Calendar Year | Vehicle Category | Model Year | Speed | Fuel | Population | VMT | Trips | CO2_RUNEX | CO2_IDLEX | CO2_STREX | CO2_TOTEX | CH4_RUNEX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | GAS | 19516.16 | 661456.55 | 84812.5547 | 256.846419 | 0 | 7.1030732 | 263.949492 | 0.0128499 |
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | DSL | 23.478797 | 466.587481 | 78.0097307 | 0.20367981 | 0 | 0 | 0.20367981 | 6.397E-06 |
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | ELEC | 6.5237901 | 243.376973 | 32.5618177 | 0 | 0 | 0 | 0 | 0 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | GAS | 61970.998 | 2301874.65 | 282492.402 | 985.386769 | 0 | 26.048203 | 1011.43497 | 0.0238754 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | DSL | 163.07795 | 7366.04818 | 777.851528 | 2.41202803 | 0 | 0 | 2.41202803 | 1.222E-05 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | ELEC | 119.51421 | 4352.04404 | 614.372816 | 0 | 0 | 0 | 0 | 0 |
| TULARE | 2018 | T6 Ag | Aggregated | Aggregated | DSL | 54.893586 | 680.956756 | 241.531778 | 0.81617477 | 0.0396285 | 0 | 0.85580327 | 2.861E-05 |
| TULARE | 2018 | T7 Ag | Aggregated | Aggregated | DSL | 59.796195 | 862.532848 | 263.10326 | 1.60736703 | 0.1131306 | 0 | 1.72049763 | 6.219E-05 |

Source: EMFAC2017 Web Database (v1.0.2). Available:
https://arb.ca.gov/emfac/2017/. Accessed 7/1/2020.

Only GHG emissions were included in the EMFAC output.

**Table A.20**
**EMFAC 2017 Output**
EMFAC2017 (v1.0.2) Emissions Inventory
Region Type: County
Region: TULARE
Calendar Year: 2018
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1

| Region | Calendar Year | Vehicle Category | Model Year | Speed | CH4_IDLEX | CH4_STREX | CH4_TOTEX | N2O_RUNEX | N2O_IDLEX | N2O_STREX | N2O_TOTEX | Fuel Consumption |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | 0 | 0.0139318 | 0.0267817 | 0.0148745 | 0 | 0.0037898 | 0.0186643 | 27.8607142 |
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | 0 | 0 | 6.397E-06 | 3.202E-05 | 0 | 0 | 3.202E-05 | 0.018152562 |
| TULARE | 2018 | LDT1 | Aggregated | Aggregated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | 0 | 0.0357381 | 0.0596135 | 0.0360189 | 0 | 0.0140929 | 0.0501118 | 106.7602006 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | 0 | 0 | 1.222E-05 | 0.0003791 | 0 | 0 | 0.0003791 | 0.214967248 |
| TULARE | 2018 | LDT2 | Aggregated | Aggregated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TULARE | 2018 | T6 Ag | Aggregated | Aggregated | 1.73525E-06 | 0 | 3.034E-05 | 0.0001283 | 6.229E-06 | 0 | 0.0001345 | 0.076271781 |
| TULARE | 2018 | T7 Ag | Aggregated | Aggregated | 1.00093E-05 | 0 | 7.219E-05 | 0.0002527 | 1.778E-05 | 0 | 0.0002704 | 0.153335962 |

Source: EMFAC2017 Web Database (v1.0.2). Available:
https://arb.ca.gov/emfac/2017/. Accessed 7/1/2020.

Only GHG emissions were included in the EMFAC output.

Table A.21
Calculation of Vehicle GHG Emission Factors

| Region | Calendar Year | Vehicle Category[1] | Model Year | Speed | Fuel | VMT (mi/day) | CO2_TOTEX (ton/day)[2] | CH4_TOTEX (ton/day)[2] | N2O_TOTEX (ton/day)[2] | CO2 (g/mi) | CH4 (g/mi) | N2O (g/mi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TULARE | 2018 | LDT1-2 | Aggregated | Aggregated | Aggregated | 2,975,759 | 1,278 | 0.086 | 0.069 | 390 | 0.026 | 0.021 |
| TULARE | 2018 | T6 Ag | Aggregated | Aggregated | Aggregated | 681 | 0.86 | 0.000030 | 0.00013 | 1,140 | 0.040 | 0.179 |
| TULARE | 2018 | T7 Ag | Aggregated | Aggregated | Aggregated | 863 | 1.72 | 0.000072 | 0.00027 | 1,810 | 0.076 | 0.284 |

Notes:

1. LDT1-2 = Light-Duty Trucks (LDT1; 0-3,750 lbs and LDT2; 3,751-5,750 lbs). T6 Ag = Medium-Heavy Duty Diesel Agriculture Trucks (14,000-33,000 lbs GVWR). T7 Ag = Heavy-Heavy Duty Diesel Agriculture Trucks (33,000-60,000 lbs GVWR).
2. Emission factors include running, idle, and starting exhaust. Source: EMFAC2017 Web Database (v1.0.2). Tulare County.

Table A.22
Emissions Associated with Dairy Electricity Use

| 2018 Population (Dairy Cows and Heifers) | Dairy Electricity Usage per Cow (MWh/cow/yr) [1] | 2018 Electricity Usage (MWh/yr) | 2018 Emission Factors (lb/MWh) [2] | | | 2018 Annual Emissions (metric ton/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| 861,875 | 0.49 | 422,319 | 496.5 | 0.034 | 0.004 | 95,111 | 6.513 | 0.766 | 95,503 |

Notes:

1. Source: Tulare County RMA. *Draft EIR for the ACFP, and Dairy CAP* . January 2016. Appendix E.2.
2. Source: The Climate Registry. *2020 Default Emission Factor Document* . April 2020. Table 3.1. 2018 Emisson Rates. eGRID CAMX Subregion.

Table A.23
GHG Emissions Associated with Dairy Refrigeration Equipment

| 2013 Total Refrigerant Charge (lb) | 2018 Total Refrigerant Charge (lb)[1] | Refrigerant Type[2] | Global Warming Potential[3] | Annual Refrigerant Loss Rate[4] | 2018 Annual Emissions (metric ton/yr) | |
|---|---|---|---|---|---|---|
| | | | | | HFCs | $CO_2e$ |
| 48,072 | 50,346 | HFC-23 | 14,800 | 25% | 5.71 | 84,496 |

Notes:

1. The 2018 refrigerant charge was scaled from 2013 in proportion to the number of dairy cows.
2. HFC-23 was conservatively selected as a worst case refrigerant for industrial refrigeration in terms of its global warming potential.
3. GWP is from the IPCC fourth assessment report (AR4). GWP is consistent with the CARB California Greenhouse Gas Emission Inventory Program.
4. Source: The Climate Registry. *2020 Default Emission Factor Document* . April 2020. Table 4.1. Industrial Refrigeration.

Table A.24
California Herd Distribution Fractions by Manure Management System

| Manure Management System | Herd Fraction | |
|---|---|---|
| | Dairy Cows | Dairy Heifers |
| Anaerobic Digester | 1.19E-02 | 0.00E+00 |
| Anaerobic Lagoon | 5.82E-01 | 0.00E+00 |
| Daily Spread | 1.06E-01 | 1.08E-01 |
| Deep Pit | 1.04E-03 | 0.00E+00 |
| Dry Lot | 0.00E+00 | 8.74E-01 |
| Liquid/Slurry | 2.02E-01 | 8.74E-03 |
| Pasture | 6.71E-03 | 9.25E-03 |
| Solid Storage | 9.10E-02 | 0.00E+00 |
| **Total** | **1.00E+00** | **1.00E+00** |

Source: *California's 2000-2014 GHG Emissions Inventory. Technical Support Document. 2016 Edition* . Annex 3B. Manure Management (IPCC 3A2). The herd distribution fractions reflect 2013 conditions to preserve business-as-usual manure management practices for the 2018 BAU emission calculations. Nevertheless, the distribution fractions have not changed in the CARB GHG Emission Inventories through the most recent available year (2017).

Table A.25
Tulare County 2018 Dairy Cattle Herd Counts

| Dairy Cows | Dairy Heifers |
|---|---|
| 569,140 | 352,371 |

Note: 2018 year cattle populations were provided by Tulare County. Dairy Cows category includes milk cows and dry cows. Dairy Heifers category includes all heifers and calves.

Table A.26
$CH_4$ 2018 Business-As-Usual Emissions from Manure Management - Dairy Cows

| | Tulare Reporting Year (2018) [a] | | | | | | |
|---|---|---|---|---|---|---|---|
| | $CH_{4,man}$ (kg/yr)[b] | Vex (kg/yr)[c] | $WMS*N_{animals}$ (animals)[d] | VS (kg VS/animal/yr)[e] | $B_o$ ($m^3$ $CH_4$/kg VS)[f] | MCF (%)[g] | $c_1$ ($kg/m^3$)[h] |
| Anaerobic Digester | 557,486 | 19,385,917 | 6,785 | 2,857 | 0.24 | 0.181 | 0.662 |
| Anaerobic Lagoon | 109,883,828 | 946,122,067 | 331,159 | 2,857 | 0.24 | 0.731 | 0.662 |
| Daily Spread | 136,308 | 171,585,718 | 60,058 | 2,857 | 0.24 | 0.005 | 0.662 |
| Deep Pit | 86,421 | 1,684,014 | 589 | 2,857 | 0.24 | 0.323 | 0.662 |
| Dry Lot | 0 | 0 | 0 | 2,857 | 0.24 | 0.015 | 0.662 |
| Liquid/Slurry | 16,850,471 | 328,352,478 | 114,929 | 2,857 | 0.24 | 0.323 | 0.662 |
| Pasture | 26,011 | 10,914,397 | 3,820 | 2,857 | 0.24 | 0.015 | 0.662 |
| Solid Storage | 940,496 | 147,988,387 | 51,799 | 2,857 | 0.24 | 0.04 | 0.662 |
| **Total** | **128,481,021** | -- | **569,140** | -- | -- | -- | -- |

Table A.27
$CH_4$ 2018 Business-As-Usual Emissions from Manure Management - Dairy Heifers

| | Tulare Reporting Year (2018) [a] | | | | | | |
|---|---|---|---|---|---|---|---|
| | $CH_{4,man}$ (kg/yr)[b] | Vex (kg/yr)[c] | $WMS*N_{animals}$ (animals)[d] | VS (kg VS/animal/yr)[e] | $B_o$ ($m^3$ $CH_4$/kg VS)[f] | MCF (%)[g] | $c_1$ ($kg/m^3$)[h] |
| Anaerobic Digester | 0 | 0 | 0 | 1,252 | 0.17 | 0.181 | 0.662 |
| Anaerobic Lagoon | 0 | 0 | 0 | 1,252 | 0.17 | 0.731 | 0.662 |
| Daily Spread | 26,815 | 47,654,890 | 38,063 | 1,252 | 0.17 | 0.005 | 0.662 |
| Deep Pit | 0 | 0 | 0 | 1,252 | 0.17 | 0.323 | 0.662 |
| Dry Lot | 650,890 | 385,575,666 | 307,968 | 1,252 | 0.17 | 0.015 | 0.662 |
| Liquid/Slurry | 140,164 | 3,855,910 | 3,080 | 1,252 | 0.17 | 0.323 | 0.662 |
| Pasture | 6,891 | 4,082,026 | 3,260 | 1,252 | 0.17 | 0.015 | 0.662 |
| Solid Storage | 0 | 0 | 0 | 1,252 | 0.17 | 0.04 | 0.662 |
| **Total** | **824,761** | -- | **352,371** | -- | -- | -- | -- |

Notes:

[a] 2018 BAU emission calculations used the 2018 herd population and the most recent available factors (2017) from the California GHG Inventory Query Tool.

[b] $CH_{4,man}$: Methane emissions estimated using Equation 1 (see below).

*Equation 1* $CH_{4,man} = V_{ex} \; X \; B_o \; X \; MCF \; X \; c_1$

[c] $V_{ex}$: Volatile solids excreted estimated using Equation 2 (see below).

*Equation 2* $V_{ex} = VS \; X \; (WMS*N_{animals})$

[d] $WMS*N_{animals}$: Number of animals per waste management system. Assumes Tulare has the same distribution of waste management systems as California.

[e] VS: Volatile solids excreted per animal.

[f] $B_o$: Maximum methane producing capacity.

[g] MCF: Methane conversion factor.

[h] $c_1$: Conversion factor representing density of methane at 25C.

Abbreviations:

$B_o$ - maximum methane producing capacity
$c_1$ - density of methane at 25C
CARB - California Air Resources Board
CFR - Code of Federal Regulations
$CH_{4,man}$ - methane emissions from manure management
$CO_2e$ - carbon dioxide equivalent
GWP - global warming potential
kg - kilogram
$m^3$ - cubic meters
MCF - methane conversion factor
MMT - million metric tonnes
$N_{animals}$ - animal population
$V_{ex}$ - amount of volatile solids excreted in each WMS
VS - volatile solids production rate
WMS - waste management system
yr - year

Table A.28
$N_2O$ 2018 Business-As-Usual Emissions from Manure Management - Dairy Cows

| | Tulare Reporting Year (2018) [a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $N_2O_{man}$ [b] (kg/yr) | $WMS*N_{animals}$ [c] (animals) | $N_{ex}$ [d] (g/yr) | Direct N as $N_2O$ [e] (g $N_2O$-N/g) | Volatilization fraction [f] (fraction) | Indirect N as $N_2O$, volatilized [g] (g $N_2O$-N/g) | Runoff fraction [h] (fraction) | Indirect N as $N_2O$, runoff [i] (g $N_2O$-N/g) |
| Anaerobic Digester | 7,374 | 6,785 | 158,656 | 0 | 0.43 | 0.01 | 0.008 | 0.0075 |
| Anaerobic Lagoon | 359,902 | 331,159 | 158,656 | 0 | 0.43 | 0.01 | 0.008 | 0.0075 |
| Daily Spread | 14,970 | 60,058 | 158,656 | 0 | 0.10 | 0.01 | 0 | 0.0075 |
| Deep Pit | 646 | 589 | 158,656 | 0.002 | 0.24 | 0.01 | 0 | 0.0075 |
| Dry Lot | 0 | 0 | 158,656 | 0.02 | 0.15 | 0.01 | 0.02 | 0.0075 |
| Liquid/Slurry | 219,442 | 114,929 | 158,656 | 0.005 | 0.26 | 0.01 | 0.008 | 0.0075 |
| Pasture | 0 | 3,820 | 158,656 | 0 | 0.00 | 0.01 | 0 | 0.0075 |
| Solid Storage | 99,419 | 51,799 | 158,656 | 0.005 | 0.27 | 0.01 | 0 | 0.0075 |
| **Total** | **701,753** | **569,140** | -- | -- | -- | -- | -- | -- |

Table A.29
$N_2O$ 2018 Business-As-Usual Emissions from Manure Management - Dairy Heifers

| | Tulare Reporting Year (2018) [a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $N_2O_{man}$ [b] (kg/yr) | $WMS*N_{animals}$ [c] (animals) | $N_{ex}$ [d] (g/yr) | Direct N as $N_2O$ [e] (g $N_2O$-N/g) | Volatilization fraction [f] (fraction) | Indirect N as $N_2O$, volatilized [g] (g $N_2O$-N/g) | Runoff fraction [h] (fraction) | Indirect N as $N_2O$, runoff [i] (g $N_2O$-N/g) |
| Anaerobic Digester | 0 | 0 | 68,911 | 0 | 0.43 | 0.01 | 0.008 | 0.0075 |
| Anaerobic Lagoon | 0 | 0 | 68,911 | 0 | 0.43 | 0.01 | 0.008 | 0.0075 |
| Daily Spread | 4,121 | 38,063 | 68,911 | 0 | 0.10 | 0.01 | 0 | 0.0075 |
| Deep Pit | 0 | 0 | 68,911 | 0.002 | 0.24 | 0.01 | 0 | 0.0075 |
| Dry Lot | 721,864 | 307,968 | 68,911 | 0.02 | 0.15 | 0.01 | 0.02 | 0.0075 |
| Liquid/Slurry | 2,554 | 3,080 | 68,911 | 0.005 | 0.26 | 0.01 | 0.008 | 0.0075 |
| Pasture | 0 | 3,260 | 68,911 | 0 | 0.00 | 0.01 | 0 | 0.0075 |
| Solid Storage | 0 | 0 | 68,911 | 0.005 | 0.27 | 0.01 | 0 | 0.0075 |
| **Total** | **728,539** | **352,371** | -- | -- | -- | -- | -- | -- |

Notes:

[a] 2018 BAU emission calculations used the 2018 herd population and the most recent available factors (2017) from the California GHG Inventory Query Tool.

[b] $N_2O_{man}$: Nitrous oxide emissions estimated using Equation 1 (see below).

*Equation 1* $$N_2O = WMS*N_{animals} \times N_{ex} \times [D_{EF} + (V_{frac} \times V_{EF}) + (R_{frac} \times R_{EF})] \times 1.5711 \times (g \text{ to } kg)$$

[c] $WMS*N_{animals}$: Number of animals per waste management system. Assumes Tulare has the same distribution of waste management systems as California.

[d] $N_{ex}$: Nitrogen excreted per animal.

[e] Direct N a $N_2O$: Emission factor representing direct nitrogen as $N_2O$-N for the particular waste management system.

[f] Volatilization fraction of N for the animal group.

[g] Emission factor representing indirect nitrogen as $N_2O$-N for redeposited volatilized N.

[h] Runoff fraction of N for the animal group.

[i] Emission factor representing indirect nitrogen as $N_2O$-N for runoff N.

Abbreviations:

CARB - California Air Resources Board
CFR - Code of Federal Regulations
$CO_2e$ - carbon dioxide equivalent
g - gram
GWP - global warming potential
kg - kilogram
MMT - million metric tonnes
N - nitrogen
$N_2O$ - nitrous oxide
$N_2O_{man}$ - nitrous oxide emissions from manure management
$N_{animals}$ - animal population
$N_{ex}$ - nitrogen excreted per animal
WMS - waste management system
yr - year

Table A.30
Dairy Cattle Herd Counts for Enteric Fermentation Calculation

| Category | Dairy Cows | Dairy Heifers 0-12 mo | Dairy Heifers 12-24 mo | Dairy Calves |
|---|---|---|---|---|
| California (2017)[1] | 1,731,338 | 216,808 | 510,080 | 886,202 |
| Tulare County (2018)[2] | 569,140 | 125,636 | 167,099 | 59,636 |

Notes:

1. California populations are from the CARB 2000-2017 GHG Inventory Query Tool, most recent year available (2017).

2. 2018 year cattle populations were provided by Tulare County. Dairy cows include cows in milk and dry cows.

Table A.31
Emissions from Enteric Fermentation - Dairies

| Source | $CH_4$ (MT/yr) | | | | |
|---|---|---|---|---|---|
| | Dairy Cows | Dairy Heifers 0-12 mo | Dairy Heifers 12-24 mo | Dairy Calves | Total |
| California (2017)[1] | 250,360 | 9,437 | 33,517 | 10,309 | **303,623** |
| Tulare County (2018)[2] | 82,301 | 5,469 | 10,980 | 694 | **99,443** |

Notes:

1. California CH4 emissions are from the CARB 2000-2017 GHG Inventory Query Tool, most recent year available (2017).

2. CARB and EPA use the same methodology to estimate emissions from enteric fermentation. As such, this table assumes that Tulare emissions are proportional to the California emissions based on animal population.

Abbreviations:
CARB - California Air Resources Board
$CH_4$ - methane
$CO_2e$ - carbon dioxide equivalents
kg - kilogram
mo - months old
MT - metric tonne
yr - year

**Table A.32**
**CARB GHG Inventory - Enteric Fermentation**
GHG Emission Inventory Summary [2000 - 2017]
Main Sector: Agriculture & Forestry
Sub Sector Level 1: Enteric Fermentation
Sub Sector Level 2: Cattle
Inventory Accounting: Included
Measurement: CO2Eq
GWP: AR4
Unit: tonnes

| Inventory Accounting: Included | Main Sector | Sub Sector Level 1 | Sub Sector Level 2 | Sub Sector Level 3 | Main Activity | Activity Subset | GHG | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Beef calves | CH4 | 84,949.94 | 85,349.03 | 82,084.74 | 82,736.46 | 71,101.64 | 71,101.64 | 71,101.64 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Beef cows | CH4 | 1,479,400.47 | 1,503,261.77 | 1,455,539.17 | 1,431,677.88 | 1,407,816.58 | 1,431,677.88 | 1,562,915.01 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Beef replacements 0-12 months | CH4 | 40,393.81 | 42,092.10 | 41,851.80 | 40,697.58 | 40,697.58 | 40,697.58 | 40,697.58 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Beef replacements 12-24 months | CH4 | 109,171.74 | 114,036.45 | 113,621.36 | 108,799.75 | 108,799.75 | 108,799.75 | 108,799.75 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Bulls | CH4 | 172,708.91 | 172,708.91 | 172,708.91 | 172,708.91 | 172,708.91 | 172,708.91 | 172,708.91 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Dairy calves | CH4 | 260,459.21 | 267,381.79 | 267,106.10 | 265,780.64 | 259,591.51 | 258,153.76 | 257,732.26 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Dairy cows | CH4 | 6,630,218.15 | 6,563,822.59 | 6,398,370.80 | 6,454,459.21 | 6,304,156.71 | 6,269,241.23 | 6,259,005.22 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Dairy replacements 0-12 months | CH4 | 246,365.16 | 266,887.75 | 250,322.99 | 243,291.52 | 237,626.08 | 236,310.00 | 235,924.16 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Dairy replacements 12-24 months | CH4 | 877,507.00 | 965,933.41 | 897,716.68 | 864,081.32 | 843,959.79 | 839,285.54 | 837,915.21 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Heifer feedlot | CH4 | 164,115.00 | 170,444.21 | 166,251.99 | 178,404.53 | 178,404.53 | 178,404.53 | 178,404.53 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Heifer stockers | CH4 | 160,057.55 | 160,389.58 | 164,950.21 | 173,616.61 | 173,616.61 | 173,616.61 | 173,616.61 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Steer feedlot | CH4 | 289,863.04 | 300,710.12 | 299,269.07 | 333,701.66 | 286,774.87 | 286,774.87 | 286,774.87 |
| Included | Agriculture & Forestry | Enteric Fermentation | Cattle | None | Livestock population | Steer stockers | CH4 | 400,193.45 | 416,319.75 | 419,760.57 | 445,002.49 | 382,424.02 | 382,424.02 | 382,424.02 |

| | California 2017 Enteric Fermentation Emissions | | | | |
|---|---|---|---|---|---|
| **Dairy** | **Total** | **Dairy Cows** | **Dairy Heifers 0-12 mo** | **Dairy Heifers 12-24 mo** | **Dairy Calves** |
| Total CH4 (tonnes): | 303,623 | 250,360 | 9,437 | 33,517 | 10,309 |
| Total CO2e (tonnes): | 7,590,577 | 6,259,005 | 235,924 | 837,915 | 257,732 |

**Feedlot:**

| | |
|---|---|
| Total CH4 (tonnes): | 119,098 |
| Total CO2e (tonnes): | 2,977,443 |

GWP:
CH4 25

**Table A.33**
**Feedlot Cattle Herd Counts for Enteric Fermentation and Manure Management Calculations**

| Category | Feedlot Cattle [4] |
|---|---|
| California (2017)[2] | 1,913,552 |
| Tulare County (2018)[3] | 204,272 |

Notes:

1. California inventory: Reflects all cattle other than dairy cows, replacement dairy heifers (0-24 months), and dairy calves. Tulare inventory: Reflects all animals in feedlot facilities and mature bulls identified in dairies.
2. California populations are from the CARB 2000-2017 GHG Inventory Query Tool, 12th edition. Available at: https://ww2.arb.ca.gov/ghg-inventory-data. Accessed July 2020. Used most recent year available (2017).
3. 2018 year cattle populations were provided by Tulare County.

**Table A.34**
**Emissions from Enteric Digestion and Manure Management - Feedlots**

| Source | Enteric Digestion | Manure Management | |
|---|---|---|---|
| | $CH_4$ (MT/yr) | $CH_4$ (MT/yr) | $N_2O$ (MT/yr) |
| California (2017)[1] | 119,098 | 5,191 | 994 |
| Tulare County (2018)[2] | 12,714 | 554 | 106 |

Notes:

1. California CH4 and N2O emissions are from the CARB 2000-2017 GHG Inventory Query Tool, most recent year available (2017).
2. CARB and EPA use the same methodology to estimate emissions from enteric fermentation and manure management. As such, this table assumes that Tulare emissions are proportional to the California emissions based on animal population.

**Table A.35**
**CARB GHG Inventory - Manure Management**
GHG Emission Inventory Summary [2000 - 2017]
Main Sector: Agriculture & Forestry
Sub Sector Level 1: Manure Management
Sub Sector Level 2: Cattle
Inventory Accounting: Included
Measurement: CO2Eq
GWP: AR4
Unit: million tonnes

| Inventory Accounting: Included | Main Sector | Sub Sector Level 1 | Sub Sector Level 2 | Sub Sector Level 3 | Main Activity | Activity Subset | GHG | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Included | Agriculture & Forestry | Manure Management | Cattle | Anaerobic digester | Livestock population | Dairy cows | CH4 | 0.0439334 | 0.0441243 | 0.04269463 | 0.04376396 | 0.0427448 | 0.0425081 | 0.0424387 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Anaerobic digester | Livestock population | Dairy cows | N2O | 0.0069349 | 0.0069642 | 0.00675003 | 0.00689387 | 0.0067333 | 0.0066961 | 0.0066851 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Anaerobic lagoon | Livestock population | Dairy cows | CH4 | 8.6289664 | 8.9403626 | 8.41136353 | 8.62203551 | 8.4212575 | 8.3746165 | 8.360943 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Anaerobic lagoon | Livestock population | Dairy cows | N2O | 0.3384578 | 0.339889 | 0.32943367 | 0.33645469 | 0.3286198 | 0.3267997 | 0.3262662 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Daily spread | Livestock population | Dairy cows | CH4 | 0.0107316 | 0.0107782 | 0.010429 | 0.01069021 | 0.0104413 | 0.0103834 | 0.0103665 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Daily spread | Livestock population | Dairy cows | N2O | 0.0140783 | 0.0141379 | 0.01370296 | 0.013995 | 0.0136691 | 0.0135934 | 0.0135712 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Daily spread | Livestock population | Dairy heifers | N2O | 0.0026488 | 0.0029098 | 0.00270924 | 0.00261239 | 0.0025516 | 0.0025374 | 0.0025333 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Daily spread | Livestock population | Dairy heifers | CH4 | 0.0014464 | 0.0015886 | 0.00147925 | 0.00142656 | 0.0013933 | 0.0013856 | 0.0013834 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Deep pit | Livestock population | Dairy cows | N2O | 0.0006078 | 0.0006104 | 0.00059159 | 0.0006042 | 0.0005901 | 0.0005869 | 0.0005859 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Deep pit | Livestock population | Dairy cows | CH4 | 0.0061655 | 0.0068662 | 0.00661825 | 0.00678401 | 0.006626 | 0.0065893 | 0.0065786 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Dairy heifers | CH4 | 0.0351098 | 0.0385595 | 0.03590607 | 0.03462707 | 0.0338207 | 0.0336334 | 0.0335785 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Dairy heifers | N2O | 0.4639949 | 0.5097071 | 0.47458228 | 0.4576158 | 0.4469595 | 0.444484 | 0.4437583 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Feedlot - heifers 500+ lb | CH4 | 0.0087483 | 0.0090768 | 0.00893258 | 0.00959378 | 0.0095938 | 0.0095938 | 0.0095938 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Feedlot - heifers 500+ lb | N2O | 0.0895792 | 0.0935808 | 0.09261009 | 0.09944129 | 0.0994413 | 0.0994413 | 0.0994413 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Feedlot - steers 500+ lbs | CH4 | 0.0154071 | 0.0159727 | 0.01604187 | 0.01792339 | 0.0179234 | 0.0179234 | 0.0179234 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Dry lot | Livestock population | Feedlot - steers 500+ lbs | N2O | 0.1662845 | 0.1735719 | 0.17531271 | 0.1959238 | 0.1959238 | 0.1959238 | 0.1959238 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Dairy cows | N2O | 0.206367 | 0.2072396 | 0.20086472 | 0.20514564 | 0.2003685 | 0.1992587 | 0.1989334 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Dairy cows | CH4 | 1.202458 | 1.3391073 | 1.290752 | 1.32308032 | 1.2922703 | 1.285113 | 1.2830148 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Dairy heifers | CH4 | 0.0068525 | 0.0083448 | 0.00774081 | 0.00746508 | 0.0072912 | 0.0072509 | 0.007239 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Dairy heifers | N2O | 0.0016417 | 0.0018034 | 0.00167911 | 0.00161909 | 0.0015814 | 0.0015726 | 0.0015701 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Feedlot - heifers 500+ lb | CH4 | 0.0029083 | 0.0033312 | 0.0032095 | 0.00344707 | 0.0034471 | 0.0034471 | 0.0034471 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Feedlot - heifers 500+ lb | N2O | 0.0003918 | 0.0004092 | 0.00040498 | 0.00043487 | 0.0004349 | 0.0004349 | 0.0004349 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Feedlot - steers 500+ lbs | CH4 | 0.0029083 | 0.0033312 | 0.0032095 | 0.00344707 | 0.0034471 | 0.0034471 | 0.0034471 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Liquid/slurry | Livestock population | Feedlot - steers 500+ lbs | N2O | 0.0003918 | 0.0004092 | 0.00040498 | 0.00043487 | 0.0004349 | 0.0004349 | 0.0004349 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Dairy cows | CH4 | 0.0020479 | 0.0020568 | 0.00199019 | 0.00204004 | 0.0019925 | 0.0019815 | 0.0019783 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Dairy heifers | CH4 | 0.0003717 | 0.0004082 | 0.00038012 | 0.00036658 | 0.000358 | 0.0003561 | 0.0003555 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Not on feed - beef cows | CH4 | 0.0494887 | 0.0502869 | 0.04869051 | 0.04789231 | 0.0470941 | 0.0478923 | 0.0478923 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Not on feed - bulls 500+ | CH4 | 0.0057774 | 0.0057774 | 0.00577744 | 0.00577744 | 0.0057774 | 0.0057774 | 0.0057774 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Not on feed - calves <50 | CH4 | 0.0170489 | 0.0173311 | 0.01714743 | 0.01711761 | 0.0171176 | 0.0171176 | 0.0171176 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Not on feed - heifers 500 | CH4 | 0.0098922 | 0.0101092 | 0.01024331 | 0.01032028 | 0.0103203 | 0.0103203 | 0.0103203 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Pasture | Livestock population | Not on feed - steers 500 | CH4 | 0.0127809 | 0.0132932 | 0.01344585 | 0.01425295 | 0.014253 | 0.014253 | 0.014253 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Solid storage | Livestock population | Dairy cows | CH4 | 0.0740458 | 0.0743675 | 0.07195791 | 0.07376017 | 0.0720425 | 0.0716435 | 0.0715266 |
| Included | Agriculture & Forestry | Manure Management | Cattle | Solid storage | Livestock population | Dairy cows | N2O | 0.0934949 | 0.0938902 | 0.09100208 | 0.09294155 | 0.0907772 | 0.0902745 | 0.0901271 |

GWP:
CH4 25
N2O 298

**California 2017 Manure Management Emissions - Feedlot**

| | | |
|---|---|---|
| Total CO2e from CH4: | 129,772 | tonnes |
| Total CO2e from N2O: | 296,235 | tonnes |
| Total CH4: | 5,191 | tonnes |
| Total N2O: | 994 | tonnes |

Table A.36

Global Warming Potentials

| $CO_2$ | $CH_4$ | $N_2O$ | HFC-23 |
|---|---|---|---|
| 1 | 25 | 298 | 14,800 |

Note: Values are 100-yr GWPs from the IPCC fourth assessment report (AR4). GWPs are consistent with the CARB California Greenhouse Gas Emission Inventory Program. Available: https://ww2.arb.ca.gov/our-work/programs/ghg-inventory-program. Accessed June 30, 2020.

# Appendix B – 2018 Emission Reduction Calculations

**Appendix B - GHG Emission Reductions**

**Table B.1**
**GHG Emission Reductions from a Hypothetical 1,000 kW Solar Panel Project in Tulare County**

| Description | DC System Size (kW) | System Output (kWh/year)[1] | GHG Reduction Over 30-Year Lifetime ($MT CO_2e$)[2] | GHG Reduction Over 5 Years ($MT CO_2e$)[3] | GHG Reduction Over 1 Year ($MT CO_2e$)[3] |
|---|---|---|---|---|---|
| Standard module, fixed array (open rack), 20 deg tilt, 180 deg azimuth | 1,000 | 1,601,566 | 10,604 | 1,767 | 353 |

Notes:

1. Source: National Renewable Energy Laboratory (NREL) PVWatts Calculator, version 6.1.3. https://pvwatts.nrel.gov. Website accessed 6/2020.
2. Source: CARB, Low-Income Weatherization Program: Single-Family Energy Efficiency and Solar Photovoltaics Multi-Family Energy Efficiency and Renewables. January 1, 2019. Website: https://ww2.arb.ca.gov/resources/documents/cci-quantification-benefits-and-reporting-materials. Acessed: June, 2020.
3. GHG reductions over 5 and 1 years were scaled from the 30-year reductions.

Table B.2
GHG Emission Reductions from Solar Panel Projects at Tulare County Dairies

| Facility Name[1] | Permit # | Permit Issue Date | Size (kW) | 5-Year GHG Reduction ($MT CO_2e$)[2] | Annual GHG Reduction ($MT CO_2e$)[2] | CY 2018 GHG Reduction ($MT CO_2e$)[3] | Installed in 2018 or prior? |
|---|---|---|---|---|---|---|---|
| Fern Oak Farms | A1301506 | 7/2/2013 | 922 | 1,630 | 326 | 326 | yes |
| SBS Ag Dairy | A1402386 | 9/25/2014 | 962 | 1,701 | 340 | 0 | no |
| Rancho Teresita Dairy | A1402852 | 11/19/2014 | 1,122 | 1,983 | 397 | 397 | yes |
| DG Farms | A1403104 | 12/9/2014 | 1,109 | 1,960 | 392 | 392 | yes |
| Four Star Fruit | A1403112 | 12/3/2014 | 1,269 | 2,242 | 448 | 448 | yes |
| Ron Verhoeven Family Dairy | A1403278 | 1/26/2015 | 820 | 1,449 | 290 | 290 | yes |
| Moonlight Dairy | A1500022 | 2/10/2015 | 1,109 | 1,960 | 392 | 392 | yes |
| Terra Linda Dairy | A1500299 | 3/9/2015 | 830 | 1,467 | 293 | 293 | yes |
| Pete Vander Poel Dairy | A1500778 | 4/2/2015 | 1,098 | 1,941 | 388 | 388 | yes |
| Bar VP Dairy | A1500799 | 4/16/2015 | 1,098 | 1,941 | 388 | 388 | yes |
| Legacy Ranch #2 Dairy | A1500954 | 4/21/2015 | 840 | 1,485 | 297 | 297 | yes |
| Curtimade Dairy | A1501019 | 5/17/2016 | 412 | 728 | 146 | 0 | no |
| Lemstra Dairy | A1501662 | 6/11/2015 | 840 | 1,485 | 297 | 297 | yes |
| Robert Vander Eyk & Sons Dairy | A1503907 | 12/1/2015 | 1,107 | 1,957 | 391 | 391 | yes |
| 5 Star Dairy | A1503908 | 12/1/2015 | 1,110 | 1,962 | 392 | 392 | yes |
| Dystra Dairy | A1504116 | 12/1/2015 | 1,046 | 1,849 | 370 | 370 | yes |
| Parreira Gaspar Dairy | A1600266 | 3/9/2016 | 539 | 952 | 190 | 190 | yes |
| S&S Dairy | A1600425 | 4/25/2016 | 1,100 | 1,944 | 389 | 389 | yes |
| Vanderham West Dairy | A1600476 | 3/15/2016 | 1,105 | 1,953 | 391 | 391 | yes |
| Riverbend Farms Dairy | A1600733 | 3/16/2016 | 1,107 | 1,957 | 391 | 391 | yes |
| Arthur Leyendekker Dairy | A1600755 | 3/31/2016 | 544 | 961 | 192 | 192 | yes |
| F&L Barcellos Dairy | A1601056 | 4/13/2016 | 573 | 1,013 | 203 | 203 | yes |
| SBS AG | A1601142 | 5/10/2016 | 762 | 1,346 | 269 | 269 | yes |
| Avenue 128 Dairy | A1601191 | 5/24/2016 | 600 | 1,060 | 212 | 0 | no |
| Manuel C Leal Diary | A1601333 | 5/10/2016 | 520 | 919 | 184 | 184 | yes |
| Friesian Farms [c] | A1601590 | 6/15/2016 | 1,107 | 1,957 | 391 | 391 | yes |
| JR Dairy [c] | A1601592 | 6/15/2016 | 1,107 | 1,957 | 391 | 391 | yes |
| Felicita Dairy | A1601593 | 6/15/2016 | 1,109 | 1,960 | 392 | 392 | yes |
| T]Bar Dairy | A1601861 | 7/8/2016 | 682 | 1,206 | 241 | 241 | yes |
| Oakview Dairy | A1601996 | 8/3/2016 | 1,107 | 1,957 | 391 | 391 | yes |
| Horizon Dairy ]Tipton (Horizon Jersies) | A1602130 | 7/20/2016 | 840 | 1,485 | 297 | 297 | yes |
| GTA Dairy | A1602329 | 8/2/2016 | 696 | 1,230 | 246 | 0 | no |
| KG Farms | A1602619 | 8/31/2016 | 254 | 449 | 90 | 90 | yes |
| Four J Farms and Jerseys | A1602867 | 10/3/2016 | 962 | 1,700 | 340 | 340 | yes |
| Cornerstone Dairy | A1603456 | 11/8/2016 | 1,116 | 1,972 | 394 | 394 | yes |
| Mario Simoes Family Dairy | A1603927 | 12/29/2016 | 1,111 | 1,964 | 393 | 393 | yes |
| Mendonca Dairy | A1603966 | 12/29/2016 | 480 | 848 | 170 | 0 | no |
| Rob Van Grouw Dairy | A1603967 | 1/18/2017 | 1,107 | 1,957 | 391 | 391 | yes |
| Aukeman Farms | A1603968 | 2/2/2017 | 1,107 | 1,957 | 391 | 391 | yes |
| R&M Cattle | A1604445 | 2/2/2017 | 1,107 | 1,957 | 391 | 391 | yes |
| Schott Dairy | A1604446 | 2/2/2017 | 1,107 | 1,957 | 391 | 391 | yes |

Table B.2
GHG Emission Reductions from Solar Panel Projects at Tulare County Dairies

| Facility Name[1] | Permit # | Permit Issue Date | Size (kW) | 5-Year GHG Reduction ($MT CO_2e$)[2] | Annual GHG Reduction ($MT CO_2e$)[2] | CY 2018 GHG Reduction ($MT CO_2e$)[3] | Installed in 2018 or prior? |
|---|---|---|---|---|---|---|---|
| Junio Dairy | A1604447 | 2/2/2017 | 306 | 540 | 108 | 0 | no |
| Airoso Dairy | A1700087 | 2/2/2017 | 1,111 | 1,964 | 393 | 393 | yes |
| Skyline Dairy | A1700088 | 2/2/2017 | 803 | 1,418 | 284 | 284 | yes |
| Decade Dairy LLC | A1700354 | 2/22/2017 | 928 | 1,640 | 328 | 328 | yes |
| Sierra Cattle Company | A1700593 | 3/7/2017 | 1,101 | 1,946 | 389 | 389 | yes |
| Heritage Dairy | A1700739 | 4/5/2017 | 737 | 1,303 | 261 | 261 | yes |
| Boertje & Sons Dairy | A1700740 | 4/10/2017 | 556 | 982 | 196 | 196 | yes |
| Jer]Z Boyz Ranch | A1700741 | 4/10/2017 | 1,107 | 1,957 | 391 | 391 | yes |
| Vander Tuig Dairy | A1700780 | 4/5/2017 | 670 | 1,184 | 237 | 237 | yes |
| Joe Simoes Family Dairy | A1700781 | 4/5/2017 | 522 | 923 | 185 | 185 | yes |
| John Mendonca & Son Dairy | A1700782 | 4/5/2017 | 365 | 645 | 129 | 129 | yes |
| Willem De Boer Dairy | A1700783 | 4/5/2017 | 1,101 | 1,946 | 389 | 389 | yes |
| Scheenstra Dairy | A1700857 | 4/5/2017 | 928 | 1,641 | 328 | 328 | yes |
| Tom Dejong Dairy | A1700859 | 4/5/2017 | 1,111 | 1,964 | 393 | 393 | yes |
| John Scheenstra Dairy | A1701020 | 4/5/2017 | 180 | 317 | 63 | 63 | yes |
| Riverbend Dairy | A1701277 | 5/10/2017 | 678 | 1,198 | 240 | 240 | yes |
| Edwin Brasil Dairy | A1702384 | Ready To Issue | 679 | 1,201 | 240 | 0 | no |
| Rijlaarsdam Dairy | A1701785 | 7/3/2017 | 1,330 | 2,351 | 470 | 0 | no |
| Rijlaarsdam Dairy | A1701786 | 7/3/2017 | 653 | 1,154 | 231 | 231 | yes |
| Richard Westra Dairy | A1702954 | 10/24/2017 | 1,107 | 1,956 | 391 | 391 | yes |
| Vander Eyk Dairy | A1800879 | 4/12/2018 | 1,107 | 1,957 | 391 | 283 | yes |
| Nunes & Sons Dairy | A1801196 | 6/14/2018 | 790 | 1,396 | 279 | 154 | yes |
| Will De Groot | A1801463 | | 376 | 665 | 133 | 133 | yes |
| Will De Groot | A1801464 | | 376 | 665 | 133 | 133 | yes |
| Bosman Dairy | A1801627 | 7/10/2018 | 662 | 1,169 | 234 | 0 | no |
| Jongsma Dairy | A1802264 | 7/10/2018 | 582 | 1,029 | 206 | 99 | yes |
| Milk Maid Dairy | A2000293 | | 1,084 | 1,916 | 383 | 0 | no |
| D & V Dairy | A2000454 | | 1,085 | 1,918 | 384 | 0 | no |
| **Total 2018 Operational Solar Projects** | **58** | **--** | **51,281** | **90,634** | **18,127** | **17,786** | **--** |
| **Total All Projects** | **69** | **--** | **59,576** | **105,295** | **21,059** | **17,786** | **--** |

Notes:

1. Source for project list: Tulare County Resource Management Agency. *Dairy Solar List Updated 5-21-2020.xlsx* . Email from Jason Garcia-LoBue, MPA, Chief Planner. May 21, 2020.
2. GHG reductions were estimated using CARB's Benefits Calculator Tool for the Low-Income Weatherization Program: Single-Family Energy Efficiency and Solar Photovoltaics Multi-Family Energy Efficiency and Renewables.
3. The calendar year 2018 emission reductions for Projects with permits issued in 2018 were prorated by the number of days remaining in 2018.

**Table B.3**
**GHG Emission Reductions from Solar Thermal Hot Water Systems at Tulare County Dairies**

| Facility Name [a] | Permit # | Size (MBtu) | 5-Year GHG Reduction ($MT CO_2e$) [b] | Annual GHG Reduction ($MT CO_2e$) [b] | CY 2018 GHG Reduction ($MT CO_2e$) [b] | Installed in 2018 or prior? |
|---|---|---|---|---|---|---|
| Nunes and Sons Dairy | A1702065 | 1,005 | 3.4 | 0.68 | 0.68 | yes |
| Souza Dairy | A1702083 | 1,005 | 3.4 | 0.68 | 0.68 | yes |
| Aveline Partners Dairy | A1702084 | 1,005 | 3.4 | 0.68 | 0.68 | yes |
| **Total 2018 Operational Projects** | **3** | **3,015** | **10.2** | **2.0** | **2.0** | **--** |

Notes:

1. Source for project list: Tulare County Resource Management Agency. *Dairy Solar List Updated 5-21-2020.xlsx* . Email from Jason Garcia-LoBue, MPA, Chief Planner. May 21, 2020.
2. An average annual GHG reduction rate of 0.68 MT $CO_2e$/year per residential system was obtained from California Solar Initiative (CSI)-Thermal Program Data. CSI-Thermal Program Data.xlsx.
   Website: http://www.csithermalstats.org/download.html. Accessed June 8, 2020.

Table B.4
GHG Emission Reductions from Digester Projects at Tulare County Dairies

| Facility Name[1] | Facility ID Number | Project Title | Location | Start of Full Operation | 10-Year GHG Reduction ($MT CO_2e$)[2] | 5-Year GHG Reduction ($MT CO_2e$)[3] | Annual GHG Reduction ($MT CO_2e$)[3] | CY 2018 GHG Reduction ($MT CO_2e$)[4] |
|---|---|---|---|---|---|---|---|---|
| *2018 Operation* | | | | | | | | |
| GJ TeVelde Ranch | 246 | GJ Te Velde Tipton Dairy Digester | Tipton | 6/5/2017 | 189,080 | 94,540 | 18,908 | 18,908 |
| Circle A Dairy | 358 | Circle A Dairy Digester Fuel Pipeline Project | Pixley | 8/30/2018 | 138,745 | 69,373 | 13,875 | 4,714 |
| R Vander Eyk Dairy | 265A | R Vander Eyk Dairy Digester Fuel Pipeline Project | Pixley | 12/17/2018 | 132,586 | 66,293 | 13,259 | 545 |
| Legacy Dairy | 241 | Legacy Dairy Digester Fuel Pipeline | Pixley | 12/3/2018 | 207,209 | 103,605 | 20,721 | 1,646 |
| *2019 New Projects* | | | | | | | | |
| Van Beek | 256 | Van Beek Brothers Dairy Digester | Tipton | 1/7/2019 | 106,240 | 53,120 | 10,624 | 0 |
| Cornerstone Dairy | 313 | Cornerstone Dairy Digester Pipeline Project | Tipton | 4/17/2019 | 185,238 | 92,619 | 18,524 | 0 |
| Sousa & Sousa Dairy | 236 | Sousa & Sousa Dairy Digester Pipeline Project | Tipton | 7/17/2019 | 68,700 | 34,350 | 6,870 | 0 |
| Vander Poel Dairy | 330 | Vander Poel Dairy Digester Pipeline Project | Pixley | 8/6/2019 | 290,060 | 145,030 | 29,006 | 0 |
| Hilarides | 346 | Hilarides Dairy Digester Renovation | Lindsay | 8/30/2019 | 564,000 | 282,000 | 56,400 | 0 |
| K&M Visser Dairy | 326 | K&M Visser Dairy Digester Fuel Pipeline Project | Pixley | 9/3/2019 | 203,416 | 101,708 | 20,342 | 0 |
| Riverview Dairy | 328 | Riverview Dairy Digester Pipeline Project | Pixley | 10/3/2019 | 90,093 | 45,047 | 9,009 | 0 |
| Little Rock Dairy; Blue Moon Dairy | 40 | Little Rock Centralized Dairy Digester Pipeline Project | Tipton | 12/13/2019 | 146,839 | 73,420 | 14,684 | 0 |
| *2020+ Projected New Projects* | | | | | | | | |
| S&S Dairy Biogas | 226 | S&S Dairy Biogas | Visalia | TBD | 167,417 | 83,709 | 16,742 | 0 |
| Pixley Dairy | | Pixley Dairy Digester Fuel Pipeline Project | Pixley | TBD | 212,622 | 106,311 | 21,262 | 0 |
| Moonlight Dairy Biogas | 298 | Moonlight Dairy Biogas | Visalia | TBD | 154,834 | 77,417 | 15,483 | 0 |
| Bos Farms Dairy Biogas | 33 | Bos Farms Dairy Biogas | Tulare | TBD | 168,398 | 84,199 | 16,840 | 0 |
| Hamstra Dairy Biogas | 118 | Hamstra Dairy Biogas | Tulare | TBD | 205,115 | 102,558 | 20,512 | 0 |
| Rancho Teresita Dairy Biogas | 139 | Rancho Teresita Dairy Biogas | Tulare | TBD | 236,251 | 118,126 | 23,625 | 0 |
| 4K Dairy | 218 | 4K Dairy Digester Pipeline Project | Pixley | TBD | 192,143 | 96,072 | 19,214 | 0 |
| Aukeman Farms Dairy Biogas | 61 | Aukeman Dairy Biogas | Tulare | TBD | 207,701 | 103,851 | 20,770 | 0 |
| Decade Energy LLC | 359 | Decade Centralized Dairy Digester Pipeline Project | Tulare | TBD | 192,558 | 96,279 | 19,256 | 0 |
| Double J Dairy Biogas | 245 | Double J Dairy Biogas | Visalia | TBD | 285,496 | 142,748 | 28,550 | 0 |
| Dykstra Dairy Biogas | 323 | Dykstra Dairy Biogas | Tulare | TBD | 265,936 | 132,968 | 26,594 | 0 |
| The El Monte Dairy Biogas | 255 | El Monte Dairy Biogas | Tipton | TBD | 118,903 | 59,452 | 11,890 | 0 |
| FM Jersey Biogas LLC | 185 | FM Jerseys Dairy Digester Virtual Pipeline Project | Tipton | TBD | 161,960 | 80,980 | 16,196 | 0 |
| Horizon Jersey Dairy Biogas | 336 | Horizon Jersey Dairy Biogas | Tipton | TBD | 335,398 | 167,699 | 33,540 | 0 |
| Jacobus De Groot #2 Dairy | 63 | Jacobus De Groot #2 Dairy Biogas | Visalia | TBD | 61,616 | 30,808 | 6,162 | 0 |
| Mellema Dairy Biogas | 177 | Mellema Dairy Biogas | Visalia | TBD | 152,057 | 76,029 | 15,206 | 0 |
| Milky Way Dairy Biogas | 67 | Milky Way Dairy Biogas | Visalia | TBD | 347,462 | 173,731 | 34,746 | 0 |
| Mineral King Dairy Biogas | 364 | Mineral King Dairy Biogas | Visalia | TBD | 194,751 | 97,376 | 19,475 | 0 |
| Rancho Sierra Vista Dairy Biogas | 108 | Rancho Sierra Vista Dairy Biogas | Visalia | TBD | 172,958 | 86,479 | 17,296 | 0 |
| Riverbend Dairy Biogas | 189 | Riverbend Dairy Biogas | Tulare | TBD | 245,930 | 122,965 | 24,593 | 0 |
| Rob Van Grouw Dairy Biogas | 261 | Rob Van Grouw Dairy Biogas | Visalia | TBD | 140,442 | 70,221 | 14,044 | 0 |
| Udder Dairy Biogas | 19 | Udder Dairy Biogas | Visalia | TBD | 135,701 | 67,851 | 13,570 | 0 |
| Scheenstra Dairy | 300 | Scheenstra Dairy Biogas | Tulare | TBD | 220,360 | 110,180 | 22,036 | 0 |
| Clearlake Dairy | 151 | Clearlake Dairy Digester Pipeline Project | Tulare | TBD | 95,510 | 47,755 | 9,551 | 0 |
| JR Dairy | TBD | JR Dairy Digester Pipeline | Tulare | TBD | 168,134 | 84,067 | 16,813 | 0 |
| Fern Oaks Dairy | 346 | Fern Oaks Dairy Digester Pipeline Project | Tulare | TBD | 169,370 | 84,685 | 16,937 | 0 |

**Table B.4**
**GHG Emission Reductions from Digester Projects at Tulare County Dairies**

| Facility Name[1] | Facility ID Number | Project Title | Location | Start of Full Operation | 10-Year GHG Reduction ($MT CO_2e$)[2] | 5-Year GHG Reduction ($MT CO_2e$)[3] | Annual GHG Reduction ($MT CO_2e$)[3] | CY 2018 GHG Reduction ($MT CO_2e$)[4] |
|---|---|---|---|---|---|---|---|---|
| Mario Simoes Family Dairy; Joe M Simoes Family Dairy | TBD | Simoes Centralized Digester Pipeline Project | Tipton | TBD | 161,275 | 80,638 | 16,128 | 0 |
| Schott Dairy | 342 | Schott Dairy Digester Pipeline Project | Tulare | TBD | 129,082 | 64,541 | 12,908 | 0 |
| Hettinga Dairy Farm; Avenue 128 Dairy | 122 | Hettinga Centralized Dairy Digester Pipeline Project | Tulare | TBD | 167,339 | 83,670 | 16,734 | 0 |
| Northstar Dairy | 299 | Northstar Dairy Digester Pipeline Project | Tulare | TBD | 170,658 | 85,329 | 17,066 | 0 |
| Gerben Leyendekker Dairy | 11 | Gerben Leyendekker Dairy Biogas | Visalia | TBD | 85,419 | 42,710 | 8,542 | 0 |
| Friesian Farms Dairy | 101 | Friesian Farms Dairy Biogas | Tulare | TBD | 63,145 | 31,573 | 6,315 | 0 |
| Ribeiro Dairy | 215 | Ribeiro Dairy Biogas | Tulare | TBD | 132,348 | 66,174 | 13,235 | 0 |
| GP Dairy | | GP Dairy Biogas | Tulare | TBD | 50,722 | 25,361 | 5,072 | 0 |
| Rio Blanco Dairy | 289 | Rio Blanco Dairy Biogas | Tulare | TBD | 100,886 | 50,443 | 10,089 | 0 |
| Curtimade Dairy | 56 | Curtimade Dairy Biogas | Tulare | TBD | 174,734 | 87,367 | 17,473 | 0 |
| Elk Creek Dairy | 50 | Elk Creek Dairy Biogas | Tulare | TBD | 59,555 | 29,778 | 5,956 | 0 |
| Rib-Arrow Dairy | 213 | Rib-Arrow Dairy Biogas | Tulare | TBD | 76,343 | 38,172 | 7,634 | 0 |
| Art Leyendekker Dairy | 76 | Art Leyendekker Dairy Biogas | Tulare | TBD | 77,697 | 38,849 | 7,770 | 0 |
| Elkhorn Dairy | 324 | Elkhorn Dairy Biogas | Tulare | TBD | 211,940 | 105,970 | 21,194 | 0 |
| Dairyland Farms Dairy | 352 | Dairyland Farms Dairy Biogas | Tulare | TBD | 177,475 | 88,738 | 17,748 | 0 |
| De Boer Dairy | 60 | De Boer Dairy Digester Pipeline Project | Tulare | TBD | 191,647 | 95,824 | 19,165 | 0 |
| **Total 2018 Operational Digester Projects** | | -- | **4** | -- | **667,620** | **333,810** | **66,762** | **25,813** |
| **Total 2019 New Digester Projects** | | -- | **8** | -- | **1,654,586** | **827,293** | **165,459** | -- |
| **Total 2020+ Projected New Digester Projects** | | -- | **42** | -- | **7,039,288** | **3,519,644** | **703,929** | -- |
| **Total All Projects** | | -- | **54** | -- | **9,361,494** | **4,680,747** | **936,149** | **25,813** |

Notes:

1. Source for project lists: California Department of Food and Agriculture. Dairy Digester Research and Development Program. Projects Selected for Award of Funds. Online: https://www.cdfa.ca.gov/oefi/ddrdp/. Accessed: April 8, 2020.
2. The 10-year GHG reductions were estimated by the recipient.
3. 5-Year and annual GHG reductions were scaled from the 10-year reductions by the number of years.
4. The calendar year 2018 emission reductions for Projects that started full operation in 2018 were prorated by the number of days remaining in 2018.

Table B.5
GHG Emission Reductions from Alternative Manure Management Projects at Tulare County Dairies

| Facility Name [1] | Project Title | Start of Full Operation | 5-Year GHG Reduction ($MT CO_2e$)[2] | Annual GHG Reduction ($MT CO_2e$)[3] | CY 2018 GHG Reduction ($MT CO_2e$)[4] |
|---|---|---|---|---|---|
| *2018 Operation* | | | | | |
| Sierra View Dairy | Sierra View Dairy AMMP Grant (pasture based management; conversion from flush to scrape; solar drying) | 1/1/2018 | 35,050 | 7,010 | 7,010 |
| *2019 New Projects* | | | | | |
| Milk River | Milk River GHG Reduction Project (conversion from flush to scrape; solar drying) | 4/1/2019 | 16,012 | 3,202 | 0 |
| SBS AG | Solid Separation (conversion from settling ponds to processing pit and separating system) | 5/1/2019 | 7,887 | 1,577 | 0 |
| **Total 2018 Operational AMMP Projects** | | -- | **35,050** | **7,010** | **7,010** |
| **Total 2019 New AMMP Projects** | | -- | **23,899** | **4,780** | -- |
| **Total All Projects** | | -- | **58,949** | **11,790** | **7,010** |

Notes:

1. Source for project lists: California Department of Food and Agriculture. 2017 and 2018 Alternative Manure Management Program: Projects Selected for Award. Online: https://www.cdfa.ca.gov/oefi/AMMP/. March 27, 2018 (2017 list) and September 5, 2018 (2018 list).
2. The 5-year GHG reductions were estimated by the recipient.
3. Annual GHG reductions were assumed to be 1/5 of the 5-year reductions.
4. The calendar year 2018 emission reductions for Projects that started full operation in 2018 were prorated by the number of days remaining in 2018.

# Exhibit "B"

**ALTERNATIVE MANURE MANAGEMENT PROGRAM FOR TULARE COUNTY**

| Dairy Facility ID Number | Year Awarded Grant | Project Title | Project Description | Total Cost | CDFA Funding | Matching Funds | Construction Status | Location | GHG Reduction (5 years) (in $MTCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|
| 64 | 2017 | Sierra View Dairy AMMP Grant | Remodel Existing Dairy, with both Open Lot corrals and Covered milk cow Feed Lanes flushed facility to a bed-pack compost barn (pasture based management) and collect manure from feed lanes through scraping with mobile equipment with scraper (conversion of flush to scrape). All scraped material will be dried utilizing open solar drying. | $ 1,627,520.00 | $ 750,000.00 | $ 877,520.00 | Construction Complete | 13376 Avenue 224, Tulare County | 35,050 |
| 25 | 2017 | Milk River GHG Reduction Project | Reducing greenhouse gas emissions by 72% by introducing a vacuum scraping system into our previously flushed lanes to collect lactating cow manure. This scraped product will be run through screw presses to reduce the moisture content. This manure will then be solar dried for future use as bedding or field nutrient/amendments. This process will prevent the manure from entering the anaerobic conditions present in the manure lagoons. | $ 395,358.00 | $ 395,358.00 | $ - | Began operating in April of 2019 | 34292 Road 124, Tulare County | 16,012 |
| 104 | 2018 | Henry A. Garcia Dairy | Converting flush lanes to a vacuum scrape system utilizing a Loewen Honey Vac. Collected manure will be deposited in a newly constructed concrete bunker, processed through a de-watering screw press and then receiving a second treatment through the existing sloped screen separator. Separated solids will then be spread on a concrete solar drying pad for final drying and stock piled and covered to prevent re-watering. By reducing the organic matter entering the lagoon system we will reduce our greenhouse gas emissions by 79% annually. The total estimated mtCO2e reduction over a 5 year period is 25,720 and reductions should continue to accumulate after. | $ 503,501.00 | $ 503,501.00 | $ - | Not Yet Applied to County | 12521 Avenue 200, Tulare, Tulare County | 25,720 |
| 58 | 2018 | SBS AG | Change of Waste Water Handling and Solid Collection Management for the reduction of GHG produced. Converting from Settling Ponds to Processing pit and Separating System to capture volatile solids before the lagoons. | $ 786,308.00 | $ 385,404.00 | $ 400,904.00 | Began operating in May of 2019 | 7123 Avenue 204, Tulare County | 7,887 |
|  | 2019 | Creekside Dairy | Solid Separation | $ 611,642.00 | $ 611,642.00 | $ - |  | Tulare County | 9,150 |
| 194 | 2019 | Rainimaid | Compost Bedded Pack Barn | $ 1,188,883.00 | $ 749,820.00 | $ 439,063.00 | Applications to County and Construction to begin Q3 2020 | 33640 Road 124, Tulare County | 8,930 |
| 20 | 2019 | Jesse & James Jongsma Dairy | Solid Separation | $ 816,117.00 | $ 750,000.00 | $ 66,117.00 | Not Yet Applied to County | 6780 Avenue 144, Tulare County | 7,193 |
| 144 | 2019 | Westwood Farms | Compost Bedded Pack Barn | $ 1,058,201.00 | $ 749,698.00 | $ 308,503.00 |  | Tulare County | 20,422 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 133 | 2019 | James Jongsma Dairy | Solid Separation | $ 727,508.00 | $ 727,508.00 | $ - | Not Yet Applied to County | 9229 Road 164, Tulare County | 2,719 |
| 28 | 2019 | A&L Dairy | Solid Separation | $ 420,189.00 | $ 420,189.00 | $ - | Will began operating in Octoberl of 2020 | 23929 Road 48, Tulare County | 2,620 |
| | | | | $ 8,135,227.00 | $ 6,043,120.00 | $ 2,092,107.00 | | | 135,703 |

# Exhibit "C"

## UPDATED 2019 DIGESTER PROJECT LIST FOR TULARE COUNTY

| Dairy No. | Operation Name | Project Title | Total Cost | CDFA Funding | Matching Funds | Construction Status | Location | GHG Reduction (10 years) (in $MTCO_2e$) | How Captured Methane is Used | Reported Problems | Year of Application | Developer or Vendor for Project Implementation and/or Operation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | De Boer Dairy | De Boer Dairy Digester Pipeline Project | $ 3,650,523.00 | $ 1,825,261.00 | $ 1,825,262.00 | Not yet applied to Tulare County | 14799 and 14976 Avenue 168 ,Tulare County | 191,647 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 352 | Dairyland Farms Dairy | Dairyland Farms Dairy Biogas | $ 4,900,813.00 | $ 1,760,347.00 | $ 3,140,466.00 | Under Construction | 15920 Road 152, Tulare County | 177,475 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 324 | Elkhorn Dairy | Elkhorn Dairy Biogas | $ 6,645,917.00 | $ 2,125,882.00 | $ 4,520,035.00 | Under Construction | 10400 Avenue 368, Tulare County | 211,940 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 76 | Art Leyendekker Dairy | Art Leyendekker Dairy Biogas | $ 3,685,068.00 | $ 769,784.00 | $ 2,915,284.00 | Under Construction | 8651 Avenue 388, Dinuba, Tulare County | 77,697 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 213 | Rib-Arrow Dairy | Rib-Arrow Dairy Biogas | $ 4,175,150.00 | $ 657,231.00 | $ 3,517,919.00 | Under Construction | 18287 Road 136, Tulare County | 76,343 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 50 | Elk Creek Dairy | Elk Creek Dairy Biogas | $ 4,109,208.00 | $ 512,706.00 | $ 3,596,502.00 | Under Construction | 17993 Road 96, Tulare County | 59,555 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 56 | Curtimade Dairy | Curtimade Dairy Biogas | $ 4,773,194.00 | $ 1,747,336.00 | $ 3,025,858.00 | Under Construction | 18337 Road 24, Tulare County | 174,734 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 289 | Rio Blanco Dairy | Rio Blanco Dairy Biogas | $ 3,558,815.00 | $ 1,002,797.00 | $ 2,556,018.00 | Under Construction | 5041 Avenue 192, Tulare County | 100,886 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
|  | GP Dairy | GP Dairy Biogas | $ 3,418,177.00 | $ 502,554.00 | $ 2,915,623.00 | Under Construction | Tulare County | 50,722 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 215 | Ribeiro Dairy | Ribeiro Dairy Biogas | $ 3,814,042.00 | $ 1,124,962.00 | $ 2,689,080.00 | Under Construction | 17983 Road 128, Tulare, Tulare County | 132,348 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Friesian Farms Dairy | Friesian Farms Dairy Biogas | $ 3,814,785.00 | $ 639,602.00 | $ 3,175,183.00 | Under Construction | 5593 Avenue 176, Tulare, Tulare County | 63,145 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 11 | Gerben Leyendekker Dairy | Gerben Leyendekker Dairy Biogas | $ 3,748,357.00 | $ 845,589.00 | $ 2,902,768.00 | Under Construction | 8517 Avenue 360, Visalia, Tulare County | 85,419 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | California Bioenergy |
| 299 | Northstar Dairy | Northstar Dairy Digester Pipeline Project | $ 3,152,876.00 | $ 1,576,438.00 | $ 1,576,438.00 | Under Construction - Approved by County in 2020 | 12718 Road 144, Tulare County | 170,658 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 121 and/or 122 | Hettinga Dairy Farm; Avenue 128 Dairy | Hettinga Centralized Dairy Digester Pipeline Project | $ 4,705,818.00 | $ 2,352,909.00 | $ 2,352,909.00 | Under Construction | 13002 Avenue 128 and/or 13400 Avenue 120, Tipton, Tulare County | 167,339 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 342 | Schott Dairy | Schott Dairy Digester Pipeline Project | $ 2,889,184.00 | $ 1,444,592.00 | $ 1,444,592.00 | Applied to County in 2020 | 13602 Road 96, Tulare County | 129,082 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 43, 90, 97, 231, 232, 233, and/or 234 | Mario Simoes Family Dairy; Joe M Simoes Family Dairy | Simoes Centralized Digester Pipeline Project | $ 4,072,920.00 | $ 2,036,460.00 | $ 2,036,460.00 | Applied to County in 2020 | 13185 Avenue 136, Tipton, and 13585 Road 136, Tipton, Tulare County | 161,275 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 346 | Fern Oaks Dairy | Fern Oaks Dairy Digester Pipeline Project | $ 3,377,788.00 | $ 1,688,894.00 | $ 1,688,894.00 | Not yet applied to Tulare County | 24163 Road 188, Tulare County | 169,370 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 207 and/or 249? | JR Dairy | JR Dairy Digester Pipeline | $ 3,506,370.00 | $ 1,753,185.00 | $ 1,753,185.00 | Approved by Tulare County in 2019 | 13806 Avenue 152 Tipton and/or 3800 Avenue 176 Tulare, Tulare County | 168,134 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 151 | Clearlake Dairy | Clearlake Dairy Digester Pipeline Project | $ 2,789,296.00 | $ 1,394,648.00 | $ 1,394,648.00 | Not yet applied to Tulare County | 24643 Road 36, Tulare County | 95,510 | RNG generation and pipeline injection for vehicle fuel use | None | 2019 | Maas Energy Works |
| 330 | Vander Poel Dairy | Vander Poel Dairy Digester Pipeline Project | $ 3,944,970.00 | $ 1,972,485.00 | $ 1,972,485.00 | Operational | 19493 Road 140, Pixley, Tulare County | 290,060 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |

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| 19 | Udder Dairy | Udder Dairy Biogas | $ 3,202,804.00 | $ 1,153,459.00 | $ 2,049,345.00 | Applications to County and Construction to begin Q2 2020 | 28723 Road 56, Visalia, Tulare County | 135,701 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 236 | Sousa & Sousa Dairy | Sousa & Sousa Dairy Digester Pipeline Project | $ 1,773,860.00 | $ 886,934.00 | $ 886,926.00 | Operational | 13510 Road 72, Tipton, Tulare County | 68,700 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| 300 | Scheenstra Dairy | Scheenstra Dairy Biogas | $ 5,469,911.00 | $ 1,873,064.00 | $ 3,596,847.00 | Applications to County and Construction to begin Q2 2020 | 16900 Road 96, Tulare, Tulare County | 220,360 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 261 | Rob Van Grouw Dairy | Rob Van Grouw Dairy Biogas | $ 4,945,654.00 | $ 1,193,757.00 | $ 3,751,897.00 | Applications to County and Construction to begin Q2 2020 | 32843 Road 76, Visalia, Tulare County | 140,442 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 328 | Riverview Dairy | Riverview Dairy Digester Pipeline Project | $ 2,664,140.00 | $ 1,332,070.00 | $ 1,332,070.00 | Operational | 9599 Avenue 88, Pixley, Tulare County | 90,093 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| 189 | Riverbend Dairy | Riverbend Dairy Biogas | $ 4,822,385.00 | $ 2,090,404.00 | $ 2,731,981.00 | Applications to County and Construction to begin Q2 2020 | 20799 Road 132, Tulare, Tulare County | 245,930 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 108 | Rancho Sierra Vista Dairy | Rancho Sierra Vista Dairy Biogas | $ 4,944,161.00 | $ 1,470,143.00 | $ 3,474,018.00 | Applications to County and Construction to begin Q2 2020 | 32866 Road 108, Visalia, Tulare County | 172,958 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 364 | Mineral King Dairy | Mineral King Dairy Biogas | $ 5,071,416.00 | $ 1,655,384.00 | $ 3,416,032.00 | Applications to County and Construction to begin Q2 2020 | 33803 Road 108, Visalia, Tulare County | 194,751 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 67 | Milky Way Dairy | Milky Way Dairy Biogas | $ 7,198,161.00 | $ 2,953,427.00 | $ 4,244,734.00 | Applications to County and Construction to begin Q3 2020 | 34800 Road 80, Visalia, Tulare County | 347,462 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 177 | Mellema Dairy | Mellema Dairy Biogas | $ 5,213,701.00 | $ 1,292,485.00 | $ 3,921,216.00 | Applications to County and Construction to begin Q2 2020 | 9420 Avenue 320, Visalia, Tulare County | 152,057 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 40 | Little Rock Dairy; Blue Moon Dairy | Little Rock Centralized Dairy Digester Pipeline Project | $ 4,193,156.00 | $ 2,096,578.00 | $ 2,096,578.00 | Operational | 13955 Road 80, Tipton, Tulare County | 146,839 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |

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| 63 | Jacobus De Groot #2 Dairy | Jacobus De Groot #2 Dairy Biogas | $ 3,381,424.00 | $ 523,736.00 | $ 2,857,688.00 | Applications to County and Construction to begin Q2 2020 | 8827 Avenue 312, Visalia, Tulare County | 61,616 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 336 | Horizon Jerseys Dairy | Horizon Jerseys Dairy Biogas | $ 6,985,835.00 | $ 2,850,886.00 | $ 4,134,949.00 | Applications to County and Construction to begin Q2 2020 | 8798 Avenue 160, Tipton, Tulare County | 335,398 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 185 | FM Jersey Dairy | FM Jersey Dairy Digester Vitural Pipeline Project | $ 4,021,494.00 | $ 2,010,747.00 | $ 2,010,747.00 | Under Construction | 11595 Avenue 164, Tipton, Tulare County | 161,960 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| 256 and/or 352 | El Monte Dairy | El Monte Dairy Biogas | $ 4,132,977.00 | $ 1,010,674.00 | $ 3,122,303.00 | Applications to County and Construction to begin Q2 2020 | 10410 Avenue 160 and/or 15920 Road 152, Tipton, Tulare County | 118,903 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 323 | Dykstra Dairy | Dykstra Dairy Biogas | $ 5,696,457.00 | $ 2,260,454.00 | $ 3,436,003.00 | Applications to County and Construction to begin Q3 2020 | 6801 Avenue 176, Tulare, Tulare County | 265,936 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 245 | Double J Dairy | Double J Dairy Biogas | $ 6,716,522.00 | $ 2,426,716.00 | $ 4,289,806.00 | Under Construction | 6656 Avenue 328, Visalia, Tulare County | 285,496 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 359 | Decade Dairy; Richard Westra Dairy | Decade Centralized Dairy Digester Pipeline Project | $ 3,547,174.00 | $ 1,773,587.00 | $ 1,773,587.00 | Approved by Tulare County | 3313 Avenue 256, Tulare, Tulare County | 192,558 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| 313 | Cornerstone Dairy | Cornerstone Dairy Digester Pipeline Project | $ 2,532,107.00 | $ 1,266,053.00 | $ 1,266,054.00 | Operational | 8769 Avenue 128, Tipton, Tulare County | 185,238 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| 50 and/or 61 | Aukeman Dairy | Aukeman Dairy Biogas | $ 4,998,508.00 | $ 1,765,457.00 | $ 3,233,051.00 | Applications to County and Construction to begin Q2 2020 | 17993 Road 96 and/or 17297 Road 96, Tulare, Tulare County | 207,701 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | California Bioenergy |
| 218 | 4K Dairy | 4K Dairy Digester Pipeline Project | $ 3,561,176.00 | $ 1,780,588.00 | $ 1,780,588.00 | Operational | 5147 Avenue 228, Pixley, Tulare County | 192,143 | RNG generation and pipeline injection for vehicle fuel use | None | 2018 | Maas Energy Works |
| | Pixley Dairy | Pixley Dairy Digester Fuel Pipeline Project | $ 3,447,237.00 | $ 1,600,000.00 | $ 1,847,237.00 | Construction | Pixley, Tulare County | 212,622 | RNG combustion in cogeneration turbines for bioethanol production | None | 2017 | Maas Energy Works |

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| 226 | S&S Dairy | S&S Dairy Biogas | $ 6,687,926.00 | $ 1,600,000.00 | $ 5,087,926.00 | Under Construction | 5311 Avenue 272, Visalia, Tulare County | 167,417 | RNG generation and pipeline injection for vehicle fuel use | None | 2016 | California Bioenergy |
| 358 | Circle A Dairy | Circle A Dairy Digester Fuel Pipeline Project | $ 2,351,228.00 | $ 1,050,000.00 | $ 1,301,228.00 | Operational | 11275 Road 96, Pixley, Tulare County | 138,745 | RNG combustion in cogeneration turbines for bioethanol production | None | 2016 | Maas Energy Works |
| 265A | R Vander Eyk Dairy | R Vander Eyk Dairy Digester Fuel Pipeline Project | $ 2,498,381.00 | $ 1,000,000.00 | $ 1,498,381.00 | Operational | 9993 Road 80, Pixley, Tulare County | 132,586 | RNG combustion in cogeneration turbines for bioethanol production | None | 2016 | Maas Energy Works |
| 298 | Moonlight Dairy | Moonlight Dairy Biogas | $ 6,355,146.00 | $ 1,500,000.00 | $ 4,855,146.00 | Under Construction | 5061 Avenue 280, Visalia, Tulare County | 154,834 | RNG generation and pipeline injection for vehicle fuel use | None | 2016 | California Bioenergy |
| 241 | Legacy Dairy | Legacy Dairy Digester Fuel Pipeline | $ 3,281,327.00 | $ 1,550,000.00 | $ 1,731,327.00 | Operational | 8660 Ave 96, Pixley, CA 93256 | 207,209 | RNG combustion in cogeneration turbines for bioethanol production | None | 2016 | Maas Energy Works |
| 33 | Bos Farms Dairy | Bos Farms Dairy Biogas | $ 12,834,030.00 | $ 1,500,000.00 | $ 11,334,030.00 | Under Construction | 20397 Road 152, Tulare, Tulare County | 168,398 | RNG generation and pipeline injection for vehicle fuel use | None | 2016 | California Bioenergy |
| 118 | Hamstra Dairy | Hamstra Dairy Biogas | $ 6,580,840.00 | $ 2,000,000.00 | $ 4,580,840.00 | Under Construction | 7590 Avenue 260, Tulare, Tulare County | 205,115 | RNG generation and pipeline injection for vehicle fuel use | None | 2016 | California Bioenergy |
| 139 | Rancho Teresita Dairy | Rancho Teresita Dairy Biogas | $ 12,500,558.00 | $ 2,100,000.00 | $ 10,400,558.00 | Under Construction | 21744 Road 152, Tulare, Tulare County | 236,251 | RNG generation and pipeline injection for vehicle fuel use | None | 2016 | California Bioenergy |
| 326 | K&M Visser Dairy | K&M Visser Dairy Digester Fuel Pipeline Project | $ 3,293,975.00 | $ 1,500,000.00 | $ 1,793,975.00 | Operational | 9279 Avenue 96, Pixley, Tulare County | 203,416 | RNG combustion in cogeneration turbines for bioethanol production | None | 2016 | Maas Energy Works |

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| | GJ TeVelde Ranch | Te Velde Tipton Dairy Digester | $ 2, 500,000.00 | N/A | N/A | Operational | 5850 Avenue 160, Tipton, California 93,272 | 189,080 | Electrical generation | None | | Maas Energy Works |
| 256 | Van Beek | Van Beek Brothers Dairy Digester | $ 2, 700,000.00 | N/A | N/A | Operational | 14808 Road 152, Tipton, California 93272 | 106,240 | Electrical generation | None | | Maas Energy Works |
| 346 | Hilarides | Hilarides Dairy Digester Renovation | $ 1, 300,000.00 | N/A | N/A | Operational | 24163 Road 188, Lindsay, California 93247 | 564,000 | Electrical generation | None | | Maas Energy Works |
| | | | $ 233,636,942.00 | $ 78,800,265.00 | $ 154,836,677.00 | | | 9,361,494 | | | | |

# Attachment “2”

## Notice of Exemption

# Notice of Exemption

**To:** ☐ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

☒ Tulare County Clerk
Room 105, Courthouse
221 South Mooney Boulevard
Visalia, CA 93291

*Dated filed at Tulare County Clerk's Office*

**Lead Agency:** Tulare County Resource Management Agency
5961 South Mooney Blvd.
Visalia, CA 93277
Attn: Sandy Roper, Project Planner
Phone: (559) 624-7101 Email: *sroper@co.tulare.ca.us*

**Applicant(s):** Tulare County Resource Management Agency
5961 South Mooney Blvd.
Visalia, CA 93277 Ph: (559) 624-7000

**Project Title:** 2019 Annual Report of total Greenhouse Gas ("GHG") emissions from dairies and feedlots for Fiscal Year 2019
**Project Location - Specific:** The project would apply to the unincorporated area of Tulare County that is zoned
**Project Location- Section, Township, Range:** N/A
**Project Location - City:** N/A **Location - County:** Tulare

**Description of Nature, Purpose, and Beneficiaries of Project:**
2019 Annual Report of total GHG emissions from dairies and feedlots for Fiscal Year 2019

**Exempt Status:** (*check one*)
☐ Ministerial (Sec. 21080(b)(1); 15268);
☐ Declared Emergency (Sec. 21080(b)(3); 15269(a));
☐ Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
☒ Common Sense Exemption: CEQA Guidelines Section 15061 (b)(3)
☒ Categorical Exemption: CEQA Guidelines Class 6, Section 15306
☐ Statutory Exemptions:

**Reasons why project is exempt:**
This action is consistent with Section 15061(b)(3), which states that a project is exempt from CEQA if "The activity is covered by the common sense exemption that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." The use of Section 15061(b)(3) is applicable and appropriate because preparing an Annual Report of total dairy GHG emissions from FY 2019 will not make any physical change to the environment since it only involves gathering information to prepare a written report concerning whether or not the County of Tulare is in compliance with the 2017 Animal Confinement Facilities Plan ("2017 ACFP") and the 2017 Dairy and Feedlot Climate Action Plan ("2017 Dairy CAP").

This action is consistent with Section 15306 Class 6, pertaining to basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. The use of Section 15306 is applicable and appropriate because preparing an Annual Report of total dairy GHG emissions from FY 2019 will not make any physical change to the environment because it only involves gathering information to prepare a written report concerning whether or not the County of Tulare is in compliance with the 2017 ACFP and the 2017 Dairy CAP.

**Name of Public Agency Approving Project:** County of Tulare, Board of Supervisors

Signature: _____ Date: _____ Title: Chief Environmental Planner
Hector Guerra

Signature: _____ Date: _____ Title: Environmental Assessment Officer
Reed Schenke, P.E. Director

☒ Signed by Lead Agency Date received for filing at OPR: N/A