Transform to Net Zero

The role of manure management in supporting net zero goals in the dairy sector

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This document has been prepared by the Dairy Subgroup of Transform to Net Zero, a cross-sector initiative to accelerate the transition to a net zero global economy. To accelerate net zero action, Transform to Net Zero member companies are sharing learnings from their own business transformation journeys to support other companies to transform to net zero.

The document is intended to provide an overview of the role of manure management in achieving net zero goals in the dairy sector. It discusses why addressing methane emissions from manure is important to reduce greenhouse gas (GHG) emissions from the dairy sector and how methane fits into ambitious net zero goals. It presents strategies for how companies across the livestock supply chain can meet methane reduction targets by accelerating the use of existing manure management technologies to immediately reduce methane, with a focus on Anaerobic Digesters (AD) given the availability of options to finance the technology. The document outlines the role of ADs in manure management, the challenges to scaling adoption, including financial, regulatory, GHG accounting, reporting and claiming, and possible paths forward. Given particular challenges within the US agricultural sector to address this issue, the analysis is bound in geographic scope to the US.

Net Zero Definitions

Net zero: The UNFCCC defines net zero as "a point in time (typically around 2050) when no further GHGs are being added to the atmosphere through human activities beyond what can be removed by human interventions." [1] Most businesses set goals for all GHG reductions in CO_2 equivalent, which can undervalue the need for addressing short-term GHGs like methane. The standard accounting method used for net zero emissions does not include the benefits of early action on methane. [2]

Net zero for agriculture: Considering methane emissions cannot go to zero, for the agriculture sector, CO_2 emissions should go to zero and methane emissions should be significantly reduced. Early action on methane for the agriculture sector is one of the most effective strategies to slow near-term warming.

[1] Paris Agreement to the United Nations Framework Convention on Climate Change, T.I.A.S. No. 16–1104. (2015)

[2] Path to net zero is critical to climate outcome

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Executive Summary

Methane is a potent greenhouse gas, and significantly reducing methane emissions is key to meeting the goals of the Paris Agreement. Urgent action from both the private and public sector on methane is needed now to avoid the most catastrophic effects of climate change. While methane cannot be fully eliminated, there are substantial benefits to companies committing to reduce agricultural methane emissions by 20-25% by 2030. [3]

Improving agricultural practices is key to reducing methane emissions. In the US, the livestock sector is responsible for about one-third of methane emissions,[4] where dairy manure is the largest source of methane from livestock manure management.[5] Companies in the dairy supply chain must address this source of GHG emissions in order to meet net zero targets.

There are existing opportunities for intervention in the dairy supply chain that can significantly reduce methane emissions and produce renewable energy. Accelerating adoption of existing manure management technologies is an immediate step companies can take. While there are many manure management systems available, this paper will focus on Anaerobic Digesters (AD) given the various economic and environmental co-benefits that can be achieved through their implementation. However, it is important to note that ADs are not suited for all farms yet. ADs are large capital expenditure projects that require significant resources and infrastructure investments. Successful implementation involves extensive collaboration among all parties involved, including corporate buyers, farmers and surrounding communities. Each farm is unique and may require a different type of manure management program suited to its needs and conditions.

While there is general consensus among companies in the dairy and agricultural industry on the need to mitigate manure methane, the cost of ADs as manure management systems makes it financially challenging for companies to embed these practices in their climate and net zero strategies. Sharing the investment in ADs across various actors can reduce the financial burden on dairy farms and companies of initiating a project.

This paper presents two primary models to fund AD infrastructure in the US.

1. **Scope 3 Stacking:** a brand and other partners operating in the same value chain share the financing for an AD and can stack Scope 3 reduction claims. Through carbon insetting, companies can claim carbon reductions proportional to their investment in the AD. Within this model, companies can either split or share reductions.

2. **RNG and Methane Mitigation:** companies in the same value chain identify common geographic areas and do aggregate purchasing of RNG or RECs (renewable energy certificates). Companies can engage and therefore claim carbon reductions through three pathways: i) buy RNG and receive the associated RECs, claiming the avoided methane benefits; ii) provide organic material (i.e., food waste) to farms with ADs and claim reductions from diverting food waste; iii) replace fossil fertilizer with fertilizer produced by ADs and obtain associated carbon reductions. There are less “overlapping” carbon claims as the RECs are not sharable and will need to be divided among companies in the same agreement.

Carbon credits provide an important source of financing for ADs. However, under current GHG accounting frameworks, companies cannot count the emission reduction toward their own reduction goal if the credits are sold to an entity outside the value chain. This creates a financial barrier for dairy companies investing in scaling manure management

[3] Benefits and costs of mitigating methane emissions

[4] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019 – Main Text - Corrected Per Corrigenda

[5] Anaerobic Digestion on Dairy Farms

technologies within their own value chain. There is an urgent need for initiatives working on carbon accounting and reporting for Agriculture, Forestry, and Other Land Use sectors (AFOLU), including SustainCERT, SBTi, GHG Protocol, and others, to define clear guidelines on how to do carbon credit sharing within the same value chain, and how to manage chain of custody for the emission reduction to enable fair reporting and claiming.

> Dairy companies should continue to engage their supply chain to reduce methane emissions and transparently report what they are doing as the guidance is clarified.

This paper presents several paths forward for companies to act now to reduce manure methane emissions from the dairy sector, while also presenting suggestions to address the existing financial challenges to ensure that the right incentives are in place for companies to continue scaling manure management technologies and practices to help decarbonize the dairy value chain.

Finally, any manure management plan needs to fully consider local impacts to the surrounding community. A robust manure management plan should include the input and engagement from the surrounding community and look beyond just climate impacts. The community benefits derived from inclusive and robust manure management initiatives include improved water and air quality, opportunities for employment, and the creation of a learning laboratory for communities proximal to livestock facilities that have been systematically and disproportionately disadvantaged by associated environmental impacts of these. Projects need to have community engagement from beginning to end, and the benefits need to be realized by the community, not just expected.

Introduction

In recent years, methane has received growing attention due to its potent greenhouse gas effect. Methane has more than 80 times the warming power of CO_2 over the first 20 years after it reaches the atmosphere.[6] Taking action now to significantly reduce methane emissions is critical to help slow the rate of warming over the next couple of decades as well as contributing to achieving the 1.5°C target in alignment with the Paris Agreement.

This paper will discuss the role of manure management in the US dairy sector in reaching methane targets and corporate net zero commitments. While agricultural methane emissions cannot go to zero, there are substantial benefits to companies committing to reduce agricultural methane emissions by 20-25% by 2030.[7]

There are existing opportunities in manure management that dairy companies and farms can take today to significantly reduce methane emissions. Accelerating improvements in manure management through existing technologies is an immediate step companies can take to reduce methane emissions in their supply chains and contribute to overall net zero commitments.

While there are existing technologies available to reduce dairy sector methane emissions, these projects require significant capital investments from companies across the dairy value chain. The lack of financing mechanisms for these projects and unclear guidelines on carbon accounting for methane reductions across the dairy sector present consequential barriers to wide scale adoption of advanced manure management systems.

[6] Methane: A crucial opportunity in the climate fight

[7] Benefits and costs of mitigating methane emissions

Role of dairy manure management in methane mitigation

Cutting methane emissions is the most effective way the US (and the rest of the world) can slow the rate of global warming over the next few decades and help avoid the most damaging short-term impacts of climate change. In the US, the livestock sector is responsible for about one-third of methane emissions.[8] Dairy manure is the largest source of methane from livestock manure management.[9] The biggest GHG hotspots in the dairy value chain are at farm level and arise from manure management and enteric fermentation.

> The quantity of methane produced during manure management depends on whether it is occurring in a 'liquid' or 'dry' manure management system.*[10]

Accelerating improvements in manure management through existing technologies is an immediate step companies can take to reduce methane emissions in their supply chains and contribute to overall net zero commitments. However, improving upon current manure management projects requires capital investment and involves significant infrastructural changes, as well as extensive collaboration among all parties involved.

Enteric fermentation, the digestive process that occurs in ruminant animals, also produces methane. It is primarily addressed through animal health/nutrition/breeding and/or feed additives. However, the effectiveness of feed additives in mitigating enteric methane and delivering co-benefits of increased production is still being researched.[11] These will therefore not be covered in this paper.

Given the existing methods of manure management which can reduce methane emissions and given the potency of methane as a greenhouse gas, addressing dairy manure management is of vital importance. While there is general consensus among companies in the dairy and agricultural industry of the need to mitigate manure methane, the cost of enhanced manure management systems makes it a financial challenge for companies to embed these practices in their climate and net zero strategies. Companies must also recognize that not all farms are willing to adopt new manure management practices, particularly those with complicated operational requirements.

[8] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019 – Main Text - Corrected Per Corrigenda

[9] Anaerobic Digestion on Dairy Farms

[10] *It is important to note that manure management also produces nitrous oxide emissions, another greenhouse gas, either directly through release from the soil after manure application or indirectly through the deposition of volatilized nitrogen gasses, runoff, and leaching of nitrogen into soils and water bodies. Over-application of manure relative to crop nitrogen needs can lead to very high rates of nitrous oxide emissions and should be avoided in manure management plans. Manure management planning must take a holistic approach to understanding all environmental impacts, including on water and air quality, as well as how these relate to social challenges. Environmental justice concerns should be at the forefront of any system.

[11] An Evaluation of evidence for efficacy and applicability of methane inhibiting feed additives for livestock

Manure management systems / GHG emissions reductions opportunities

There are a variety of manure management systems currently available. These systems range in size, infrastructure, cost, and other aspects, and not all systems will be well suited for all farms. Each farm is unique and will require a different intervention depending on their production capacity, farmer interest and need, climate, policy landscape, water quality, land access, and siting restrictions, among other considerations. For example, smaller farms have fewer options available due to requirements for existing technologies, animal housing setups, costs, etc. Housing and herd management are additional determinants for which manure management options are feasible, depending on whether it is an open lot or free stall set up. Additionally, it is important to consider local communities when designing manure management systems.

Manure management systems can generally be broadly categorized into those that avoid methane generation and those that generate and capture methane. A few commonly used manure treatment systems that avoid methane include Solid-Liquid Separators (SLS), composters, and forced aeration composting. The USDA and NRCS provide more information on each of these practices.[12] Manure management systems are either 'liquid' (also referred to as "slurry") or 'dry'. Dry systems include solid storage, dry feedlots, deep pit stacks, daily spreading of manure, and unmanaged manure. Liquid systems involve storing manure in tanks and lagoons until it is applied to cropland. Liquid systems incur significant biogas production.[13]

Methane-capture interventions involve capturing the biogas emitted and either flaring it or using it to create energy, either in the form of renewable natural gas (RNG) or combined heat and power (CHP). These primarily include lagoon covers and anaerobic digesters (AD). These systems are large manure management infrastructure projects that allow for micro-organisms to break down biodegradable material in the absence of oxygen, producing biogas and digestate.

Both covered lagoons and ADs capture methane which can be used to produce electricity, heat, vehicle fuel, bioplastics, and renewable natural gas (RNG). The digestate can be used for horticulture products, organic fertilizer, animal bedding, crop irrigation, and other products.[14] ADs and covered lagoons provide multiple benefits by reducing methane emissions, reducing odor and ammonia emissions, providing economic benefits to the parties involved in the form of energy and compost production, and producing carbon reduction credits.

1. **Lagoon covers** are less complex systems to install but retrofitting an open lagoon to a covered lagoon requires significant infrastructure changes, including extensive piping infrastructure. Typically, a second lagoon would be needed for storage if not already present on the farm.

2. **Anaerobic Digesters (AD)** provide improved management relative to a covered lagoon. These can be expanded to include other organic waste streams.

There are significant challenges to adoption of ADs. The technology is costly and requires technical expertise to operate. The price of the installation and equipment can range from $500,000 to $15 million depending on size and capacity.

[12] Manure Management, USDA National Agricultural Library
[13] CH_4 and N_2O Emissions from livestock manure
[14] How does Anaerobic Digestion Work?

Some farms consider including other organic waste streams in ADs as this can increase methane output. It is important to note that the mixture of other waste streams reduces Low Carbon Fuel Standards (LCFS) payments.[15] All manure ADs produce RNG, rated as a D3 gas, which is of higher quality, has a higher carbon reduction, and is more expensive ($90/btu), as it earns a higher price from incentive programs such as LCFS. Biogas produced from all manure systems can also be used for on-farm electric generation and possible net metering. eRINs, which are similar to RECs and are from electricity generation from methane, are also being discussed and could increase the incentive for electric generation.[16,17]

AD with mixed manure and organic waste feedstocks produce either CHP or RNG rated as D5 which has a lower carbon reduction and lower price ($25/btu) but can be produced on small/medium farms and with non-dairy partners.

There can be biosafety issues depending on the waste source, and certain waste streams can increase the ammonia concentration in the digestate and hence the amount of land required for application. Alternatively, this could offset purchase of inorganic farm fertilizer if used on the farm.

If the LCFS market gets saturated as more companies take advantage of this program, the payment rate will drop and thus reduce the program's ability to provide substantial financing support. The LCFS is also designed to decrease its cap over time, thus reducing the demand for low carbon fuel standards. The lack of a comparable national policy further jeopardizes the potential of this program to support mounting supply. As more states develop programs similar to the LCFS system in California, it could help stabilize these markets.

While ADs provide a variety of co-benefits, they are not always the best solution for all situations. Studies have found that Solid-Liquid Separation alone can achieve significant GHG emissions reductions sometimes greater than ADs. [18]

Manure Management and Environmental Justice

Community engagement is essential during the development and implementation of manure management initiatives to ensure an equitable distribution of benefits and to avoid perpetrating existing environmental injustices. No intervention should just focus on climate.

There are a variety of localized impacts associated with the dairy value chain beyond just effects on climate. Livestock production affects water quality, pollution, and odor, among others. This environmental degradation often disproportionately impacts low income and communities of color, who tend to live in closer proximity to livestock farms. Engaging affected communities in the selection, development, and implementation of solutions must be a business imperative so that manure intervention initiatives align with community needs.

[15] The Low Carbon Fuel Standard (LCFS) is a California state program designed to cut GHG emissions associated with transportation. Through the program, the state purchases and provides low carbon and renewable alternatives to fuel, reducing petroleum dependency and improving air quality. As of today, the LCFS is the main financial mechanism driving adoption of ADs on dairy farms in the US.

[16] Introducing the RFS Power Coalition

[17] Senators urge EPA to process eRIN applications

[18] Anaerobic digestion, solid liquid separation, and drying of dairy manure: Measuring constituents and modeling emission

Finance and carbon claiming as main barriers to manure management

Manure management projects can range greatly in scope and scale. Financing manure management technologies can be expensive and require significant investments. Currently, energy and integrated livestock companies have been able to address some of the financial challenges regarding manure management using ADs because they are able to take advantage of California's LCFS incentives, which provides credits for low carbon fuel production based on the fuel types Carbon Intensity (CI) score. Dairy generated biogas has the lowest CI score (and therefore highest price) listed by LCFS. However, the current LCFS program greatly favors large animal operations. Small and medium dairy farms have a less favorable return-on-investment (ROI) for methane capture manure management technologies, such that their dairy company partners do not incur the same level of financial benefits from the LCFS program as large dairy farm partners do. Nevertheless, large farms still face significant challenges in financing ADs without support from the LCFS program.

Sharing these investments across various actors can help reduce the financial burden of initiating and maintaining a project. However, the current discrepancies in methodologies for both quantifying and accounting for methane emissions reductions from manure management make it difficult to authentically report GHG emissions reductions and communicate and compare between companies on these. Unlocking questions around carbon reporting and claiming will help unlock additional financing opportunities for manure management practices.

By illustrating these challenges, this document hopes to contribute to discussions on GHG reporting and claims in the AFOLU sector, notably those around manure management.

The SBTi and GHG Protocol guidelines for FLAG (Forest, Land, and Agriculture) sectors are still being finalized. Near- and long-term pathways, with supporting guidance documents, are expected to be finalized by March 2022 and by the end of 2022, respectively.[19,20] The lack of available standards, methods, and data for the FLAG sector are a key barrier to setting and pursuing emission reduction targets (i.e., if multiple parties are involved in GHG reduction projects, how should the carbon reduction claims be shared among them?)

> There is an opportunity to contribute to these discussions and to the development of reporting standards and carbon crediting. These discussions are increasingly relevant as competition for carbon credits from manure digesters between companies in the consumer packaged goods and energy industries increases.

[19] SBTi Corporate Net-Zero Standard

[20] Land Sector and Removals Guidance

Current Barriers

FINANCIAL

While larger farms can access funding from investors (e.g., private equity firms) and are able to achieve higher efficiency, small and medium farms currently do not have viable financing mechanisms for such systems. Most farmers already have an operating loan, reducing their willingness to take on additional credit to finance these systems themselves. Ongoing maintenance and operation of the AD equipment incurs additional long-term costs. Moreover, there are limited financing opportunities for other manure improvement technologies beyond ADs.

TECHNOLOGY

Anaerobic digester systems require complicated operation and maintenance.

SOCIAL AND CULTURAL

» **Lack of knowledge/technical support:** Farms lack familiarity with equipment, particularly ADs, and do not want the responsibility of operation and maintenance. There is limited training and support for farmers to operate new equipment, which can be complicated.

» **Lack of interest:** There is hesitancy among farmers to adopt manure management practices. Farmers may not be interested in changing their behavior when they are used to specific ways of doing things, and they may lack incentives to invest in new equipment or other measures to reduce emissions. Farmers dedicate most of their time to the dairy production process and do not have capacity to adopt complex manure management as additional responsibility.

» **Information overload and confusion:** Farmers are being approached from many angles to adopt these practices. Farmers may be more willing to trust companies or brands they have a direct relationship with over external parties such as Venture Capital firms or utility companies who are approaching them with AD projects.

» **Community pushback:** It is important to get wide community buy-in for these products. A lack of community engagement could lead to community pushback to a manure management system.

POLICY

There is a spectrum of regulatory barriers resulting in a lack of incentives for farmers to adopt more sustainable practices. State and federal government applications for grants and assistance programs can be complicated and require extensive paperwork, discouraging farmers from applying. Federal and state investments and policies to encourage methane capture on dairy farms would incentivize corporate investment in advanced manure management technologies.

CARBON ACCOUNTING AND CLAIMING

Supply chain companies can make a significant impact in reducing methane emissions from their value chain by investing in advanced manure management technologies on farms. The opportunity to claim reductions from these investments offers an additional and important incentive for dairy companies to engage. Carbon credits provide an important source of financing for certain manure solutions such as ADs. However, under current GHG accounting frameworks, companies cannot count the emission reduction in their own accounting if the credits are sold to an entity outside the value chain. This creates a barrier for companies to invest in large capital investment projects such as ADs at scale. Resolving the carbon crediting issue can help unlock significant financing for advanced manure management technologies on farms, such as ADs.

Developing a national registry of carbon credits for the AFOLU sector is needed in order to avoid double counting of carbon credits. This registry would help to address two current issues: i) carbon credits sold outside the supply chain are not also being claimed as reductions from companies in the supply chain, and ii) companies inside a value chain can share the same reduction claims without double counting. The registry would allow for tracking of credits to ensure companies do not seek carbon credits for reductions that are reported in their Scope 3 inventory, and that companies do not make offsetting claims for reductions being reported by another company. However, this kind of national registry is still far away for the AFOLU sector. The lack of a regulatory body to standardize carbon accounting and claiming presents an additional barrier to addressing this challenge.

Available financing mechanisms

Currently, there are two primary models prevalent in the US to fund ADs, which were identified based on conversations with experts in the field.

DEVELOPER FUNDED/PPA

The company owns the AD asset and pays the farmer a fee for manure and land lease, and either the company or the developer owns the maintenance. The developer provides upfront financing and in turn receives most of the revenue. Farmers receive a small part of the revenue but receive other benefits including a fee for the manure and a fee for land lease. The model can either follow the RNG or electricity generation pathway.

- **RNG Pathway:** The utility companies buy the RNG, and municipalities/companies provide food/organic waste. The model can also involve others interested in the benefits of the digester who are willing to pay for land use. Currently, the RNG credits are usually sold to the LCFS market in California. The size of the incentives is significant. For example, from August – November 2021, the price ($)/MT fluctuated between $142.50 and $183 depending on supply and demand.[21] This model can involve retailers (i.e., Amazon, Wal-Mart) who would purchase the avoided emissions from the LCFS, while the dairy company can obtain a GHG emissions reduction from replacement of fossil-fertilizer with digestate.

  It is important to note that the gas must be processed and transported via pipelines. Pipeline injection requires an interconnecting fee to connect to the pipeline, which can be significant. It is challenging for farms that are not proximal to existing pipeline infrastructure to participate.

- **Electricity Pathway:** The farm, developer, and company partner to finance the system, typically with upfront contributions from the company and developer, with layered incentive payments to farmers to keep the systems running. The developer handles the electricity generation and sale. The farmer obtains benefits of the manure produced and possible heat generation or lower electricity rate. Either the company or developer are responsible for the labor and maintenance of the equipment. Municipalities and companies can also contribute food and organic waste.

  In this model, there are two streams for carbon credit claiming: i) avoided methane produced from the lagoon qualifies as a carbon credit or Scope 3 reduction; ii) renewable energy generation creates RECs that can be sold to the RPS market or bought by the company.

PARTICIPATORY/JOINT VENTURES

This model comprises equity-partners in a new business venture between farmers and various groups. The business investor is responsible for the building and maintaining the AD technology, while farmers are usually asked to provide labor to operate the equipment. Equipment maintenance can either be the responsibility of the venture or farmer, depending on the agreement. For example, the company is a partner in a new business and is responsible for bringing capital to the project to pay for new investments. There is also an opportunity for any party to participate in this model, including those outside of the value chain. Within this model all equity partners incur both risks and benefits from the project. Notably, a key distinction in this model is that farmers can hold a significant amount of equity in the project and therefore also incur risk. Currently, the carbon reduction sharing in this model remains unclear but is likely shared among farmers and business partners.

Farmers should be diligent in fully understanding these partnership agreements, and the risks and benefits to each party involved.

[21] November 2021 - Clean Fuels Market Update

Table 1. Overview of federal and state funding opportunities (not including LCFS).

Program	Description
USDA Rural Energy for America Program (REAP)[22]	Provides guaranteed loan financing and grant funding to agricultural producers for renewable energy systems or to make energy efficiency improvements, including new system loans for agricultural production and processing. Renewable energy systems covered include anaerobic digesters.
USDA NRCS EQIP (Environmental Quality Incentives Program)[23]	Provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits, including cleaner air and water. The program includes support for systems that improve livestock waste management. 1. I.e., cost-share program where a farm operator purchases and constructs the digester and applies for federal funding after project completion. 2. The farmer is in charge of the operation and maintenance of the AD.
Biofuel Producer Program[24]	Payments to US based producers of biofuel, biomass-based diesel, or renewable fuel to offset unexpected market losses as a result of the COVID-19 pandemic.
Loan guarantees[25]	Federal agency guarantees a full loan repayment to lower the cost of financing a digester, allowing the project to attract a larger number of potential lenders since they are guaranteed repayment, even if the digester operator defaults on the loan.
Industrial Revenue Bond[26]	Government issues bonds to raise funds for digester, where the state or local entity owns the asset for the length of the bond. These loans have lower interest rates and can incur property tax relief to farm operators. The farm operator must repay the loan and will receive ownership of the asset in return. The farmer is responsible for the operation and management.
Regional Conservation Partnership Program (RCPP)[27]	GNRCS co-invests with partners to implement projects that address conservation challenges. ADs can sometimes be included in the program depending on state policies year-to-year.
Conservation Innovation Grants (CIG)[28]	The program that supports the development of innovative new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Projects improve agricultural operations while addressing water quality, air quality, soil health, and/or wildlife habitat challenges.

[22] Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants
[23] Environmental Quality Incentives Program
[24] Biofuel Producer Program
[25] Funding On-Farm Anaerobic Digestion
[26] Funding On-Farm Anaerobic Digestion
[27] Regional Conservation Partnership Program
[28] Conservation Innovation Grants

Paths Forward

The following two models, developed in conjunction with experts in the field and companies in the dairy value chain, show great promise in helping to scale manure management practices and reduce methane emissions. While both of these pathways are viable today, both would benefit from clearer accounting standards for carbon claiming for AFOLU sectors.

1. **Scope 3 Stacking:** In this model, a brand and other partners operating in the same value chain can enter a partnership to share the financing for an AD and then split the carbon reduction claims. This model uses carbon insetting, where the project is wholly or partially contained within a Scope 3 supply chain boundary to allow companies to claim carbon reductions proportional to their investment in the GHG reducing project. It relies on a vertical relationship between entities within the same value chain and allows multiple entities to leverage each of their abilities to support the financial burden of the project. The carbon reduction needs to be kept within the value chain and cannot be sold outside as carbon credits. In this model, companies split the reductions. For companies to share the reductions, as described in the SAFc model below, centralized registry would help to maintain environmental integrity.

2. **RNG and Methane Mitigation:** In this model, companies in the same value chain identify common geographic areas and do aggregate purchasing of RNG or RECs (renewable energy certificates). This model includes both 'all-manure' and 'organic waste' ADs and therefore allows for partnership with non-dairy companies. There are less "overlapping" carbon claims in this model as the RECs are not sharable. There are three ways companies can engage and therefore claim carbon reductions:
   i) Buy RNG from the developer, marketer or large energy companies and the associated RECs, thus claiming the avoided methane benefits – note that the same RECs cannot be shared between two parties.
   ii) Provide organic material (i.e., food waste) to farms with ADs – even if the brand does not sign an agreement to buy the RNG, it may be able to claim reduction from diverting food waste (reduced Scope 3 Category 5 Waste generated in operations). However, companies providing organic waste must be proximal to the AD to avoid incurring both high costs and emissions from transport of the waste. Moreover, the rules are unclear on this model, as these "avoided methane emissions" are also captured in the Green-e certificates. If a company contributes food waste to the AD, it is unlikely they will be able to claim credits because these are already embedded in the RNG. The accounting remains unclear and there needs to be standardization in this space to increase engagement and investment from companies. In the meantime, companies should engage to reduce methane emissions and transparently report what they are doing as the guidance is clarified.
   iii) Replace fossil fertilizer with fertilizer produced by ADs and obtain associated carbon reductions.

   The Green-e certificates discussed in (i) will need to be divided among companies in the same agreement, proportional to their investment in the technology.

The story of Sustainable Aviation Fuels (SAF) provides an example of how a different industry addressed this challenge. SAFs cost 2-5 times more than conventional jet fuel but provide the most viable in-sector decarbonization approach for aviation. SAF certificates (SAFc) allow for cost-sharing across actors in the value chain looking to reduce emissions associated with aviation. The fuel is decoupled from the emissions reduction benefits. SAF producers issue a defined amount of SAFc. Firms purchase the credits and use them towards mitigation efforts. The fuel and credits can thus be sold separately, such that the payments for credits help cover the price premium.

SBTi recognizes SAF as in-sector mitigation options for aircraft operators and their customers. Aircraft operators can use carbon credits for their Scope 1 emissions and customers of aviation services can use them for Scope 3 abatement. While carbon credit double counting is still being resolved, SAFc provides a model that could be replicated in the dairy value chain, with sharing of carbon credits across the value chain.

Conclusion

Reducing methane now is the fastest way to slow global warming in the near term and is a critical part of avoiding the worst consequences of climate change. It's an opportunity we can't afford to miss.

There are existing opportunities for dairy companies to mitigate methane through investments in advanced manure management systems on farms. While there continue to be financial, technical, and cultural barriers that hinder the adoption of proven technologies to reduce emissions, supply chain companies have a critical role to play in addressing these barriers and reducing emissions today.

Reducing agricultural methane emissions is urgent and necessary for meeting climate goals. But addressing methane alone without also addressing localized pollution impacts is not enough. A robust manure management plan should include the input and engagement from the surrounding community and look beyond just climate impacts. The community benefits derived from inclusive and robust manure management initiatives include improved water and air quality, opportunities for employment, and the creation of a learning laboratory for communities proximal to livestock facilities that have been systematically and disproportionately disadvantaged by associated environmental impacts of these. Projects need to have community engagement from beginning to end, and the benefits need to be realized by the community, not just expected.

Companies with dairy value chains should collaborate with their suppliers to evaluate the proper manure management strategies that work for the farm and surrounding community. If an AD is the appropriate choice, implementation will require extensive collaboration among farmers, companies across the supply chain, and technology developers to establish a fair financing and benefit-sharing scheme. Companies will have to continue to advocate for the establishment of formal guidelines on GHG accounting, reporting, and crediting, and should work with policy makers to develop incentive programs that can help scale the adoption of methane reducing manure management technologies.

Glossary of Terms

1. **Carbon credit:** A tradable credit granted to a country, company, etc. for reducing emissions of CO_2 or other GHG by one metric ton.[29]

2. **Carbon insetting:** Describes a project contained within a Scope 3 supply chain boundary of a company, a project partially within Scope 3 supply chain boundary (spanning their supply chain and other companies' supply chains), and a project adjacent to a supply chain boundary.[30]

3. **Carbon offset:** Reducing GHG emissions (including through avoided emissions), or increasing GHG removals through activities external to an actor, in order to compensate for GHG emissions, such that an actor's net contribution to global emissions is reduced. Offsetting is typically arranged through a marketplace for carbon credits or other exchange mechanisms. Offsetting claims are only valid under a rigorous set of conditions, including that the reductions/removals involved are additional, not over-estimated, and exclusively claimed. Further, offsetting can only be used to claim net zero status to the extent it is "like for like" with any residual emissions.[31]

[29] Definition of carbon credit

[30] SBTI Corporate Net-Zero Standard

[31] Race to Zero Lexicon

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