

A Practical Guide for Including Agricultural Methane Emission Reduction Targets in Nationally Determined Contributions



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2. Introduction

The first global stocktake (GST) of the Paris Agreement in 2023 affirmed that the world is not on track to limit global warming to 1.5°C, and the window for meaningful change is quickly closing. The outcome text from the GST recognised the need to substantially reduce methane emissions by 2030.

The Global Methane Pledge estimates that methane emissions from agriculture need to be reduced by 20-25% below 2020 levels by 2030¹. Yet, without serious reduction efforts, the UNEP² expects agricultural methane emissions to rise by 16% over 2020 levels by 2030, principally due to increasing global livestock numbers.

The case for action on methane is clear. Methane abatement is essential for achieving climate goals, with actionable measures that can reduce emissions, while supporting yields and farmers' incomes. The Global Methane Assessment (GMA) states that methane emissions can be reduced by 45% (30Mt/year) by 2030³. The GMA estimates that methane emissions from rice cultivation can be reduced by 6–9 Mt/year, whereas methane emissions from livestock could be reduced from anywhere between 4–42Mt/year³, depending on the uptake and type of mitigation actions.

Furthermore, action to abate methane emissions also brings multiple socio-economic and adaptation co-benefits, ranging from improved air quality to enhanced resilience of agricultural systems.

Addressing the mitigation of methane emissions from the livestock and rice cultivation sectors in countries' Nationally Determined Contributions (NDCs) 3.0 through establishing clear, methane-specific targets and measures, presents an opportunity for countries to raise ambition and enable implementation. This guidance document provides practical support to help countries increase their livestock and rice methane mitigation ambition.

The [NDC 3.0 Navigator](#) developed by the NDC Partnership and UNFCCC, is an interactive tool that supports the development of NDCs to be submitted in 2025.

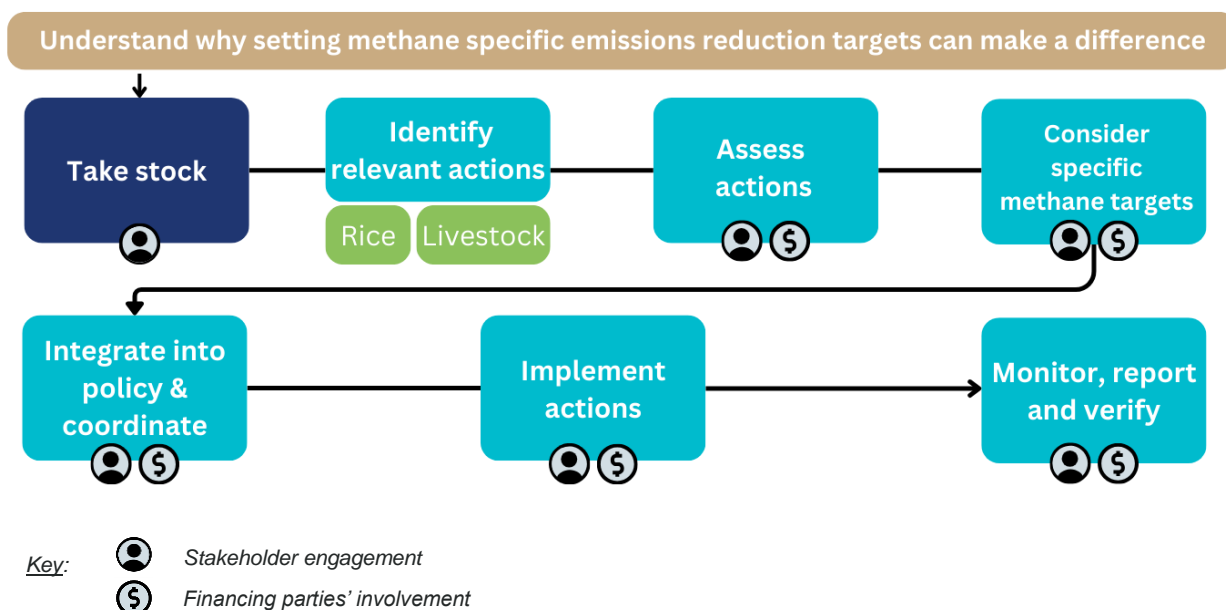


Figure 1. An overview of the steps to include methane reduction targets in NDCs 3.0

What is this guidance for?

This guidance has been developed with the support of the Reducing Agricultural Methane Programme (RAMP). RAMP, led by IFAD, supports smallholder farmers to lower methane emissions from agricultural activities. This document is destined primarily for those countries seeking support to integrate agricultural methane mitigation measures and/or specific targets into their NDC 3.0 to be submitted in 2025. A longer version of this document, with more detailed information, case studies and examples will be published in early 2025.

3. Why does investing in reducing agricultural methane matter?

3.1 Reducing methane emissions makes a difference

Methane abatement is one of the most effective climate mitigation investments available. Methane is a potent greenhouse gas (GHG), with a Global Warming Potential (GWP) of 28 (over 100 years)⁴. This means that it holds 28 times more heat than carbon dioxide. However, methane is a short-lived climate pollutant with an atmospheric lifetime of around 12 years⁵. Because of this, taking action to reduce methane can lead to 'quick-wins'. For example, if total methane emissions were reduced by 30% by 2030, it could reduce warming by at least 0.2°C between 2040 and 2070⁶. Therefore, reducing, or even keeping to current levels, will have an important climate impact. In 2021-22, the livestock sector received 2.90 billion USD methane abatement finance, while rice paddy abatement received only 10 million USD⁷. To achieve the desired outcome, greater investment will be required to finance these abatements.

3.2 The importance of including Methane emissions in NDCs 3.0

Methane-specific targets have not been a focus of previous NDCs. Only 36% of NDCs in 2021 specified measures that address agricultural methane emissions⁸. Including specific, clearly defined methane reduction actions in NDCs 3.0 is an opportunity to not only demonstrate a progression though raising ambition, but also ensure that methane is viewed as a priority both domestically and internationally to drive implementation of measures. For example, this ensures that methane is given the necessary high-level political focus and prioritisation within a country to support the mainstreaming of methane reduction measures into domestic policies and plans. It also signals priorities internationally to funders and investors, which can help enable implementation of measures.

The business case for reducing methane emissions now is about more than just climate change effect. Global co-benefits include:

- **Reducing tropospheric ozone (methane is a precursor)**⁹. Ozone has negative impacts on human health¹⁰. Reducing methane emissions by 30% below 2020 levels by 2030 could **prevent 255,000 premature deaths annually** and avoid 775,000 asthma-related hospitalisations¹¹.
- Tropospheric ozone is responsible for **the loss of 5-7% of staple crops** annually¹¹. Reducing methane emissions may help **increase crop yields**, countering the reduction in yields expected because of climate change.
- Reducing methane emissions by 30% below 2020 levels by 2030 could **prevent 73 billion hours of lost labour** due to extreme heat. Many of these hours are associated with agricultural workers who are particularly vulnerable as they work outside in all weather conditions.¹¹
- Finance for collaborative measures e.g. manure management technology or residue harvesting equipment will **support resilience** in farming communities and create new business revenue using the **additional outputs**.
- Specifying emission reduction potential from relevant and actionable methane mitigation measures will **catylase funding opportunities** from international funds, as methane mitigation actions can be measured and verified.
- Altering paddy rice practices can **save up to 40% of water use**, reducing the impacts of droughts and breeding grounds for mosquitos with positive human health impacts. Irrigation pumping is also reduced, saving money, energy, and emissions.¹²

4. How to integrate methane reduction aims in the countries NDCs 3.0?

4.1 The Steps

4.1.1 Take stock

NDCs are country led, and all countries have different circumstances and priorities. It is important countries take stock of and evaluate the situation, resources, and progress to date, to determine the relevant

opportunities to integrate methane. This could involve engaging with national GHG inventory focal points, and technical experts in the ministries of agriculture, environment and/or research, alongside organisations such as farmer unions, to understand:

- The significance of livestock and rice production in the country.
- The current state of methane emissions, including key sources and trends. This information is summarised in countries' latest national inventory reports. Having clarity on key sources is important when targeting efforts and directing financing.
- Current uptake and implementation process of (if any) methane mitigation measures.
- The policies relevant to livestock and/or rice production that already exist. For example, those supporting the uptake of mitigation measures by farmers (i.e. subsidies, advisory programmes).

The **outcome** of this step will be an understanding of the methane emission sources and progress to date on mitigation. This will inform the next step: **identifying effective and practical mitigation measures**.

4.1.1 Identifying effective and practical mitigation measures for reducing methane emissions

Once there is an understanding of the national situation, it will be possible to identify the appropriate methane reduction measures that are effective and practical. This section focuses on examples of measures for livestock and rice production. In addition to mitigating climate change, many of these actions can build resilience, supporting adaptation.

4.1.1.1 Mitigating methane from livestock

In most regions of the world, livestock are an integral part of farming, providing food, energy, building materials, clothing, currency, social status and income for millions of people. However, they are also a significant source of global GHGs. Methane is produced through enteric fermentation and from manure management. The split by source and species is shown in Figure 2¹³.

Enteric fermentation is a digestive process which breaks down carbohydrates, releasing methane as a by-product. The amount of methane released is highly dependent on the type of digestive system. Ruminant livestock, such as cattle and sheep, have a rumen which supports fermentation, leading to significant emissions of methane. Non-ruminant livestock, such as pigs, release a much smaller amount of methane. The amount and type of feed also influences emissions. For example, low-quality feed takes a longer time to break down, prolonging the enteric fermentation process and increasing the emissions released.

Methane is also produced during the **storage and treatment of livestock manures** (both dung and urine) under anaerobic conditions (without oxygen). The amount of methane produced depends on the amount of manure produced and how it is managed. When manure is stored as a liquid, for example in a lagoon or tank, it decomposes anaerobically and can lead to significant methane emissions.

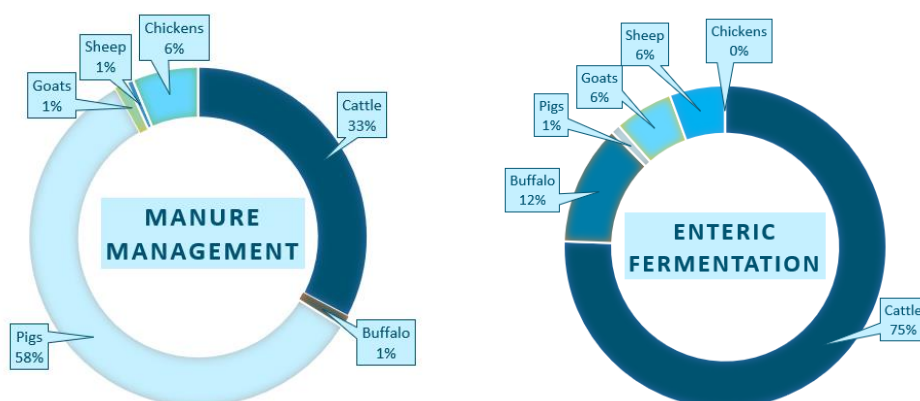


Figure 2. Methane emissions by source and species.

Table 1: Examples of mitigation measures for livestock production

Action	Description	Key benefits	Key challenges
Livestock management			
Reducing disease burdens¹⁴	Healthier stock optimises production reducing the emissions' intensity. Identifying illness early can be supported through accessible veterinary services, community animal health workers, vaccinations, frequent checking of stock, prioritising feet health, providing balanced nutrition etc.	Increased productivity from healthier stock, leading to income benefits and increased food security. Reduced costs for medicines. Improved resilience to stressors.	Farmers may not recognise early signs of illnesses nor have the tools to tackle them early on.
Herd health plan¹⁸	Tracks all aspects of herd health, including disease, access to adequate feed and water and housing. Optimising herd health will reduce emissions.	Increased productivity from healthier stock, leading to income benefits and better food security. Potential for reduced costs on medicines.	Some farmers may not have the tools to track herd health.
Selecting high-performing animals¹⁵	Retaining high-performing animals in the herd will increase output (meat, milk) from the same number of livestock.	Increased income from increased productivity in milk and meat.	Research facilities to better understand genetics may not always be accessible.
Increasing herd fertility¹⁸	By increasing output (offspring) from the same number of livestock, the emissions intensity per unit of product is reduced.	Increased income from increased productivity in milk and meat.	Increasing herd fertility can lead to higher total numbers of livestock which would increase total methane emissions.
Breeding livestock with low methane emissions¹⁶	Identifying individuals in the herd with low-methane traits for breeding leads to cumulative and permanent reductions in methane.	Selecting traits relating to productivity, such as feed efficiency may benefit the overall production of livestock ¹⁷ .	Measuring methane involves costly technology. Traits should be chosen carefully so as to not negatively impact production.
Feeding			
Increase high-quality forage¹⁸	High quality forage such as legumes and nutrient-dense grass can be digested easier, reducing the methane from enteric fermentation.	More digestible feed can lead to healthier livestock, increasing productivity and therefore income for farmers.	High-quality forage might not be available.
Feed additives¹⁸	Some seaweed ¹⁹ , oilseeds ²⁰ and manufactured enzyme inhibitors ²¹ impact the rumen by disrupting the enzyme activity of methanogens	Can reduce methane emissions significantly	May not be available in low-to-middle income countries. Results are highly variable. Increases costs. May not be practical for pastoral systems.
Manure management			
Anaerobic digestion (AD)²²	Breakdown of manures in an anaerobic system to produce biogas and digestate.	Biogas can be used to generate electricity, heat and/or fuel and could improve access to these. Digestate can be applied to land as fertiliser.	AD plants require high capital costs and technical input. Some areas may not have the infrastructure to use biogas/digestate.
Separate solid-liquid manure¹⁸	Mechanical separation reduces the organic material in the liquid element (i.e. main cause of methane during storage).	Liquid and solid components can be managed separately. The liquid could used by an AD plant and solid can be composted creating further product potential.	High capital and operational costs. Infrastructure may not be accessible.
Composting¹⁸	Composting manure is an aerobic process, even more so if heaps are regularly turned.	Reduced odour during storage, free, nutrient rich material to be spread on crops. Surplus can be sold to on.	Composting can be labour intensive and can take weeks to months to complete.
Reduce storage time²³	Storing manures for a shorter period of time, for example, by increasing spreading, will reduce anaerobic decomposition, reducing methane.	Reduces the need to build extra manure storage.	An increase in labour; risk of increased leaching/run-off if nutrients are being over applied; risk of increasing ammonia and nitrous oxide emissions.

4.1.1.2 Mitigating methane from rice production

Rice is a vital crop in many parts of the world and is valuable for its cultural and economic significance. However, it is a significant source of GHGs. It is estimated that rice production is responsible for nearly 50% of total GHGs from croplands²⁴. Methane is produced from **flooded rice fields** due to the anaerobic

decomposition of organic material. Additionally, methane can be produced from **burning rice residues**. Rice straw has a high moisture and cellulose content, thus producing high amounts of methane.

The measures to mitigate methane from rice production relate to how water, crop, and residues are managed. Examples of these are set out in **Error! Reference source not found.2**, along with benefits and challenges.

Table 2: Examples of mitigation measures for rice production

Action	Description	Key benefits	Key challenges
Water management			
Alternate wetting and drying (AWD)²⁵	A cycle of periodic draining and re-flooding, avoiding continuous flooding. Ensures crops have sufficient water when needed. The field is 'conditioned wet' (saturated without flooding) using intermittent irrigation and dries over time.	Reduced water usage, low impact on yield, supports good root anchorage of the plant; reduces pumping costs and fuel consumption in pump irrigation systems; supports soil health ²⁶ .	Control of water supply and drainage is needed; requires information and training.
Dry direct seeding²⁷	Direct seeding of rice into dry soil, rather than puddled transplanting.	Faster planting, saving scarce resources like water and labour ²⁸ .	Variable impacts on yield reported.
Mid-season drainage²⁹	Also called a "single drawdown", involves drainage for 5–10 days during the growing season ²³ .	Reduces ineffective tillers, removes toxic substances, prevents root rot, increases yields, reduces water use.	Additional labour and cost associated with draining paddy fields.
Aerobic rice systems³⁰	A system that grows rice in well-drained, non-puddled and non-saturated soils. Usually established using dry direct seeding.	Reduces water use.	Not suitable for locations with high rainfall & where water cannot be regulated. Increased weed pressure. This method may produce lower crop yields but is suitable for drier climates.
System approach			
System of rice intensification (SRI)³¹	Combines alternate wetting and drying (AWD) irrigation measures with improved soil, nutrient, and plant management practices. Should be tailored to local conditions and combined with a range of agroecological approaches.	SRI reduces costs for irrigation water, seeds, and fertilizers, which can lead to greater profit margins for farmers.	Water control; water access; labour availability; biomass supply; pest and disease control.
Variety Innovation			
Short-duration varieties³²	Improved short duration varieties could be harvested in about 110 to 130 days, compared to traditional varieties that take between 160-200 days to mature.	Increases farmer incomes; improve soil health; more frequently available land for subsequent plantings.	Access to seeds; need for training in new practices; economic implications of switching varieties.
Low emission varieties^{33,34}	Produce less root exudates (organic substances released by the roots that lead to methane) or have a root structure that supports lower rates of methane production.	Certain varieties can increase yield.	
Higher-yielding varieties³⁵	Reduces methane emissions intensity.	Increases productivity, better resistance to stresses; increases farmer income.	
Residue management			
Incorporation of rice straw³⁶	Incorporating rice residue into the soil rather than burning them eliminates emissions from burning. More effective when combined with water-related options like AWD.	Enhances soil fertility, reducing the need for synthetic fertilisers. New demand for machinery can drive innovation and create new markets.	Lack of available machinery and/or fuel.
Mulching³⁷	Crop residues can be mulched and left on the field or incorporated in the soil, before seeding the next crop.	Reduces soil erosion; retains moisture; reduces water use; improves soil structure; reduces weeds; increases soil organic matter.	Some options for straw use rely on its collection and removal from the field, which represents a laborious activity under the typically low levels of mechanization in most rice producing regions.
Composting³⁸	Composting rice straw in an aerobic process, i.e. with regular turning, will reduce methane from storage.	Improves soil health; used as an organic fertiliser. Can create new markets.	

4.1.2 Evaluate actions to create strategies

After understanding the mitigation actions that have the potential to be effective and practical given the national circumstances, the next step is to evaluate and refine them. This involves creating a tailored list of mitigation options to reflect in the NDC 3.0.

Consultations with technical experts are beneficial at this stage, particularly to provide feedback on how realistic implementation of different mitigation actions will be, and providing insights on any infrastructure or other enabling actions that might support uptake of proposed mitigation measures.

Some elements to consider for each mitigation action:

- **The mitigation potential:** Tools such as GLEAM-i can help estimate potential methane reductions. Speaking to agriculture emissions experts, such as those working on the GHG inventory, or undertaking a literature review looking for published, peer-reviewed evidence that states methane mitigation potential can provide this information (see section 4.1.3 and Box 1³⁹).
- **Cost-effectiveness:** Cost-effectiveness and efficiencies are critical factors in the design and selection of mitigation actions. It is important to consider which actions deliver the greatest emissions reductions per unit of cost to optimise financial resources, and ensure long-term sustainability of policy mechanisms that incentivise, encourage, or enforce specific actions. Marginal Abatement Cost Curves⁴⁰ (MACCs) are visual tools to help identify the most cost-effective managerial and technological methane mitigation options.
- **Practicalities and feasibility:** Consider the country's context for rice and livestock production. This includes the climate and capacity of the agricultural sector to implement the measure.
- **Social impacts:** Rice and livestock are important in many cultural traditions. Consider whether changing practices will have negative impacts on social norms, or whether they can be integrated.
- **Co-benefits:** Review what they might be, and whether they align with other national priorities. For example, improving air pollution, reducing water use, supporting biodiversity.
- **Potential pitfalls:** To avoid pollution swapping or "mal-mitigation", it is crucial to evaluate if a mitigation activity for methane may be increasing another GHG or environmental impact. For example, intermittent aeration practices for rice production can increase nitrous oxide emissions⁴¹. Mitigation measures should be selected using a systems approach that considers upstream and downstream emissions of all GHGs, as well as water use, biodiversity, nutrition, rural development, and equity.
- **Alignment with existing policies:** An essential consideration for policies to support mitigation measures is alignment with existing policy frameworks and initiatives. This ensures that inefficiencies do not arise from the introduction of new policies or schemes.

GHG assessment of the Rwanda Dairy Development Project (RDDP) using GLEAM

The RDDP aimed to boost dairy production and rural incomes in Rwanda through climate-smart dairy production, teaching farmers to sustainably produce higher volumes of milk and improve market access.

A GLEAM-i assessment compared two 20-year scenarios: without project (WOP), representing business-as-usual, and with project (WP), reflecting project improvements. Improvements included herd, feed and manure management.

WP saw a 23% rise in total GHG emissions, but a 17% drop in emission intensities due to higher milk productivity. Recommendations included removing low-producing livestock and better feed and crop residue management.

Box 1: Illustration of the use of GLEAM-i for the Rwanda Dairy Development Project.

4.1.3 Consider targets specific to methane

If agriculture from livestock and rice are significant for a country and relevant mitigation measures have been identified and evaluated, then setting methane target(s) to increase ambition in the NDC 3.0 could be considered. To instil confidence in national stakeholders and financing institutions, these targets should aim to be:

- **Implementable:** Consider what is possible regarding practical implementation of mitigation measures. For example, ones

Targets in the NDC 3.0 must build on the last NDC, reflecting the highest possible ambition in line with national circumstances.

requiring technology or investment could take longer to achieve a higher uptake and the desired emission reductions.

- **Evidence-based:** Targets should result from emission modelling, providing data-driven evidence and be based on transparent underlying assumptions. Parties must account for their NDCs in their Biennial transparency reports (BTRs) and demonstrate whether they have achieved any mitigation targets. The NDC and BTR together show if and how a Party is meeting its goals.
- **Reachable:** Good targets (e.g. SMART) must have a timeline, and NDC targets must also state the year by which the target should be reached.

The **NDC 3.0 Navigator** has advice on setting targets.

- **Coherent with global cooperative initiatives** possibly already joined by countries, such as the Global Methane Pledge¹ or the Global Methane Initiative⁴².
- **Trackable:** Indicators should be identified which can be used to track progress against the target. This could be relevant to individual actions, for example, hectares of rice cultivation which aim to have mitigation measures implemented, or number of livestock that are targeted.

Where possible, the quantitative targets should be communicated in physical units (e.g. tonnes) rather than in units of CO₂-equivalents⁴³. It is recommended to make targets SMART (specific, measurable, achievable, relevant, and time-bound), and to identify indicators that to track any progress⁴⁴.

4.1 The People

In addition to the steps outlined about what to do, a key part of integrating methane targets into an NDC is understanding who to involve.

4.1.1 Understanding the structure of the sectors

Mitigation (and adaptation) measures often require behavioural changes from farmers or those involved in the agriculture food chain. Consider looking into the structure of the livestock and rice sectors beyond agricultural production. This might include understanding food prices and the structure of the rural economy, including population, gender breakdown and wages.

It is important to acknowledge this when considering the mitigation actions and methane targets, as ultimately, success will depend on the uptake of mitigation measures by farmers.

4.1.2 Map stakeholders

It is essential to involve internal (individuals or groups within the government entity responsible for developing and implementing the NDCs) and external (individuals or groups who are affected by or have an interest in the NDCs) stakeholders at every step of this process. Stakeholder mapping helps to identify who will be directly or indirectly involved, or affected by policy implementation, to support mitigation measure roll-out.

This could involve consultations with a range of external stakeholders, which can help map the country's production systems and provide an understanding of methane emissions by subsector and region. These mapping exercises are critical to identifying baselines and priority actions to improve agricultural production technologies and practices.⁴⁵

Examples of internal stakeholders

- Agriculture, environment, and finance ministries
- Relevant government agencies associated with environmental, climate, and agricultural affairs
- Agencies or departments associated with reporting
- Relevant departments or institutions that draft NDCs

Examples of external stakeholders

- Producer associations
- National or local farming organisations
- Subsector associations
- Local traditional authorities
- Trade associations and wholesale retailers
- Environmental and climate groups
- Animal rights and welfare groups
- Research centres
- Advisory services
- Technical experts from the private sector

4.1.3 Consider the financing options

Finance is fundamental to translate methane emission reduction ambition into concrete action. Methane abatement finance has one of the highest ratios of global warming benefit per dollar of capital invested, and yet methane abatement solutions are still underfunded considering their climate change mitigation potential⁴⁶. Clearly including methane-specific reduction targets and/or implementable mitigation actions for livestock and rice cultivation in NDCs 3.0 is an opportunity for countries to attract finance and create a pipeline of investment opportunities.

There are some important parameters to consider when considering agriculture methane-specific actions or targets:

- Evaluate the co-benefits and the cost of mitigation action implementation, including the cost of capacity building, human resources, infrastructures, etc.
- Consider different available sources of funding. Some may be more relevant than others depending on the nature of the actions, and the relevant financial instruments or mechanisms required to support their implementation:
 - domestic budgetary support
 - bilateral or multilateral support
 - international financing institutions
 - private sector investment, or public-private partnerships

Uruguay World Bank performance-linked loan based on lowering the methane emissions intensity of beef production

In 2023, Uruguay secured a \$350 million development policy loan from the World Bank. This loan includes a unique interest reduction mechanism tied to Uruguay's success in reducing methane emissions intensity in beef production. As part of the loan terms, Uruguay aims to reduce methane emissions (per unit of beef) by 33% between 2025-2029 and by 36% between 2030-2034 (1% greater than its NDC targets). Uruguay could reduce interest payments up to \$12.5 million if both targets are met.

This 'first-ever performance-linked' loan sets a precedent for integrating financial incentives with climate goals and supports Uruguay's commitment to balancing economic growth with environmental sustainability. The success of this loan could lead to similar financial products for other countries, promoting global public goods and climate action.

Example: Uruguay World Bank performance-linked loan based on lowering the methane emissions intensity of beef production⁴⁷

5. How to mainstream actions and measure success?

Once agricultural methane-specific targets have been considered, it is important to focus on translating them into actionable and enforceable strategies. Countries must also consider transparency, which involves clearly explaining the assumptions and methodologies used in the NDC. Transparency ensures accountability, builds trust among stakeholders and financial partners. Transparency is crucial for verifying that nations are fulfilling their commitments and for identifying areas where additional support or action is needed. These indicators will therefore be key to tracking progress against the target(s).

This section and the steps associated are described in Figure 4 and will be further developed in the longer version of this document.



Figure 3. An overview of the steps to follow on mainstreaming actions and measure success in NDCs 3.0

6. Conclusion

It is crucial to tackle agricultural methane globally: while methane is a potent GHG, it is a short-lived climate pollutant. Taking action by implementing mitigation measures which target methane from enteric fermentation, manure management and rice cultivation can lead to “quick wins”.

This document captures a series of steps countries can follow to help identify the most impactful opportunities for agriculture methane mitigation. Multiple different mitigation measures exist for livestock and rice production, each with varying relevance to different countries.

Setting methane specific targets, based on country appropriate mitigation actions, can help to raise ambition and send important signals to support implementation, such as driving finance. Mitigation (and adaptation) measures often require behavioural changes from farmers, so it is important to understand the agriculture sector more widely than production. Considering the people involved, and ensuring they are adequately engaged, will be an important key to success.

Tackling agricultural methane globally will bring multiple socio-economic and adaptation co-benefits, ranging from improved air quality to enhanced resilience of agricultural systems.

Resources

[**NDC 3.0 Navigator**](#)

The NDC 3.0 Navigator is a tool for the development of NDCs to be submitted in 2025, to support enhanced ambition and accelerate implementation.

[**United Nations Environment Programme \(UNEP\) – Global Methane Assessment \(2022\)**](#)

This report provides a comprehensive review of global methane emissions, including a sectoral breakdown. It highlights agriculture as one of the major sources and offers detailed statistics on methane production from various activities.

[**Intergovernmental Panel on Climate Change \(IPCC\) – Assessment Reports \(2023\)**](#)

The IPCC offers extensive research and data on methane emissions, particularly in its special reports on agriculture, land use, and climate change. It provides methane's Global Warming Potential (GWP) and the role of methane in agriculture.

[**Food and Agriculture Organization \(FAO\) of the United Nations – FAOSTAT Emissions Database**](#)

FAO tracks agricultural emissions globally, including methane emissions from livestock, rice cultivation, and manure management. The FAO's **FAOSTAT** provides country-level data and sectoral breakdowns.

[**Climate & Clean Air Coalition – Guidance on Including Methane in NDCs \(2024\)**](#)

This guidance aims to provide countries with strategies and recommendations for incorporating ambitious and targeted methane mitigation measures into their NDCs to effectively reduce methane emissions and achieve significant climate, health, and economic co-benefits.

[**Initiative for Climate Action Transparency - Stakeholder Participation Guide: Supporting Stakeholder Participation in Design, Implementation and Assessment of Policies and Actions \(2020\)**](#)

With this guidance document, ICAT help users conduct effective stakeholder participation in the assessment of policies by enhancing transparency, collaboration, and the overall credibility of the impact assessments.

[**Climate Policy Initiative - The Landscape of Methane Abatement Finance \(2022\)**](#)

Climate Policy Initiative assess global investments in methane abatement activities for 2019/2020, establishing a baseline for measuring future investment needs and progress in mitigating methane emissions.

References

- ¹ Global Methane Pledge. (n.d.). *Home*. Available at: <https://www.globalmethanepledge.org/> [Accessed 16 Oct. 2024].
- ² United Nations Environment Programme/Climate and Clean Air Coalition (2022). *Global Methane Assessment: 2030 Baseline Report Summary for Policymakers*. Nairobi. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/41108/methane_2030_SPM.pdf?sequence=1&isAllowed=y
- ³ United Nations Environment Programme and Climate and Clean Air Coalition (2021). *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions*. Nairobi: United Nations Environment Programme. Available at: <https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions>
- ⁴ Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
- ⁵ Methane | Climate & Clean Air Coalition, Available at: <https://www.ccacoalition.org/short-lived-climate-pollutants/methane>, [Accessed 16 Oct. 2024].
- ⁶ United Nations Environment Programme/Climate and Clean Air Coalition (2022). *Global Methane Assessment: 2030 Baseline Report Summary for Policymakers*. Nairobi. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/41108/methane_2030_SPM.pdf?sequence=1&isAllowed=y
- ⁷ Climate Policy Initiative (2023) "Landscape of Methane Abatement Finance 2023". Available at: <https://www.climatepolicyinitiative.org/publication/landscape-of-methane-abatement-finance-2023/>
- ⁸ UNEP-Convened Climate and Clean Air Coalition (2024). *Leveraging the Benefits of non-CO₂ Pollutants and Air Quality in NDC 3.0: Guidance on Including Methane in Nationally Determined Contributions*. Available at: https://www.ccacoalition.org/sites/default/files/resources/files/Guidance%20on%20Including%20Methane%20in%20NDC%203.0_0.pdf
- ⁹ Fiore, A. M., J. J. West, L. W. Horowitz, V. Naik, and M. D. Schwarzkopf (2008), Characterizing the tropospheric ozone response to methane emission controls and the benefits to climate and air quality, *J. Geophys. Res.*, 113, D08307, doi:10.1029/2007JD009162.
- ¹⁰ Asthma and Lung UK. (2017). *Air Pollution*. Available at: <https://www.asthmaandlung.org.uk/living-with/air-pollution/your-lungs> [Accessed 28 Oct. 2024].
- ¹¹ Global Methane Pledge. (2023). *Key Messages on Methane at COP28*. Available at: <https://www.globalmethanepledge.org/sites/default/files/documents/2023-12/GMP%20key%20messages%20on%20methane%20at%20COP28%20-%20final%20for%20website%20-%20NDC%20number%20fixed.pdf> [Accessed 21 Oct. 2024].
- ¹² Machibya, M., Mdemua, M., Tumbo, S.D., Lankford, B.A., Kajokac, M.D. and Mwandepad, E., (n.d.) *Relationships between rice irrigation, mosquito breeding, malaria, water losses and reduced rice yields: research from the Usungu plains, Tanzania* [online]
- ¹³ Food and Agriculture Organization. (n.d.). *GLEAM version 3 - Global Livestock Environmental Assessment Model*. Available from: https://foodandagricultureorganization.shinyapps.io/GLEAMV3_Public/
- ¹⁴ Kyriazakis, I., Arndt, C., Aubry, A., Charlier, J., Ezenwa, V.O., Godber, O.F., Krogh, M., Mostert, P.F., Orsel, K., Robinson, M.W. and Ryan, F.S., 2024. Improve animal health to reduce livestock emissions: quantifying an open goal. *Proceedings B*, 291(2027), p.20240675.
- ¹⁵ UNFCCC, 2008. *Challenges and opportunities for mitigation in the agricultural sector*. Available from: <https://unfccc.int/sites/default/files/resource/docs/2008/tp/08.pdf>
- ¹⁶ De Haas, Y., Veerkamp, R.F., De Jong, G. and Aldridge, M.N., 2021. Selective breeding as a mitigation tool for methane emissions from dairy cattle. *Animal*, 15, p.100294.
- ¹⁷ Scotland's Farm Advisory Service. *Low Emissions Livestock Breeding: The What and The Why*. Available at: <https://www.fas.scot/article/low-emissions-livestock-breeding-the-what-and-the-why/> [Accessed 28 Oct. 2024].
- ¹⁸ Forabosco, F., Chitchyan, Z. and Mantovani, R., 2017. Methane, nitrous oxide emissions and mitigation strategies for livestock in developing countries: A review. *South African Journal of Animal Science*, 47(3), pp.268-280.
- ¹⁹ Nagaraju Indugu, Kapil Narayan, Hannah A. Stefenoni, Meagan L. Hennessy, Bonnie Vecchiarelli, Joseph S. Bender, Reeti Shah, Grace Dai, Satvik Garapati, Charles Yarish, Sergio C. Welchez, Susanna E. Räisänen, Derek Wasson, Camila Lage, Audino Melgar, Alexander N. Hristov, Dipti W. Pitta. Microbiome-informed study of the mechanistic basis of methane inhibition by *Asparagopsis taxiformis* in dairy cattle. *mBio*, 2024; DOI: [10.1128/mbio.00782-24](https://doi.org/10.1128/mbio.00782-24)
- ²⁰ Haque, M. Dietary manipulation: a sustainable way to mitigate methane emissions from ruminants. *J Anim Sci Technol* 60, 15 (2018). <https://doi.org/10.1186/s40781-018-0175-7>
- ²¹ Alemu AW, Pekrul LKD, Shreck AL, Booker CW, McGinn SM, Kindermann M and Beauchemin KA (2021) 3-Nitrooxypropanol Decreased Enteric Methane Production From Growing Beef Cattle in a Commercial Feedlot: Implications for Sustainable Beef Cattle Production. *Front. Anim. Sci.* 2:641590. doi: 10.3389/fanim.2021.641590
- ²² Global Methane Initiative, 2013. *Successful Applications of Anaerobic Digestion from Across the World*. Available at: [Successful Applications of Anaerobic Digestion from Across the World](https://www.gmi.org/~/media/Files/Successful%20Applications%20of%20Anaerobic%20Digestion%20from%20Across%20the%20World.pdf)
- ²³ Food Forward NDCs, *Reducing Emissions from Livestock Through Sustainable Management Practices*. Available at: <https://foodforwardndcs.panda.org/food-production/reducing-emissions-from-livestock-through-sustainable-management-practices/> [Accessed 28 Oct. 2024].
- ²⁴ Food Forward NDCs. (n.d.). *Reducing Emissions from Rice Cultivation*. Available at: <https://foodforwardndcs.panda.org/food-production/reducing-emissions-from-rice-cultivation/> [Accessed 7 Oct. 2024].
- ²⁵ International Rice Research Institute. (n.d.). *Water Management: For Safe Alternate Wetting and Drying*. Available at: <http://www.knowledgebank.irri.org/step-by-step-production/growth/water-management/#for-safe-alternate-wetting-and-drying> [Accessed 8 Oct. 2024].
- ²⁶ CCAC, 2016. *Alternate wetting and drying infographic*. Available from: <https://www.ccacoalition.org/resources/alternate-wetting-and-drying-infographic>
- ²⁷ M. Farooq, Kadambot H.M. Siddique, H. Rehman, T. Aziz, Dong-Jin Lee, A. Wahid, 2011. Rice direct seeding: Experiences, challenges and opportunities, *Soil and Tillage Research*, Volume 111 (2), pp.87-98. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0167198710001960>
- ²⁸ Rahman, M.M., 2019. Potential benefits of dry direct seeded rice culture: A review. *Fundamental and Applied Agriculture*, 4(2), pp.744-758. Available at: https://www.researchgate.net/publication/331155677_Potential_Benefits_of_Dry_Direct_Seeded_Rice_A_Review
- ²⁹ Syed Faiz-ul Islam, Jan Willem van Groenigen, et al., 2018. The effective mitigation of greenhouse gas emissions from rice paddies without compromising yield by early-season drainage. *Science of The Total Environment*, Volume 612, pp 1329-1339. Available at: <https://www.sciencedirect.com/science/article/pii/S0048969717323641>
- ³⁰ International Rice Research Institute. (n.d.). *Rice knowledge bank. Aerobic Rice*. Available at: <http://www.knowledgebank.irri.org/step-by-step-production/growth/water-management/aerobic-rice> [Accessed 8 Oct. 2024].
- ³¹ SRI 2030. (n.d.). *What is SRI?*. Available at: <https://www.sri-2030.org/what> [Accessed 8 Oct. 2024].
- ³² International Rice Research Institute. (n.d.). *Short Duration Rice Varieties*. Available at: <https://ghgmitigation.irri.org/mitigation-technologies/short-duration-rice-varieties> [Accessed 8 Oct. 2024].
- ³³ Hu, J., Bettembourg, M., Moreno, S. et al. 2023. Characterisation of a low methane emission rice cultivar suitable for cultivation in high latitude light and temperature conditions. *Environ Sci Pollut Res* 30, 92950–92962. Available at: <https://link.springer.com/article/10.1007/s11356-023-28985-w>
- ³⁴ FAO, 2022. *Methane Emissions in Livestock and Rice Systems – Sources, quantification, mitigation and metrics (Draft for public review)*. Livestock Environmental Assessment and Performance (LEAP) Partnership. FAO, Rome, Italy. Available at: <https://openknowledge.fao.org/server/api/core/bitstreams/d1fb956a-1427-4d30-911e-703608d9445b/content>
- ³⁵ Slameto, Fahrudin DE and Saputra MW (2024) Effect of fertilizer composition and different varieties on yield, methane and nitrous oxide emission from rice field in East Java Indonesia. *Front. Agron.* 6:1345283. Available at: <https://www.frontiersin.org/journals/agronomy/articles/10.3389/fagro.2024.1345283/full>

-
- ³⁶ Chen, X, Liu, M., Kuzyakov, Y., Li, et al., 2018. Incorporation of rice straw carbon into dissolved organic matter and microbial biomass along a 100-year paddy soil chronosequence, *Applied Soil Ecology*, Volume 130, pp.84-90. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0929139318301161>
- ³⁷ Mazuecos-Aguilera, I., Salazar, S., Hidalgo-Castellanos, J. et al., 2024. Combined application of N-fixing PGPB and rice straw mulch compensates N immobilization by straw, improving crop growth. *Chem. Biol. Technol. Agric.* 11, 31. Available at: <https://chembioagro.springeropen.com/articles/10.1186/s40538-024-00555-3>
- ³⁸ International Rice Research Institute. (n.d.). Rice knowledge bank. *Composting Rice Residue Fact Sheet*. Available at: [http://www.knowledgebank.irri.org/training/fact-sheets/nutrient-management/item/composting-rice-residue-fact-sheet#:~:text=Although%20organic%20fertilizers%2C%20including%20rice.rich%20in%20potassium%20\(K\)](http://www.knowledgebank.irri.org/training/fact-sheets/nutrient-management/item/composting-rice-residue-fact-sheet#:~:text=Although%20organic%20fertilizers%2C%20including%20rice.rich%20in%20potassium%20(K)) [Accessed 23 Oct. 2024].
- ³⁹ Wanjugu Ndung'u, P., Mottet, A., Ozkqn, S. (2023). Greenhouse gas assessment of the project Rwanda Dairy Development Project (RDDP), unpublished IFAD report.
- ⁴⁰ Eory, V., Pellerin, S., Garcia, GC., Lehtonen, H., Licite, I., Mattila, H., Lund-Sorensen, T., Muldowney, J., Popluga, D., Strandmark, L., & Schulte, R. (2018). Marginal abatement cost curves for agricultural climate policy: state-of-the-art, lessons learnt and future potential. *Journal of Cleaner Production*, 182, 705 - 716. Advance online publication, Available at: <https://doi.org/10.1016/j.jclepro.2018.01.252>
- ⁴¹ Environment Defense Fund (EDF) (2018). Global risk assessment of high nitrous oxide emissions from rice production. Available at: https://www.edf.org/sites/default/files/documents/EDF_White_Paper_Global_Risk_Analysis.pdf
- ⁴² Global Methane Initiative. (n.d.). Home. Available at: <https://www.globalmethane.org/> [Accessed 28 Oct. 2024]
- ⁴³ Climate and Clean Air Coalition. (2021). *M-RAP Roadmap Template Guidance - Working Final*. Available at: <https://www.ccacoalition.org/sites/default/files/resources/M-RAP%20Roadmap%20Template%20Guidance%20-%20Working%20Final.pdf>
- ⁴⁴ Sina Wartmann, Sabina Shaikh (Ricardo E&E), Lorenz Moosmann, Cristina Urrutia (Öko-Institut), Carlos Essus, Felipe Gómez-Villota and Oscar Zarzo Fuertes (GIZ), 2023, NDC Progress Indicators: a guidance for practitioners, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Available at: https://transparency-partnership.net/system/files/document/GIZ_NDC-Indicators-Paper_231031.pdf
- ⁴⁵ ICAT (Initiative for Climate Action Transparency) (2020). Stakeholder Participation Guide: Supporting Stakeholder Participation in Design, Implementation and Assessment of Policies and Actions, J.C. Durbin and S. Vincent, eds. Washington, D.C.: Climate, Community & Biodiversity Alliance and Verra; Bonn: ICAT. <https://climateactiontransparency.org/icatguidance/stakeholder-participation/>
- ⁴⁶ CPI, 2022. The Landscape of Methane Abatement Finance [Paul Rosane, Baysa Naran, Angela Ortega Pastor, Jake Connolly, Dharshan Wignarajah]. Climate Policy Initiative. Available at: [Landscape-of-Methane-Abatement-Finance.pdf](https://www.climatepolicyinitiative.org/publication/the-landscape-of-methane-abatement-finance)
- ⁴⁷ World Bank. (2024). *Case Study: Uruguay Performance-Linked Loan*. Available at: <https://thedocs.worldbank.org/en/doc/254f79b50d1370d8b88e4a1b9947974e-0340012024/original/Case-Study-Uruguay-performance-linked-loan.pdf>