DAIRY METHANE INITIATIVES

CASEY WALSH CADY
CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

DAIRY INDUSTRY KEY STATISTICS

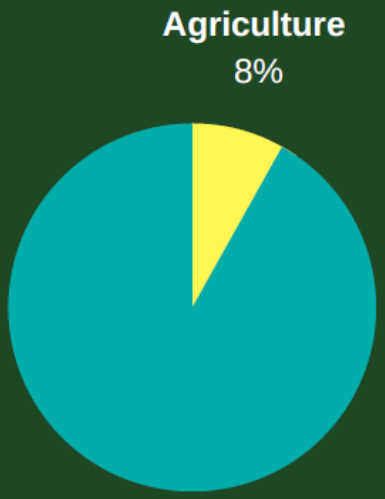
CA #1 dairy state in US

- 1.7 million milking cows
- 1,400 dairies
- 1215 avg. herd size
- 20% of US milk

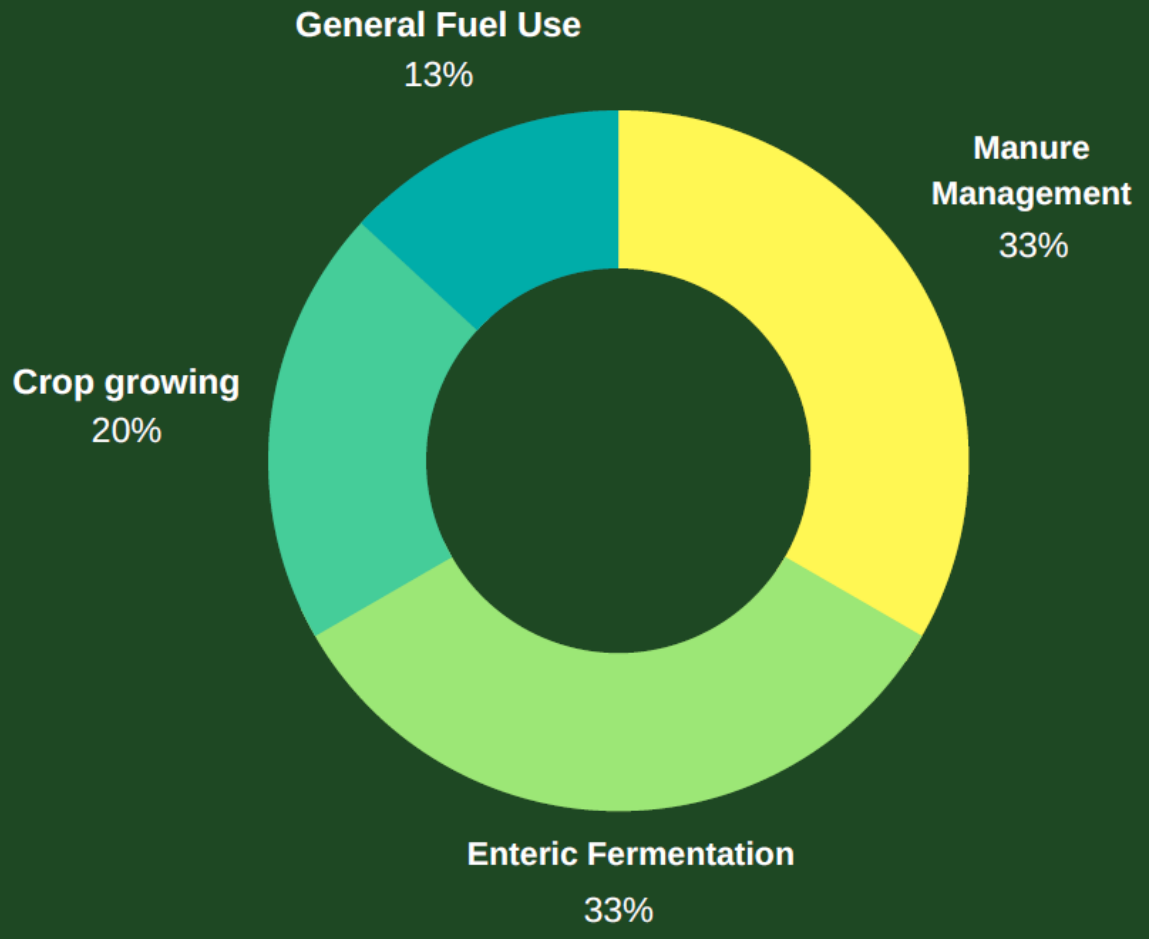
Recent Legislation

- SB 1383 Reduce dairy and livestock methane emissions by 40 percent from 2013 levels by 2030

CA GHG Emissions by Sector



INDUSTRY EMISSIONS AS PART OF TOTAL STATEWIDE EMISSIONS



AGRICULTURE GHG EMISSIONS BY ACTIVITY

SOURCE: CALIFORNIA AIR RESOUCES BOARD CALIFORNIA GHG INVENTORY FOR 2015

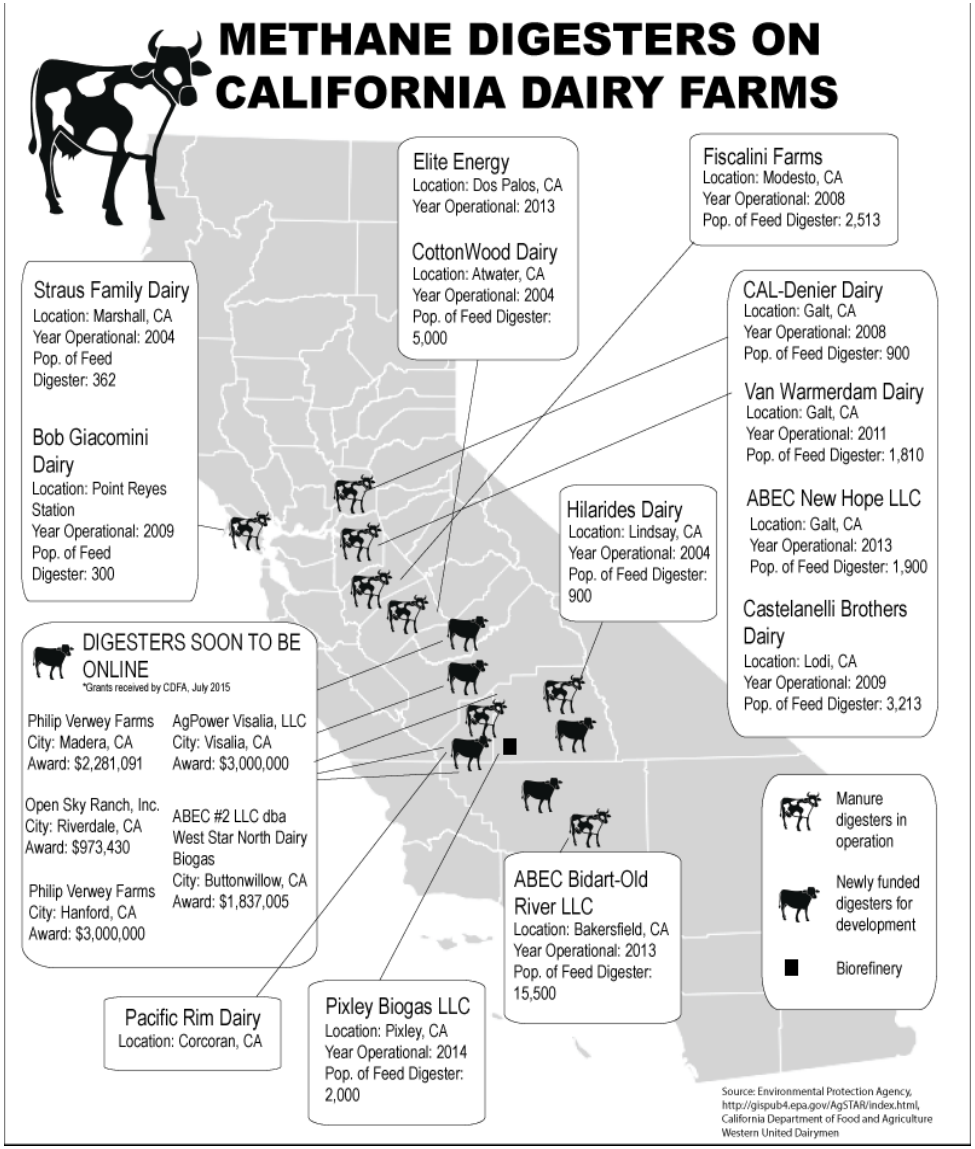
CALIFORNIA'S DAIRY REGIONS

Vary by overall population, dairying style, climate, and environmental conditions.

Approximately 91 percent of state's dairy cows and more than 80 percent of dairies are in the Central Valley (primarily freestall barns with flush systems or drylots).

~3 percent of state's dairy cows are in North Coast region, such as Humboldt, Marin and Del Norte counties, primarily on pasture.

~5.6 percent of dairy cows are in Southern California, including Riverside, Imperial, and San Diego counties, primarily on drylots.



Kebreab, E., UC Davis. 2016

TYPICAL FLUSH LAGOON

CDFA's Dairy Methane Programs

Anaerobic Digesters

- Potential for 12 + new projects to be built by 2020
- $29-$36 million

Alt. Manure Mgmnt. Practices

- Switch to scrape or solid manure management & composting -
- $ 9 - $16 million

Dairy Digester Research & Development Program

Grant size

- A maximum of 50% of the total cost of project, up to $3 million.
- 2-year project term

Eligibility:

- Existing milk producers, dairy digester developers.
- Cluster projects.
- Eligible bio-methane uses: On-site use or into electrical grid/pipeline (electricity generation or transportation fuel/RCNG), utilization of thermal energy on site or at neighboring facility

Environmental Quality Requirements:

- Water Quality Protection: Double-lined ponds consistent with the Tier 1 specification of the Dairy General Order Central Valley Regional Water Quality Control Board, or, above-ground tank, or, below-ground concrete lined tank.
- Air Quality Protection: Total NOx emissions no greater than 0.50 lb/ MW-hr.

In 2015 - 6 Dairy Digesters Funded

Project	Amount awarded	Biogas end-use	Status
Verwey-Hanford Dairy Digester	$3,000,000	Electricity	Completed.
Open Sky Ranch	$973,430	Electricity	Completed.
Verwey-Madera Dairy Digester	$2,281,091	Electricity	In progress.
West-Star North Dairy Biogas Project	$1,837,005	Electricity, RCNG in future	In progress.
Lakeview Dairy Biogas Project*	$2,000,000	Electricity, RCNG in future	In progress.
Carlos Echeverria & Sons Dairy Biogas Project*	$1,000,000	Electricity, RCNG in future	In progress. * Kern cluster

In 2017 – Awards Pending

- CDFA Received 36 applications for $29 - $36 million.
- Funding Recommendations to be released later this month
- Additional appropriation of $99 million for 2017-2018.

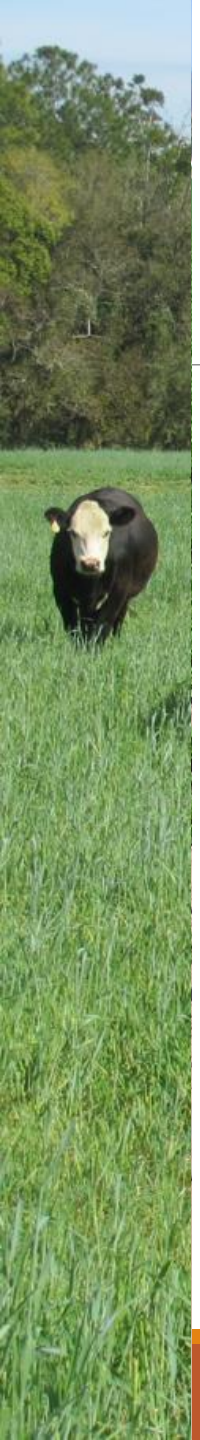
Completed Covered Lagoon Digester

AMMP's Identified to Date

- Mentioned specifically in SB 1383 and ARB SLCP Reduction Strategy:
  - Composting
  - (Convert from flush to) scrape systems
  - Mechanical solids separation
- *Mentioned specifically in ARB SLCP Reduction Strategy (March 2017)*
  - *Conversion to pasture*

AMMP Program Requirements

- Methane and equivalent Greenhouse Gas reductions from alternative (non-digester) manure management practices on California dairy and livestock operations must be permanent, annual and measureable.
- Matching funds, although not required, are highly encouraged. CDFA will fund up to 100% of the total project costs with a maximum grant award not to exceed $750,000 per project.
- Compliance with the California Environmental Quality Act (CEQA) and all applicable permitting within six months of the execution of the grant agreement.
- Use commercially available technology with proven operating history.



AMMP Program Requirements cont.

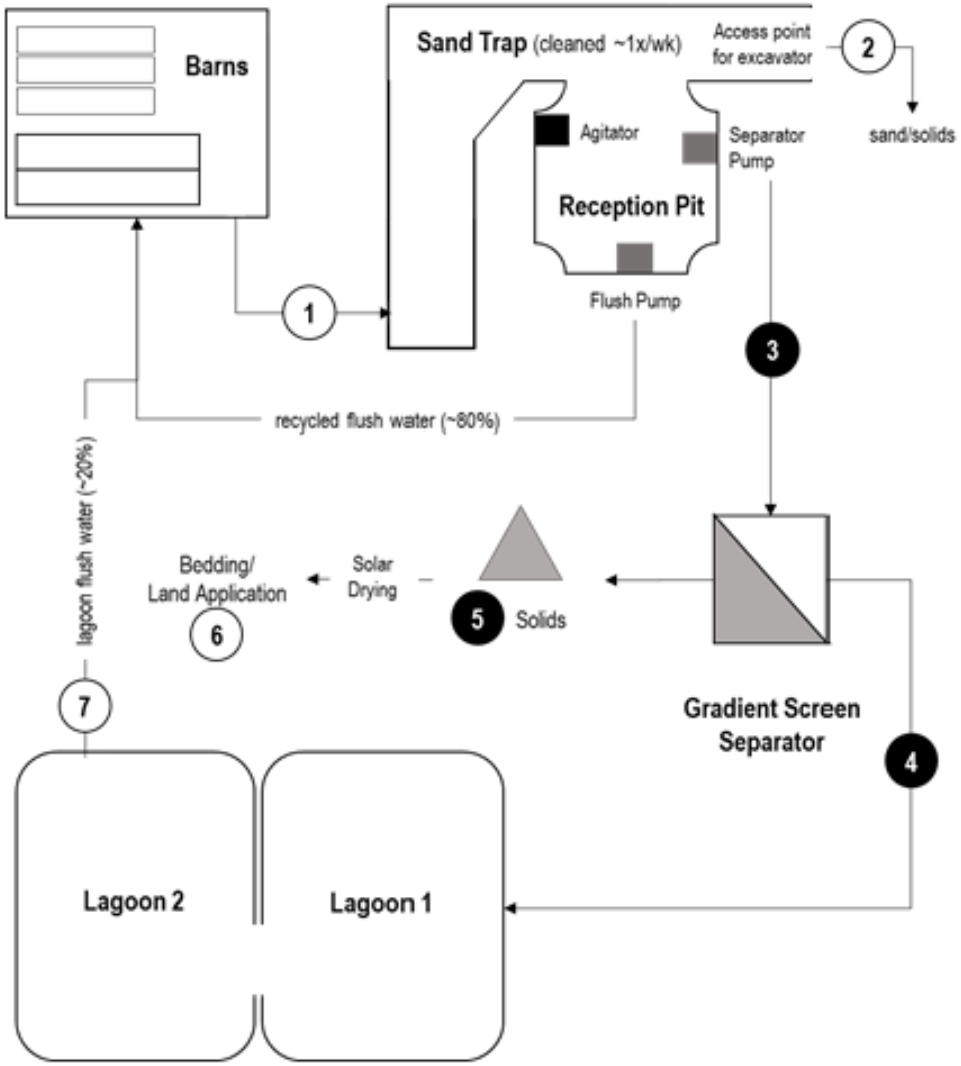
Must use Air Resources Board's Quantification Methodology for FY 2016-17 and Estimated GHG Reduction Calculator.

The calculator assists applicants in estimating avoided methane emissions from anaerobic manure decomposition.

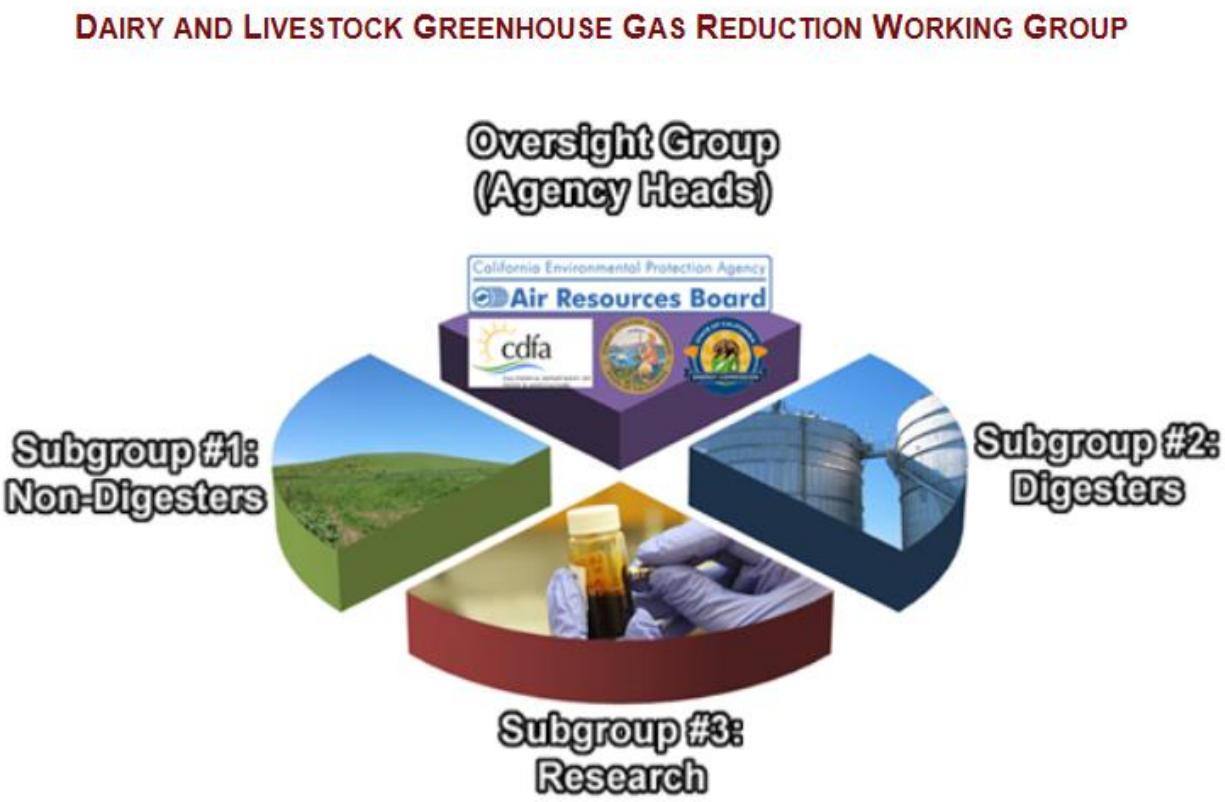
The ARB GHG quantification methodology is available at:
https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/quantification.htm

Questions regarding the QM Tool should be submitted to:
GGRFProgram@arb.ca.gov

Manure Management Example



Policy Efforts Dairy & Livestock GHG Reduction Working Group



RESEARCH EFFORTS

1. Converting Manure to Reduce Greenhouse Gas Emissions, Minimize Environmental Impacts, and Enhance the Economic Feasibility of Dairy Operations: Dr. William R. Horwath and Dr. Xia Zhu-Barker, UC Davis

2. Producing Valuable Co-Products and Improving Nutrient Management for Dairy Manure Digester Systems: 2014-16: Dr. Ruihong Zhang, UC Davis

3. Effect of Solid Separation on Mitigation of Methane Emission in Dairy Manure Lagoons: 2016-17 Dr. Ruihong Zhang, UC Davis

4. Benchmarking of pre-Alternative Manure Management Program Dairy Emissions – Dr. Frank Mitloehner, UC Davis

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