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How California is Creating a Pathway to Reduce Dairy Methane

The California dairy industry contributes 45% of the state's anthropogenic methane emissions and is under a legislative mandate to achieve 40% methane emission reductions by 2030. Through shrinking cow numbers and a series of incentives, California dairy producers have adopted anaerobic digesters, built manure management infrastructure, and plan to utilize feed additives in the future as a multiprong approach to reduce methane emissions.

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Abstract

As highlighted in the Global Methane Pledge, reducing methane emissions has been identified as a core strategy and the best short-term solution against atmospheric warming. Well before the release of the United Nations Environmental Program’s Global Methane Assessment in 2021, California had set aggressive targets for reducing methane 40% below 2013 levels by 2030 with the passing of SB 1383 in 2016. All methane sources including those from the dairy and other livestock industries are required to reduce emissions. Dairy comprises approximately 45% and other livestock make up 10% of the total anthropogenic annual methane emitted in California. This analysis focuses on California’s efforts to reduce dairy methane emissions and the progress it has made toward the target over the past 7+ years. The California dairy industry is on track to achieve these emission reduction targets based on falling cow numbers, constructing anaerobic digesters and manure management infrastructure, and the potential to implement feed additives for enteric methane reduction. Looking into the future, this case study highlights the additional methane emission reduction efforts that are underway that will enable the California dairy industry to achieve its full contribution toward the 40% reduction goal by 2030.

Learning Outcomes

1. Assess pathways for how dairy farms can be utilized as part of climate solutions in California and around the world.
2. Distinguish how the dairy industry is meeting the policy goals laid out by legislature and how accounting can be utilized to evaluate progress to make actionable reductions.
3. Determine the incentives that can be implemented to make rapid methane mitigation for climate and dairy farm profitability outcomes.

Which Sustainable Development Goals (SDGs) Does the Case Support?

- **Goal 2: Zero Hunger** – Dairy farms are producers of high-quality protein and other nutrients that play a role in nourishing populations throughout California, the USA, and the world.

- **Goal 7:** Affordable and Clean Energy – Capturing the methane from dairy farm manure management systems, via the use of anaerobic digesters, can convert this gas into energy-dense fuels such as renewable natural gas or electricity. Thus, capturing and using manure as a raw material is not just preventing methane emissions from being released into the atmosphere but also replacing fossil fuel sources that would traditionally contribute to California’s energy mix.
- **Goal 8:** Decent Work and Economic Growth – Utilizing anaerobic digesters can generate additional revenue streams for dairy farm operators to help supplement on-farm revenue and economic contributions of bioenergy companies. This income source has created new jobs in rural communities throughout California and a source of energy to power economic activity.
- **Goal 13:** Climate Action – The California dairy industry remains the largest contributor to the state’s methane budget comprising approximately 45% of the total. The construction of anaerobic digesters, manure handling infrastructure, falling cow numbers, and potentially feed additives has put the dairy industry on a path to reduce its annual methane emissions by over 40%.

Background and Context

California has continuously pursued aggressive climate change legislation and regulation with emission reduction landmark goals of net zero emissions by 2045 (California Office of the Governor, 2022). While most of the emissions causing climate change are in the form of carbon dioxide (CO₂), there has been much interest in the emissions of non-CO₂ gases, mostly methane and nitrous oxide. In 2016, the California legislature passed SB 1383 which seeks to reduce short-lived climate pollutants (SLCPs) including methane, by 40% from 2013 levels by 2030 (SB-1383, 2016). SB 1383 mandated the California Air Resources Board (CARB), the regulatory body in charge of setting air quality standards and goals, to implement a Short-Lived Climate Pollutant Reduction Strategy (California Air Resources Board, 2023).

The CARB plan targeted the dairy industry and other livestock industries in California because most of their emissions are in the form of methane (CH₄). CARB and the California Department of Food and Agriculture (CDFA) implemented an incentive/penalty model to implement manure management strategies first. The need to implement enteric methane emission reductions would be assessed when strategies became available. In 2022, CARB published its most recent report detailing progress toward the legislative goal and what still needs to be done (California Air Resources Board, 2022a). The report noted that the California dairy industry needs to reduce methane emissions by an additional nine million metric tons (MMT) of carbon dioxide equivalent (CO₂e) to reach the 2030 goal. The report stated that the industry is projected to eliminate 4.6 MMT CO₂e annually, showing progress but set to fall short of the 40% reduction goal in 2030.

SB 1383 only authorized CARB to implement regulations to meet the 2030 dairy and livestock reduction targets after January 1, 2024, and only after technologies are widely available and economically feasible to prevent cows and farms from moving to other states and countries. This tactic would not reduce global livestock emissions but only transfer emissions to other places. This case study compares CARB’s assessment of livestock methane reductions with our independent analysis of where the methane mitigation strategies and accomplishments are expected to be in the next few years. Achieving the state’s aggressive reduction goal will require a concerted approach involving methane avoidance, manure methane capture and utilization, enteric methane reduction activities, and accelerated methane reductions that accompany likely continuing reductions in dairy cow numbers in California.

CARB Review of California Livestock Methane Emissions

In 2013, California methane emissions accounted for 40 MMT CO₂e or about 9% of the state’s total greenhouse gas (GHG) emissions compared on a 100-year timespan (California Air Resources Board, 2022b). As shown in Fig. 1, dairy and other livestock farms make up 55% of the anthropogenic methane emissions in California. Dairy cattle contribute 18 MMT CO₂e of methane emissions and beef cattle almost

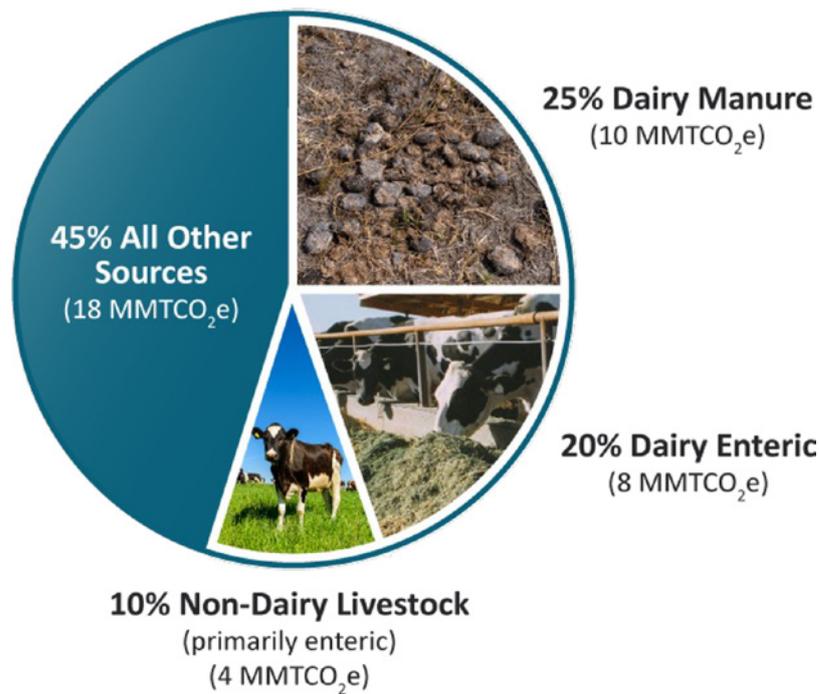


Fig. 1. 2013 California methane emissions by source (California Air Resources Board, 2022a). The California dairy industry constitutes a major component of the state's methane emissions.

all of the other 4 MMT CO₂e (California Air Resources Board, 2022b). A 40% reduction in methane emissions equals a reduction of 9 MMT CO₂e annually from the 2013 livestock methane emissions base. Through dairy digester development, reduced cattle numbers, and alternative manure management projects, CARB projected livestock methane would fall by about 4.6 MMT CO₂e by 2030.

In a proportional breakdown by emission source, about 80% (7.2 MMT CO₂e) of the targeted 9 MMT CO₂e reductions will need to come from the dairy industry, with the other 20% (1.8 MMT CO₂e) coming from the beef cattle and other livestock industries. CARB's Analysis of Progress report also assumes that, while the state's dairy cow numbers are projected to decline, California's beef cattle and other livestock industries are projected to grow. CARB's analysis assumes that reducing livestock methane emissions comes almost entirely from the California dairy industry. CARB's analysis indicated that the dairy industry would need to achieve considerably greater emissions reductions than 9 MMT CO₂e to offset anticipated emissions growth in the California beef industry.

Emission Reduction Progress Going Forward – 2023–2030

Our analysis generally supports CARB's expectation that reductions in methane emissions will be achieved through a combination of continued implementation of manure management methane reduction projects, some adoption of enteric methane strategies, and continued gradual reductions in dairy cow numbers. However, this analysis indicates that CARB likely underestimated ongoing reductions in dairy cow numbers in California. Moreover, there were in 2022 approximately double the number of dairy digesters that CARB recognized in operation. The increase in California digesters is even more significant including those operating or under development at the end of 2023. The next sections discuss how CARB's dairy methane reductions will be achieved through a combination of the following:

- Continued reductions in dairy cow numbers,
- Continued manure methane avoidance,
- Continued manure methane capture and utilization, and
- Implementation of enteric strategies (Fig. 2).



Fig. 2. Four primary strategies to reduce California dairy methane. These include reducing herd size through efficiency and attrition, reducing methane production from manure, capturing that methane for fuel utilization, and the utilization of feed additives.

Forces that Reduce Methane Emissions

Reduced dairy cow numbers

Since 2008, the total California herd size has been reduced from 1.84 million milk cows to 1.70 million milk cows in 2023. The number of milk cows in California is projected to continue to gradually decline, while milk production remains about constant as milk production (especially milk solids [protein and fat]) increase per cow. The question is now the rate and extent of decline in cow numbers that occur over the remainder of the decade.

CARB estimated that trends observed between 2007 and 2017 (0.5% average reduction in total cattle and calves) will continue from 2018 to 2030 (California Air Resources Board, 2022a). However, oddly given different emissions per cow and distinct industry trends, CARB's projections mix changes in the beef cattle numbers with those in the dairy cow numbers. A lactating dairy cow produces greater methane emissions compared to a beef cow due to more feed consumed per day and the way their manure is stored in anaerobic lagoons. There are also distinct costs of production and competitive pressures on dairy that imply different supply and demand drivers that influence the beef cattle numbers relative to the dairy cow population.

As a result, it is critical to consider and manage methane and other GHG emissions from distinct livestock industries separately. For example, nearly all methane from beef cattle production are enteric emissions due to major differences in how beef cattle are raised, and manure is managed. Unless drought, low cattle prices, or other economic forces cause rapid declines in California beef cattle numbers, reducing these emissions will largely be dependent on emerging enteric methane strategies placing even greater importance on the development of these solutions.

CARB's approach took livestock (beef and dairy) data from the US Ag Census between 2007 and 2017, derived a reduction in the total number of cattle and calves in California (~0.5% annually), and applied this factor to the entire period for all the distinct industries (dairy, beef cows and calves, beef feedlots and beef yearlings feeding on pasture) through 2030. As this case study documents, the assumption that the beef and dairy trends are the same fails to recognize the important differences between the economic forces and emission patterns in these two distinct industries.

Whether looking at just the lactating cow population alone or adding in the replacement dairy heifer population, the rate of decline in the number of milk cows in California has been between -0.5% and -0.75% a year. Dividing 18 MMT CO₂e by the estimated number of dairy cows in 2013 (~1.84 million) provides the methane emissions rate per animal in 2013 at about 9.57 MT CO₂e/cow. Using USDA data, the California dairy industry lost 65,326 animals between 2012 and 2017. This results in an estimated annual methane emission reduction of around 653,260 MT CO₂e from California dairy herd size reduction in the 5-year period.

If the rate of herd attrition and associated methane reductions were to remain constant from 2013 through to 2030, California should expect to realize a methane emission reduction over the 18 years of between 2.34 and 2.39 MMT CO₂e. However, evidence suggests that California milk cow numbers have been and will continue to fall faster during the period 2017-2030 than they did in the previous periods. In percentage terms, the dairy cow number population decline will increase in this decade. As an example, from 2017 to 2022, using Census data the herd size averaged an annual decline of 0.71% per year.

The following led to the reduced number of milk cows in California:

- Drought, and resulting cutbacks in surface water deliveries,
- Higher costs of groundwater pumping when it is available,

- Increasing water scarcity and increased cropland taken out of production due to beginning implementation of the Sustainable Groundwater Management Act ((SGMA) in 2014 and limits on groundwater pumping,
- Drought concerns raising the cost of California-produced alfalfa hay and silage,
- Higher costs of transportation causing higher costs of lucerne shipped into California,
- Continued wage increases and difficulties finding qualified dairy farm workers,
- Rising energy, fuel, and dairy concentrate feed costs,
- Increased regulation, including increasing waste discharge requirements for Central Valley dairies,
- Challenges in the dairy permitting for new or expanding dairies in many areas, and
- Increased productivity growth and improved management of dairies in other parts of the United States and other export regions, which keep competitive pressure on milk prices for California producers.

Milk cow numbers vary from year to year as economic conditions change, but the downward trend is clear in recent data.

To reflect recent history and the increasing pressure from the drivers listed continuing pressure. We assume a –1% per year herd reduction rate from 2022 to 2030. These rates of decline in cow numbers more accurately reflect dairy industry trends. If these trends prevail, California will have about 1.56 million milk cows in 2030. Consequently, the estimate for total dairy cow methane reductions between 2013 and 2030 is between 2.6 and 3.3 MMT CO₂e. If California reduces the lactating cow herd by 15% from 2012 to 2030, then it will achieve almost 30% toward the 9 MMT CO₂e SB 1383 goal.

Manure management methane abatement and avoidance

Dairy manure methane emissions can be reduced through two primary methods: (1) methane avoidance and (2) methane capture and utilization. Manure methane can be avoided by changing manure management practices in dairy operations. These projects not only avoid methane production but can also provide other environmental benefits such as improved soil health, water quality improvement and conservation, and improvement of nutrient management. Alternative manure management practices can take many forms, including but not limited to the following:

- Liquid solid diversion – solid manure separation systems,
- Conversion of flush/lagoon systems to scrape or vacuum with subsequent solar drying or composting of manure instead of anaerobic storage,
- Utilization of compost-bedded pack barns, and
- Conversion to pasture-based systems.

The CDFA's Alternative Manure Management Program (AMMP) grant program has invested significant dollars in projects to 2024, funding some 168 projects. California's dairy industry, in coordination with CDFA, was also recently awarded up to US\$85 million by the USDA under the Partnerships for Climate-Smart Commodities. The funding will leverage an additional \$40 to \$45 million in matching state funds and an estimated \$180 million of private capital investments. Practices eligible for funding are expected to include but not be limited to vermifiltration, composting, algae raceways, advanced solid-liquid separation, and evaporative liquid waste processing systems. In California, the adoption of these practices is expected to reduce methane emissions anywhere from 0.6 to 1.1 MMT CO₂e annually.

Additionally, the federal Inflation Reduction Act (IRA) also provides \$20 billion over the next several years for climate-smart agricultural programs and projects, including \$8.45 billion in new funding for the Environmental Quality Incentives Program (EQIP). The IRA also provides \$4.95 billion in new funding for the Regional Conservation Partnership Program, which targets methane reduction. These significant additional funds will greatly expand investments in methane avoidance and capture projects, resulting in significant additional dairy methane reduction in California as well as other parts of the United States.

Manure methane capture and utilization

Dairy digesters are widely recognized as one of the most efficient and effective ways to reduce dairy manure methane emissions. AgSTAR is a collaborative program sponsored by the US Environmental

Protection Agency (EPA) and USDA that promotes the use of biogas recovery systems (digesters) to reduce methane emissions from livestock waste. Before the enactment of SB 1383, about 15 dairy digesters were operating in California. Expanded state incentives designed to offset the high capital cost of digester installation have fueled broader interest and adoption of digesters. In addition to grants provided for capital costs by CDFA's Dairy Digester Research & Development Program (DDRDP), other critical incentive programs have enabled projects to monetize the reductions and provide ongoing revenue streams that enable financing and development of these multimillion-dollar methane reduction facilities. These programs include:

- Bioenergy Market Adjusting Tariff (BioMAT)
- Cap-and-Trade Offset Program
- Low Carbon Fuel Standard (LCFS) Program
- Federal Renewable Fuel Standard (RFS)
- California Public Utilities Commission (CPUC) Pipeline Interconnection Incentive Program
- Renewable Natural Gas Procurement (SB-1440, 2014)

In the absence of these incentive programs, dairies would not be able to afford to build and operate anaerobic digestion facilities on their farms. While dairy digesters offer significant and cost-effective methane emission reductions, without large-scale public incentives, the rate of adoption would be significantly less (California Air Resources Board, 2022a).

CARB's *Analysis of Progress* report assessed the methane reduction benefits of the state's move to dairy digesters (California Air Resources Board, 2022a). However, CARB's inventory of dairy digester projects that are currently in operation and under development substantially undercounts the actual number of projects that are being undertaken in California. Only projects that are funded via the DDRDP are included in this calculation.

More complete inventories compiled by leading industry observers and validated in this analysis indicate that, by August 2023, there were 227 dairy digesters in operation in California or being actively developed that account for manure from 255 dairy farms (CDFA, 2022, 2023; Dairy Cares Personal Contact, 2023). CARB predominantly accounted for only the digesters that were funded by CDFA (n=111) but there are 116 more projects or virtually double the number of dairy digester projects active throughout the state. If each of these additional projects achieves the same annual methane emission reduction as the average dairy digester project funded by the DDRDP (17,817 MT CO₂e annually), then CARB has significantly underestimated the expected methane emissions reductions from California dairy digesters by at least 2 MMT CO₂e at 4.1 MMT CO₂e annually.

The inventory of California dairy digester projects and the estimate above may not adequately document the total number of dairy digester projects being pursued by dairy farmers and digester developers in the state. Recent conversations and public statements from dairy digester developers indicate that there may be as many as 25 additional dairy digester projects not accounted for by either CARB or the digester inventory (Aemetis, 2022). Thus, even the projection of additional methane reductions from anaerobic digestion anticipated herein may underestimate the progress toward the 2030 goal.

Enteric methane reduction

Enteric methane from dairy cattle and other ruminant livestock is a significant source of GHG emissions in the USA and California, accounting for 12 MMT CO₂e annually in the state, or 30% of statewide methane emissions (40 MMT CO₂e; (California Air Resources Board, 2022b). Dairy cattle account for 8 MMT CO₂e of enteric methane and the remaining 4 MMT CO₂e is from beef cattle and other ruminant livestock. Potential strategies to reduce emissions from the digestion process include diet modifications, feed additives, feed efficiency improvements, and selective breeding of low methane-producing animals (Beauchemin *et al.*, 2022). Of the solutions available, feed additives have been suggested to offer the greatest potential for short-term enteric methane reductions due to their ability to deliver considerable reductions shortly after adoption (Honan *et al.*, 2021). Unlike manure management strategies, utilization of feed additives could be implemented at operations of all sizes with livestock that are fed a consistent daily diet. While feed additives hold considerable methane mitigation potential, very few have been implemented on farms.

A recent meta-analysis examined 98 enteric methane mitigation options from a comprehensive data set of treatment means from 425 peer-reviewed studies published between 1962 and 2018 (Arndt *et al.*, 2022). The authors found that most of the options (63 out of 98 or 64%) were not successful in mitigating enteric methane. The authors ultimately found that only five options reduced enteric methane production and emissions intensity (g methane per kg meat or milk) without negatively affecting milk production, and only three options reduced emissions intensity while increasing animal productivity.

With ongoing research and development efforts, several feed additives are expected to become commercially available in the next several years, which could be used to reduce enteric methane emissions from dairy cattle in California. Each of these is discussed below:

3-NOP (Bovaer(R))

The most well-studied feed additive for reducing methane, 3-nitrooxypropanol (3-NOP), is expected to become commercially available in the USA in 2024. There is a significant body of evidence to support the effectiveness of 3-NOP in reducing enteric methane emissions by approximately 30% (Feng and Kebreab, 2020; Alemu *et al.*, 2021). The molecule 3-NOP is currently undergoing long-term trials and FDA approval, which could achieve market access later this year. Bovaer is approved for use in over 60 countries as of the beginning of 2024 including the major milk-producing nations of Brazil, Australia, and the European Union (Kebreab *et al.*, 2023).

Essential oils

There are a couple of commercial essential oil products available for potential enteric methane reduction such as Mootral Ruminant and Agolin Ruminant. The former is a pelleted, natural product made from garlic powder and citrus extract and the latter is a commercial blend of clove, wild carrot, and coriander. In work completed at UC Davis, they have shown mixed efficacy in their ability to reduce methane emissions with reduction levels at maximum being around 20% but more typically around 8–10% reduction in the short-term (Roque *et al.*, 2019a; Carrasco *et al.*, 2020). Since these feed additives are both made from readily available plant extracts, there is a possibility to scale up and readily implement them for dairy farms today.

Seaweed and algae

Seaweed and algae have also demonstrated the ability to mitigate methane emissions. Seaweeds have highly variable chemical composition, depending on the species, time of collection, and growth environment. Some macro algae contain specific bioactive components that inhibit the activity of methane-forming microbes in the rumen. Although there are many species of seaweed, research has shown that two red seaweed species, *Asparagopsis taxiformis* and *A. armata* have specific qualities that help inhibit enteric methane production when fed to cattle at rates greater than 50% reduction (Roque *et al.*, 2019b, 2021). Before all cows across California are fed seaweed, the impacts on animal and human safety, persistent emission reduction, and the potential for negative effects on milk production and composition need to be evaluated.

The primary products discussed above provide an effectiveness range from 10% to greater than 50%. Scenarios considered in this case study assume adoption rates ranging from 50% to 80% for dairy milk cows only. For purposes of this exercise, a constant 1.70 million milk cows producing milk in California was assumed. These modeled scenarios could result in potential enteric emission reductions from 0.4 to 3.2 MMT CO₂e. However, for this analysis, we adopt a more conservative approach. Whereas CARB's methodology attributes a higher level of CO₂e annually to each animal's enteric emissions, other sources put this figure at roughly 3 MT/year (Rotz, 2018). Using this lower figure for each dairy cow's enteric emissions yields a highly conservative estimate of the reductions that are likely to result from the implementation of feed additives to reduce enteric emissions.

As Table 1 demonstrates, widescale adoption of feed additives has the potential to provide substantial enteric methane reduction from California milk cows. In this analysis, those reductions range from 255,000 MT CO₂e/year assuming a feed additive with a 10% reduction effectiveness and 50% herd penetration to approximately 2 MMT CO₂e/year for technologies that achieve a 50% reduction effectiveness and 80% herd penetration.

Table 1. Enteric methane projected reductions at various dairy sector penetration scenarios (MT CO₂e/year). Assumes 1.7 million milk cows producing 3 MT CO₂e for a total of 5.1 MMT CO₂e annually.

Reduction effectiveness of feed additives	Herd penetration			
	50%	60%	70%	80%
10%	255,000	306,000	357,000	408,000
20%	510,000	612,000	714,000	816,000
30%	765,000	918,000	1,071,000	1,224,000
40%	1,020,000	1,224,000	1,428,000	1,672,000
50%	1,275,000	1,530,000	1,785,000	2,040,000

Enteric implementation

Research on nutrition and management-based enteric methane mitigation options must continue and expand to support the identification and adoption of mitigation options and better understand their consequences on animal health, well-being, productivity, and product quality (Tricarico *et al.*, 2022), including the following:

- Better delivery mechanisms of feed additives, especially for grazing animals,
- Long-term effects on animal health, well-being, and reproduction,
- Adaptation by the ruminal microbiome in the animal and ensuring long-term reductions, and
- Milk compositions, shelf life, sensory attributes (taste and smell), and consumer acceptance.

The opportunities to reduce methane on commercial dairy farms include more areas than those covered here. Additional interventions in the form of low methane genetics, microbiome interventions, vaccine development, and manure amendments can play a role in reducing the industry's carbon footprint (Wright *et al.*, 2004; Peterson and Mitloehner, 2021; Richardson *et al.*, 2022). No one solution can be utilized to reduce the California dairy industry's carbon footprint alone. The four approaches mentioned in this case study were selected due to being verifiable and easily implementable so that the legislative mandate to reduce methane emissions by 40% by 2030 based on 2013 levels can be achieved. Dairy cow population reductions are naturally taking place within California, manure management practices have been successful due to investments in California's AMMP and DDRDP programs, and the momentum continues to grow to utilize enteric methane feed additive inhibitors on farms. As additional technologies become widely available, they will be part of the mix of investments the California dairy industry utilizes to meet SB 1383 and climate goals in the future.

Conclusions

California's dairy industry is expected to achieve a 40% reduction in methane by 2030. Substantial methane emission reductions follow from reduced milk cow numbers with little or no loss in total milk production. The remaining reductions will be best achieved through continued implementation of California's incentive-based approach, including methane avoidance, methane capture and utilization, and implementation of emerging enteric fermentation solutions.

California's current methane avoidance program, CDFA's AMMP provides important methane reduction opportunities, particularly for smaller dairies where methane capture and utilization technologies are less well suited. Continued implementation of dairy digesters in California represents a proven, efficient, and cost-effective approach to significantly reduce dairy methane emissions.

Enteric emission reduction opportunities are increasingly emerging and are likely to be commercially available in the near term. Several promising feed additives are completing testing and being approved for commercial use. As these products become available, broad implementation across the dairy industry can provide significant additional reductions to meet the SB 1383 goal. The development of a CARB-approved GHG-offset compliance protocol will be an important tool to quantify, verify, and help offset the costs of feeding these products.

Table 2 summarizes the projections for California dairy industry methane reductions and progress toward the 40% reduction target by 2030. As the table documents, the dairy industry is on pace to meet and likely exceed the 7.2 MMT CO₂e methane reduction to reach the 40% target. Figure 3 shares

Table 2. Methane emission reduction projections from 2016 through 2030. Comparison between CARB’s analysis of progress report and this case study’s values.

Projected dairy sector methane reductions		
Reduction type	CARB livestock emission reductions (MMT CO ₂ e)	Case study dairy emission reductions (MMT CO ₂ e)
Herd reduction	2.4	2.6–3.3
Anaerobic digestion	1.9	4.1
Alternative manure management practices	0.3	0.6–1.1
Enteric emission reduction strategies	0	0.2–2.0
Total	4.6	7.5–10.5

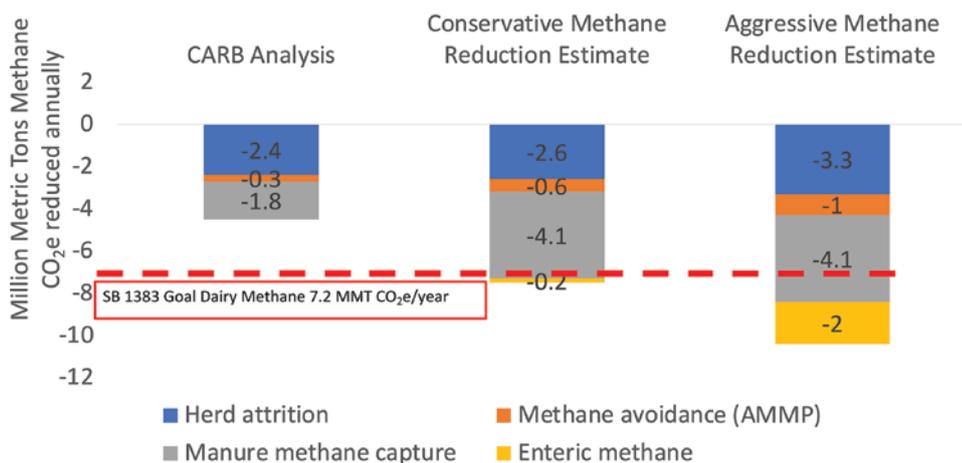


Fig. 3. Methane emission reductions from 2016 through 2030. Comparison between CARB’s analysis of progress report and this case study’s conservative and liberal estimates.

the same story that no matter the range of the estimate built into this analysis, the California dairy industry will achieve the SB 1383 goal by 2030.

California’s dairy methane reduction efforts are recognized as achieving more rapid methane reductions than those implemented elsewhere. California’s incentive-based approach is now being adopted by the USDA and attracting new funding from Congress, which recently appropriated an additional \$20 billion to USDA for incentives to assist climate-smart agricultural practices and billions more for renewable energy incentives (USDA, 2023). Additionally, the Converting Our Waste Sustainably (COWS) Act was introduced in Congress to replicate the AMMP grants program at the federal level (Office of Senator Alex Padilla, 2023). The SB 1383 emission goal focuses on a single time point along the pathway for California Dairy Industry sustainability. Reaching these goals is likely to be just one landmark in the continuing efforts to achieve substantial, sustainable emission reductions.

Exercises/Group Discussion Questions

1. What incentives or policy programs can be created within other dairy-producing regions or states that can help achieve methane reduction goals?
2. What efforts can be put forth to avoid leakage and ensure that the main strategy to reduce methane emissions for a country or region is not herd attrition?
3. How do you define sustainable dairy production and what outside programs can influence the adoption of methane reduction technologies?

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Conflict of interest

The authors have no conflicts of interest to declare.

Further Reading

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Case studies represent real industry practice which may differ across countries and local circumstances. We recommend all actions taken abide by your local legislative requirements and good practice.

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