

# Creating a Carbon-Neutral Milk Future: Ensuring the Long-Term Viability of Our Dairy Industry and Protecting the Environment

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Within the domain of sustainable agriculture, the dairy industry holds a prominent position in the pursuit of carbon neutrality. The significance of attaining carbon neutrality within this industry cannot be exaggerated, as it not only guarantees the long-term viability of dairy farming methods but also plays a crucial role in decreasing the effects of climate shift on our planet.

The dairy industry, traditionally seen as a fundamental aspect of nutrition and economic success, is now acknowledging its need to decrease its impact on the environment by reducing its carbon emissions. The dairy business contributes to greenhouse gas emissions through various means, including methane emissions from cattle and energy-intensive procedures in milk production.

Tackling these difficulties is not only crucial for the environment but also essential for the industry's long-term sustainability. By adopting carbon neutrality, dairy farmers and producers can improve their competitiveness in a market that increasingly values sustainability.

Adopting carbon-neutral operations is a strategic investment in the long-term sustainability of dairy production. It entails reconsidering conventional methods, incorporating cutting-edge technologies, and embracing environmentally friendly farming techniques. By implementing these initiatives, the dairy sector may effectively decrease its greenhouse gas emissions while upholding stringent milk production standards.

With growing awareness of the ecological consequences of their decisions, customers are increasingly seeking sustainable dairy products. Attaining carbon neutrality enables the industry to fulfil this need, guaranteeing that consumers can indulge in their preferred dairy products with the awareness that they are making a positive impact on the environment. This article explores different facets

of the path towards achieving a milk industry that produces no net carbon emissions. The article seeks to illuminate the way towards a sustainable and prosperous dairy business.

Carbon-neutral milk refers to milk that is produced with minimal or no net release of carbon dioxide into the atmosphere. It is created by several methods that aim to reduce or offset the carbon emissions associated with milk production. These methods may include implementing sustainable farming practices, using renewable energy sources, optimizing feed efficiency, and investing in carbon offset projects. The goal is to achieve a balance between the amount of carbon emitted during milk production and the amount of carbon removed from the atmosphere.

## Comparison between Carbon-Neutral Milk vs Conventional Milk

Below table outlines the key differences between Carbon-Neutral Milk and Conventional Milk, highlighting the aspects of certification, production processes, sustainability focus, farming practices, environmental impact, shelf life, emissions reduction efforts, and overall sustainability benefits. Choosing carbon-neutral milk can contribute to environmental sustainability and reduced greenhouse gas emissions compared to conventional milk.

## Calculation of Carbon Footprint of Milk

Calculating the carbon footprint of normal milk involves figuring out how much greenhouse gases are produced during the process of making that milk. Here's a simpler breakdown:

- 1. Find the Sources:** Look at where the greenhouse gases come from in making milk, like growing feed for cows, cow digestion, managing manure, transporting milk, and using energy.
- 2. Estimate Emissions:** Calculate how much carbon dioxide, methane, and nitrous oxide are released from each source. Convert these gases into CO<sub>2</sub> equivalents to compare them.

Table 1: Comparison between Carbon-Neutral Milk vs Conventional Milk

Aspect	Carbon-Neutral Milk	Conventional Milk
<b>Certification</b>	Officially certified as Carbon Neutral by agencies like SCS Global Services.	Generally, lacks specific certifications for low carbon emissions.
<b>Production Process</b>	Comprehensive assessment of carbon footprint, offsetting residual emissions.	May have larger carbon footprint due to farming practices.
<b>Sustainability Focus</b>	Prioritizes emission reduction at the farm level with sustainable techniques.	Farming practices may not emphasize emissions reduction.
<b>Farming Practices</b>	Cultivates tannin-rich fodder, uses manure separators, carbon reduction programs.	May lack rules on pasture grazing, organic feed, or antibiotic limitations.
<b>Environmental Impact</b>	Reduced impact due to lower emissions and sustainable practices.	Potentially larger carbon footprint from intensive farming methods.
<b>Shelf Life</b>	Longer shelf life due to Ultra-High Temperature pasteurization.	Usually has a shorter shelf life with regular pasteurization.
<b>Emissions Reduction</b>	Actively invests in carbon offsets to maintain net zero emissions.	Generally, lacks specific initiatives for emission reduction.
<b>Overall Sustainability Benefits</b>	Promotes sustainable agriculture and reduces greenhouse gas emissions.	May contribute to environmental degradation through farming practices.

**3. Assign Emissions to Milk:** Decide how much of these emissions should be linked to the milk produced based on factors like feed used, its nutritional value, and how efficiently cows digest it.

**4. Calculate Carbon Footprint:** Divide the total greenhouse gas emissions by the amount of milk produced to get the carbon footprint per unit of milk.

**5. Compare:** You can use this method to compare the carbon footprints of milk from different places or production methods.

The carbon footprint can change based on how you assign emissions, so different allocation of emission might give slightly different results.

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#### Achieving Climate Neutrality in the United States The dairy industry

The U.S. dairy business is aggressively striving to attain climate neutrality by prioritizing the reduction of greenhouse gas emissions and deploying cutting-edge measures. This article provides the results that outline the steps necessary for the U.S. dairy industry to achieve carbon neutrality.

## 1. Objective of Achieving Climate Neutrality

The U.S. dairy industry is striving to attain climate neutrality instead of simply achieving net-zero carbon emissions. This approach highlights the significance of accurately measuring greenhouse gas emissions based on their long-term influence on temperature. The U.S. dairy industry has the ability to achieve climate neutrality by 2041 by gradually reducing its emissions each year, according to a case study published by the CLEAR Centre at the University of California, Davis.

## 2. Emphasis on Methane Emissions

Methane emissions, which contribute significantly to the overall greenhouse gas emissions from the livestock sector, are a primary area of concern for reaching climate neutrality in the U.S. dairy industry.

Addressing methane emissions is essential for achieving climate neutrality objectives and harmonizing with international agreements such as the Paris Agreement, which seek to restrict global warming to less than 2 degrees Celsius.

## 3. Results of the Research:

Research undertaken by professionals such as Dr. Frank Mitloehner and Dr. Sara Place offers practical guidance for animal agriculture, like dairy, to achieve climate neutrality while maintaining milk production.

The study underscores the need of decreasing methane emissions by 18-32% in order to prevent beef and dairy animals from further contributing to global warming. This highlights the necessity for setting ambitious yet attainable objectives for climate neutrality.

## 4. Sustainability Measures:

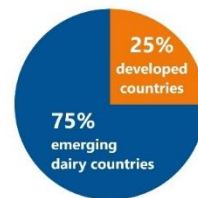
The U.S. dairy industry has pledged to achieve greenhouse gas neutrality by 2050 and is currently engaged in efforts to decrease its carbon footprint through the use of sustainable agricultural methods and technology innovations.

Utilizing technology, implementing best practices, and ensuring that innovations are accessible and affordable for farmers are crucial measures being

utilized to achieve net zero emissions in the dairy industry. The U.S. dairy industry is making substantial progress towards reaching climate neutrality, sustaining milk production levels, and encouraging sustainable dairy farming methods by adhering to research findings and industry initiatives.



### Dairy GHG emissions by segments



25% of global dairy GHG emissions are from dairy farms in **developed countries**.

75% of global dairy GHG emissions are from dairy farms in **emerging countries**.

## Challenges and opportunities in attaining carbon neutrality in the dairy sector: A viewpoint from India

The dairy sector in India is crucial for the country's economy since it generates employment opportunities and contributes significantly to ensuring food security. Nevertheless, the process of adopting carbon-neutral practices poses significant obstacles when striving for long-term environmental sustainability. Indian dairy farms encounter challenges, such as emissions originating from dry peatlands, which highlights the adverse environmental effects in these regions. Furthermore, the need for ongoing innovation presents a challenge in efficiently implementing carbon-neutral practices. In order to tackle these difficulties, it is essential to implement measures like carbon farming training and practical manure recycling. These programs can play a vital role in decreasing emissions and fostering sustainability. The agricultural sector, consisting of more than 75 million farms of different sizes, faces specific challenges and possibilities in attaining net-zero goals. To reduce methane emissions, which account for 30% of the country's total methane emissions, it is necessary to enhance the quality of animal feed, utilize feed additives, and increase the adoption of renewable energy sources. Furthermore, the promotion of sustainable methods such as agroforestry and conservation agriculture among smallholder farmers can increase productivity while reducing the negative effects on the environment. In order for the Indian dairy industry to reach carbon

neutrality, it is crucial to address difficulties pertaining to methane emissions, feed quality, adoption of renewable energy, and implementation of sustainable agricultural techniques. Indian dairy farms can achieve sustainability, economic viability, and environmental stewardship by implementing focused interventions and promoting collaboration among stakeholders.

### How have dairy farms in India quantified the carbon emissions resulting from their operations?

In a comprehensive study conducted in Anand district, Gujarat state, western India, researchers explored the carbon footprint of milk production within the multi-functional smallholder dairy system. Here are the key findings from their cradle-to-farm gate life cycle assessment (LCA):

#### Study Details:

- Location: Anand district, Gujarat state, India.
- Farm Sample: The study covered 60 smallholder dairy farms across 12 geographically distinct villages in the district.
- Farm Composition: On average, each farm had 4.0 animals, including lactating cows, lactating buffaloes, replacement cows, replacement buffaloes, retired cows, retired buffaloes, and oxen.

#### Greenhouse Gas Emissions:

- The emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) were assessed.
- These emissions were allocated to fat- and protein-corrected milk (FPCM) based on mass balance, price, and digestibility.
- Cattle contributed:
  - CO<sub>2</sub>: 11.0%
  - CH<sub>4</sub>: 75.4%
  - N<sub>2</sub>O: 13.6% to the total greenhouse gas (GHG) emissions.
- Buffalo emissions:
  - CO<sub>2</sub>: 8.2%
  - CH<sub>4</sub>: 80.5%
  - N<sub>2</sub>O: 11.3% to the total GHG emissions.

### Carbon Footprint (CF)

#### Cow Milk

- On a mass basis: 2.3 kg CO<sub>2</sub>-eq/kg FPCM.
- Economic basis: 1.9 kg CO<sub>2</sub>-eq/kg FPCM.
- Digestibility basis: 2.0 kg CO<sub>2</sub>-eq/kg FPCM.

#### Buffalo Milk

- On a mass basis: 3.0 kg CO<sub>2</sub>-eq/kg FPCM.
- Economic basis: 2.5 kg CO<sub>2</sub>-eq/kg FPCM.
- Digestibility basis: 2.7 kg CO<sub>2</sub>-eq/kg FPCM.

#### Retired Animals:

- Emissions from retired cows (>10 years old and no longer producing milk) were 1571.3 kg CO<sub>2</sub>-eq/retirement year.
- Emissions from retired buffaloes were 2556.1 kg CO<sub>2</sub>-eq/retirement year.

#### Overall Impact

- The average CF of milk production under the smallholder dairy system in Anand district was 2.2 kg CO<sub>2</sub>-eq/kg FPCM.
- When considering milk, manure, finance, and insurance as economic functions, the CF reduced to 1.7 kg CO<sub>2</sub>-eq/kg FPCM.
- Remarkably, this CF was lower by 65% for cow milk and 22% for buffalo milk compared to estimates for southern Asia by the Food and Agriculture Organisation (FAO).

This study sheds light on the environmental implications of milk production in smallholder dairy systems, emphasizing the need for sustainable practices.

### Strategies to Minimize the Environmental Impact of Milk Production for Indian Dairy Farms

Indian dairy farms face unique challenges in reducing their carbon footprint while ensuring sustainable and efficient milk production. Here are tailored suggestions to minimize environmental impact and promote sustainability within the Indian dairy sector:

#### Enhancing Feed Quality

Improving the quality of animal feed is a crucial step towards reducing emissions. Incorporate high-quality options such as legumes and pasture into



the feed mix. This not only enhances the nutrition for cows but also reduces methane emissions by up to 30% while increasing overall productivity.

### Exploring Innovative Feed Alternatives

Consider exploring novel feed alternatives such as seaweed. Seaweed has shown promising results in mitigating methane emissions in cattle when added to their diet. This innovative approach can contribute significantly to reducing greenhouse gas emissions from dairy operations.

### Implementing Renewable Energy Solutions

Introduce biogas digesters on farms to convert animal waste into biogas. This renewable energy source can be used for cooking and heating, reducing methane emissions from animal waste and decreasing reliance on fossil fuels. Additionally, utilize solar panels and wind turbines to generate clean and sustainable energy for farm activities, further reducing greenhouse gas emissions.

### Promoting Sustainable Milk Procurement

Advocate for the adoption of sustainable energy sources for milk chilling and storage facilities. This reduces emissions during milk procurement operations. Furthermore, encourage local milk procurement and invest in eco-friendly transportation options to minimize emissions throughout the milk supply chain.

### Adopting Sustainable Agricultural Practices

Promote sustainable agricultural methods such as agroforestry and conservation agriculture among smallholder farmers. These practices enhance soil health, decrease the need for chemical fertilizers, and mitigate erosion. Providing incentives, training, and access to environmentally friendly technologies can facilitate the adoption of these sustainable practices.

By implementing these strategies, Indian dairy farms can effectively reduce their carbon footprint, promote environmental sustainability, and contribute to the long-term resilience of the dairy sector. These measures not only benefit the environment but also

enhance the economic viability of dairy farming operations.

### Advancing Sustainability in the Dairy Sector

The pursuit of a carbon-neutral milk future is not merely an ambitious objective, but an imperative requirement for the long-term viability of our planet and the dairy sector. Dairy farms around the world are making substantial efforts to decrease their environmental impact by assessing carbon footprints, adopting cutting-edge technologies, and implementing sustainable farming methods.

In India, a country where dairy farming is of great economic and cultural importance, the obstacles of adopting carbon-neutral techniques are being tackled with resolute determination and innovative approaches. Indian dairy farms are leading the way towards a more environmentally friendly future by conducting studies to measure carbon footprints, identify areas with high emissions, and suggest specific remedies.

In order to achieve carbon neutrality in the dairy industry, it is necessary to focus on several key actions: enhancing the quality of feed, transitioning to renewable energy sources, minimizing emissions during milk procurement, and encouraging the use of sustainable agricultural methods. These measures not only decrease the amount of carbon emitted by dairy operations but also improve production, soil health, and economic sustainability for farmers.

Consumers contribute significantly to environmental efforts by selecting carbon-neutral milk. Each acquisition of carbon-neutral dairy products constitutes a choice in favor of a more robust ecosystem and a future that is capable of being maintained for future generations.

The dairy industry's dedication to achieving carbon neutrality is not merely a passing trend, but rather a crucial progression towards a more environmentally friendly and sustainable global ecosystem. Let us toast with a glass of carbon-neutral milk to commemorate the progress achieved and the exciting future that lies ahead for both our dairy sector and the world.

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