Comparing agricultural emissions reduction targets, strategies and policies

A snapshot comparison of 16 international jurisdictions

A Literature Review
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1. Executive Summary

This report was commissioned by Beef + Lamb New Zealand in mid-2024 to provide a New Zealand audience with a high-level snapshot of agricultural Greenhouse Gas (GHG) reduction targets, strategies and policies in a subset of international jurisdictions.[1] This is intended to support discussion and decisions of the development of domestic policies to reduce agricultural GHG emissions.

All 16 jurisdictions examined have economy-wide GHG reduction targets that include the agriculture sector, but there are significant differences in how these jurisdictions plan on meeting these targets.

Most jurisdictions specifically acknowledge the important role of food production and want to use technology and improved farming practices to achieve their goals. There is generally a strong desire to achieve emissions reductions in food-producing sectors without reducing production or overall animal numbers.

Nearly all of the jurisdictions analysed plan to use incentives and regulations rather than taxes or pricing mechanisms to encourage GHG reductions. This includes directly subsidising farmers for climate-friendly farming practices, enabling farmers to claim carbon credits for reducing agricultural GHG, subsidising farmers to carry out carbon audits and farm plans, and making cheaper credit available for farmers who carry out climate-friendly farming practices.

Key Findings

Policies in place to reduce agricultural GHG do so using different baselines and metrics. Some countries aim to reduce emissions on an absolute basis while others seek reductions based on emissions intensity or 'business-as-usual' scenarios. All the jurisdictions examined have strategies that acknowledge the agriculture sector's complex nature and seek to reduce agricultural GHG while maximising co-benefits.

Jurisdictions that already subsidise their farmers for their production (such as the USA, EU members and the UK) are repurposing some of these subsidies to subsidise GHG-reducing practices and technologies.

Jurisdictions that do not subsidise their agriculture sector (like Australia, Brazil and Uruguay) are implementing a diverse range of policies to reward their farmers for on-farm activities related to emissions reductions or removals. These free trading jurisdictions take care to ensure that GHG reducing policies are not classified as trade distorting subsidies or trade barriers. This includes the allocation of carbon credits to

[1] The term 'jurisdiction' is used, rather than 'country', as the European Union is examined.

farmers based on the adoption of GHG-reducing farm-practices or technologies as well as better access to finance.

No country with an emissions trading scheme (ETS) intends to include and price biological agricultural GHG) via an ETS. Several jurisdictions exclude all farming emissions from their ETS, including those relating to energy and transportation use.

Denmark and New Zealand are the only jurisdictions intending to price agricultural GHGs. Both countries, however, plan to price these GHG outside of their ETS. It is important to note that the tax proposals in Denmark are far from revenue-neutral for farmers or their government. Danish farmers are likely to receive billions of dollars of additional subsidies and an intensity-based rebate to ensure they are not unduly negatively impacted by the pricing of ruminant animal emissions.

In some jurisdictions, farmers can receive carbon credits for a variety of activities, this includes New Zealand where some landowners can receive carbon credits for certain kinds of forests. Other jurisdictions with an ETS or similar policy (such as California, Canada, Japan and Australia) do, or intend to, enable more options for farmers and farmers can also generate credits for undertaking farm-based activities that reduce emissions below business-as-usual levels using innovative practices.

The range of incentivised activities identified in the 16 jurisdictions analysed that reduce agricultural GHG include no-till cropping, cover cropping, rotational grazing, the use of feed additives and inhibitors, forestry, plant-based agriculture, better animal health and genetics, soil carbon testing, organic farming, the reduced use of pesticides, the reduced use of fertilisers, the use of biochar, and precision farming.[2]

Of these activities, most jurisdictions provide incentives for increased forestry or soil carbon sequestration. These incentives often come with strict conditions designed to maximise co-benefits, such as biodiversity, while also limiting negative outcomes, such as reduced food production. Many jurisdictions also account for afforestation and soil carbon sequestration together with agricultural GHG, describing the combined GHG categories as the ‘Land Sector’ or ‘Agriculture, Forestry, and Other Land Uses (AFOLU)’.

Many of these practices and technologies identified in agriculture GHG reduction strategies and policies simultaneously reduce GHG and deliver wider environmental or social benefits. These include improving climate resilience, biodiversity, and water quality, improving food security, fostering economic development, or maintaining culturally significant areas.

[2] The Intergovernmental Panel on Climate Change (IPCC) has a strict definition of what constitutes an ‘agricultural’ GHG and how it should be counted in inventories. However, most jurisdictions examined take a broader approach and include farming practices in their GHG policies that farmers could be rewarded for that are outside of this definition, such as electrifying farm vehicles and machinery. Thus, not all practices farmers are rewarded for are included in their GHG inventories.

The jurisdictions examined take a diverse approach to setting domestic GHG reduction targets and Nationally Determined Contributions (NDCs) under the Paris Agreement. Long-term targets are relatively homogeneous, with almost all jurisdictions setting all-GHG net-zero targets for 2050. The Netherlands, Israel and Japan have set emissions reduction targets that are not net-zero by 2050. India has committed to a 2070 net-zero target. Uruguay has not set a target beyond 2030.

Along with long-term GHG reduction targets, there are a range of shorter-term emissions reduction or intensity targets. Targets can be set in NDCs submitted to the UNFCCC or set in domestic legislation. Some of these shorter-term targets include improving the GHG intensity of beef production, reducing the GHG from fertiliser use, expanding the use of no-till farming, increasing forestry land use and meeting GHG-specific reduction targets.

Most of the jurisdictions analysed are heavily investing in research and development to deliver technologies that will reduce agricultural emissions. This includes research into methane-reducing livestock feed additives, research into improving GHG inventories and research into reducing the GHG from fertilisers.

As breakthrough agricultural GHG-reducing practices and technologies are developed and accounted for in national GHG inventories, many jurisdictions examined appear to have a stronger policy framework than New Zealand to incentivise their adoption. This includes having policies and funding mechanisms in place to support the adoption of not only novel technologies but also on-farm activities and practices.

To address this gap, New Zealand policymakers could seek to implement policies that incentivise reduced agricultural GHG and to bolster New Zealand's international competitiveness, taking care not to distort trade and maximising environmental, social and economic co-benefits.

New Zealand is not alone in seeking to implement such a complex policy goal, and this report highlights many examples of policies that other jurisdictions are implementing to achieve these outcomes.

Background

This report was commissioned by Beef + Lamb New Zealand in mid-2024 to provide a New Zealand audience with a high-level snapshot of agricultural GHG reduction targets, strategies and policies in a subset of international jurisdictions. This is intended to support domestic insights and decisions regarding the setting of domestic policies concerning agricultural GHG.

The jurisdictions examined are

1. New Zealand
2. Australia
3. Canada

4. United States
5. United Kingdom
6. The European Union (EU)
7. Ireland
8. Netherlands
9. Denmark
10. Norway
11. Israel
12. Uruguay
13. Brazil
14. Japan
15. South Africa
16. India

The 16 countries were selected to:

- Provide information on the jurisdictions referred to by the New Zealand Climate Change Commission (NZ CCC) as implementing targets 'more ambitious' than New Zealand. These jurisdictions are Australia, Canada, the EU, Israel, Japan, Norway, and the United States.
- Compare a selection of developed jurisdictions commonly used by New Zealand policymakers. These jurisdictions are the United Kingdom, Ireland, Denmark, the Netherlands, and Uruguay.
- Provide a comparison with jurisdictions that are large livestock producers in geographically diverse regions. These jurisdictions are Brazil, South Africa and India.

The report does not attempt to state what agricultural GHG reduction policies should be or to claim which policies in which jurisdictions are best. It rather aims to highlight key examples of relevant GHG reduction policies to add nuance to a New Zealand-based discussion.

The report is structured into four main sections.

- **Section 1** is an executive summary.
- **Section 2** outlines the themes shared across the 16 agricultural GHG reduction strategies and policies.
- **Section 3** is the largest section of the report and contains 16 sub-sections that include information on the agricultural GHG reduction targets, strategies and policies of the 16 jurisdictions examined.
- **Section 4** simplifies the report's findings and summarises the conclusions in three high level tables.

There are two appendices, one highlighting voluntary GHG reduction targets made in some of the jurisdictions examined and another highlighting comments made by some of the jurisdictions regarding biogenic methane and GHG metrics.

2. Common Themes Across Agricultural GHG Reduction Strategies

Agricultural GHG reduction strategies vary widely across countries, but certain practices and policies are emerging as common approaches to mitigating emissions.

This section explores some of the recurring strategies, practices, and technologies jurisdictions have adopted to reduce agricultural GHG. The New Zealand policy framework is then highlighted and compared to other key jurisdictions examined.

Pricing of Agricultural GHG

No jurisdictions plans to price agricultural GHG in an ETS that prices emissions outside of the agricultural sector. The only jurisdictions examined that plan to tax (or price) agricultural GHG are Denmark and New Zealand. Both jurisdictions plan to price agricultural GHG by 2030 outside of their ETS. While it is not clear how this will be done by New Zealand, the Danish plan has been modelled, costed, and agreed to by a range of key stakeholders.

Taxing some agricultural GHG is only one aspect of the planned Danish policy, which intends to spend billions of dollars to incentivise large-scale land-use change and achieve a wide range of environmental outcomes. More information on this Danish policy can be found in the Denmark subsection of section 3.

The EU is actively considering creating a separate ETS for agricultural GHG and land-based carbon sequestration, replying on an independent study on policy options in 2023 to inform this.[3] While the EU has not ruled out such a policy, political momentum on the matter appears to have stalled. The September 2024 report of the Strategic Dialogue on the future of EU agriculture was well received by the European Commission and considered the time 'premature' for considering taxing agricultural GHG via an ETS. More information on this is contained within the EU subsection of Section 3.

GHG Reduction Targets

The jurisdictions examined take a diverse approach to setting GHG reduction targets and Nationally Determined Contributions (NDCs). Long-term targets are relatively homogeneous, with almost all jurisdictions setting all-GHG net-zero targets for 2050. The Netherlands, Israel and Japan have set substantial, but not net-zero, 2050 targets, and India has committed to a 2070 net-zero target.

[3] https://climate.ec.europa.eu/news-your-voice/news/looking-how-mitigate-emissions-agriculture-2023-11-13_en

Along with long-term GHG reduction targets, there are a range of shorter-term targets. These targets are sometimes set in NDCs submitted to the UNFCCC and sometimes set only in domestic legislation. These shorter-term targets include: improving the GHG intensity of beef production, reducing the GHG from fertiliser use, expanding the use of no-till farming, increasing forestry and GHG-specific targets.

New Zealand is unusual among the jurisdictions examined in having a set of domestic targets (as outlined in the Zero Carbon Act) that differs significantly from its NDC. Other jurisdictions have set targets that differ from their NDC, but these are either sector or sub-sector-based and (relative to New Zealand) better complement other targets. New Zealand is also unique in having taken a split gas approach in its domestic targets and an aggregated gas approach in its NDC.

Uruguay has set a 2030 NDC which includes targets that disaggregate different types of GHG and set separate targets for carbon dioxide, methane and nitrous oxide. Similarly, the targets set by New Zealand in its Zero Carbon Act (ZCA) disaggregate biogenic methane from all other GHGs. This approach, however is not taken in New Zealand's NDC, which takes a combined GHG approach.

If New Zealand policymakers wish to bring coherence to the current system and are confident in the science behind the decision to take a split gas approach in the ZCA, the example of Uruguay demonstrates that such a split gas approach could also be taken in New Zealand's NDC.

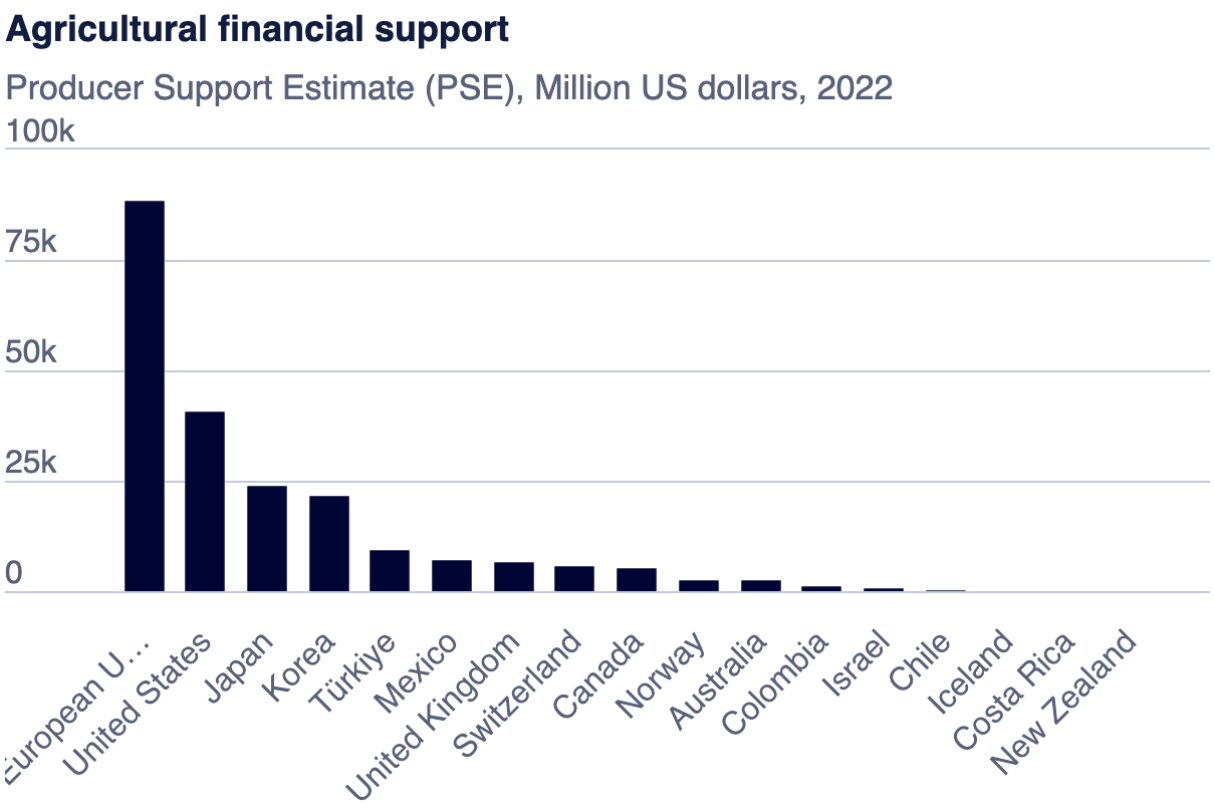
Government Support and Subsidies

In the decades since the formation of the Cairns Group. A 2022 United Nations (UN) Food and Agriculture Organisation (FAO) report estimates that agricultural subsidies annually amount to 540 billion USD. The FAO describes two-thirds of these subsidies as price-distorting and harmful to the environment.[4] This annual figure is estimated to increase to 1.8 trillion USD by 2030 under modelled BAU scenarios.

The below figure is produced by the Organisation for Economic Cooperation and Development (OECD) and compares direct producer-supporting subsidies in several key countries.[5]

[4] https://openknowledge.fao.org/server/api/core/bitstreams/05983446-7ad7-4ea5-9257-fda5e186467f/content#:~:text=By%20repurposing%20agricultural%20producer%20support,healthy%20lives%2C%20nature%20and%20climate.

[5] https://www.oecd.org/en/data/indicators/agricultural-financial-support.html?oecdcontrol-87d45bcfe1-var6=PSE&oecdcontrol-a9befebb18-var1=EU%7CAUS%7CCAN%7CCHL%7CCOL%7CCRI%7CISL%7CISR%7CJPN%7CKOR%7CMEX%7CNZL%7CNOR%7CCHE%7CTUR%7CGBR%7CUSA&oecdcontrol-0c34c1bd70-var3=2022



While the Cairns Group continues to advocate for the removal of agricultural subsidies and distortionary trade policies, many countries, Intergovernmental Organisations (IGOs), and non-governmental organisations (NGOs) are advocating to 'repurpose' existing subsidy schemes that were traditionally linked to production to more directly recognise practices that financially benefit the environment.

Many view repurposing subsidies as more politically feasible than phasing them out, as it leads to fewer adverse social outcomes and will additionally give regulators the ability to influence the agriculture sector. The case for repurposing rather than removing agricultural subsidies was made in a 2022 FAO report, which states:

> *"The decline in farm income from the removal of agricultural subsidies, if not compensated, would push a small portion of the population in developing countries into extreme poverty, thus increasing the prevalence of undernourishment. This analysis makes a strong case for repurposing rather than eliminating agricultural producer support."*[6]

A key challenge for farmers in free market, non-subsidised trading countries such as New Zealand is that they must compete in global markets with international competitors that are being significantly subsidised.

There is an increasing trend towards subsidies being redirected to support farmers in reducing their emissions or improving their environmental footprint. New Zealand farmers will likely face a future in which they continue to participate in unbalanced

[6] https://www.unep.org/resources/repurposing-agricultural-support-transform-food-systems, pp, 8

global markets. In these markets, international competitors may be increasingly not directly subsidised for production but rather 'financially recognised' for providing environmental services and 'public goods.' In contrast, New Zealand farmers are expected to provide these services with little support or policy incentives.

Reducing Food Production

The importance of ensuring food security is commonly cited in policy documents and strategies throughout the 16 jurisdictions examined. However, the importance of this aim and how 'food security' is defined differs among the 16 jurisdictions.

Uruguay has clearly stated that it will not reduce its food production, particularly livestock, to meet climate targets. Uruguayan officials argue that the country's role as a global food producer must be protected and that under the Paris Agreement, reducing food production is not a viable or necessary strategy for GHG mitigation. Uruguay emphasises increasing efficiency in livestock production rather than reducing herd sizes, seeking to achieve climate goals through sustainable intensification, better grazing management, and enhancing pasture carbon sequestration.

Similarly, the Netherlands has committed to maintaining food production levels. The Dutch Government has publicly stated that reducing food production is not part of its climate agenda. Instead, the Netherlands is investing heavily in technology, innovation, and efficiency to meet its GHG reduction targets while maintaining agricultural output. This includes advancements in precision farming and low-methane livestock technologies. Recent policies to buy out dairy farmers are driven primarily by nitrate, not GHG concerns.

In contrast, Denmark plans to implement a sweeping policy of taxes and subsidies to meet a range of environmental targets. While non-animal-based agriculture is expected to increase in Denmark, this policy will likely lead to decreased livestock and possibly overall food production, as land will be converted into forests and wetlands.

While there are differing approaches among the developed jurisdictions examined, all developing jurisdictions, such as India and South Africa, clearly note and prioritise the importance of improving food security.

New Zealand's policy values the country's role as a food exporter, but it is unclear how much priority is placed on food production if GHG reduction targets cannot be achieved without reducing food production. Recent policy proposals to price agricultural GHG to meet GHG targets were expected to result in significant cuts to food production

Livestock Feed Additives and Inhibitors

Many jurisdictions examined, incentivise or subsidise improved livestock practices and feed to encourage the reduction of agricultural emissions. A strong example is Flanders and Slovenia in the EU, which directly subsidises feed additives for livestock.

> *"The Flemish Minister of Agriculture, Credits, will shortly introduce a support scheme for cattle farmers who use feed that inhibits methane formation. Five methane-reducing feed measures are distinguished. This concerns animal feed containing rapeseed meal or brewer's grain, extruded or expanded linseed, rapeseed fat, nitrate or 3-nitrooxypropanol. Because the feed is more expensive, the minister wants to stimulate its use through a subsidy."*[7]

The USA, the UK, and Brazil are large agricultural jurisdictions that also focus on livestock feed additives and inhibitors. These additives and inhibitors are often included in short-term plans to reduce GHG before 2030, such as the case in the UK. DSM's Bovaer (also known by its generic name, 3NOP) is being approved by an increasing number of jurisdictions to reduce methane from livestock.

Among the jurisdictions examined, New Zealand has taken a cautious approach to using feed additives and inhibitors. In June 2024, the New Zealand Government announced a review of the regulations that have slowed the uptake of livestock additives and inhibitors, expected to take six months.[8] If this review enables the use of technologies, such as Bovaer, it is unclear if or how New Zealand farmers will be incentivised to use the technology. Some jurisdictions directly subsidise the use of livestock feed additives and inhibitors, while some jurisdictions that do not directly subsidise farmers, such as Brazil and Australia, incentivise the use of livestock feed additives and inhibitors through novel means, such as generating carbon credits and better access to credit.

Maximising Co-Benefits

A recurring theme throughout the jurisdictions examined was ensuring that policies designed to reduce agricultural GHG maximise co-benefits and minimise negative outcomes. Co-benefits include environmental benefits, such as improving climate resilience, biodiversity and water quality or can be broader, such as improving food security, economic development or maintaining culturally significant areas.

Some practices and technologies designed to reduce agricultural GHG generally have few co-benefits, but policies aim to minimise adverse outcomes. These include the use of livestock feed additives and inhibitors, the electrification of on-farm transport, and the generation of renewable electricity on farms.

Other practices and technologies are promoted by jurisdictions explicitly because they are known to achieve a wide range of co-benefits, such as no-till cropping, landscape appropriate afforestation, the planting of riparian margins, reduced pesticide use, reduced fertiliser use, the use of biochar, and rotational grazing.

[7] https://www.tridge.com/news/flemish-farmers-receive-a-subsidy-for-using-feed-t
[8] https://www.regulation.govt.nz/our-news/regulatory-review-announced-for-agricultural-and-horticultural-products

A prominent example of a policy aiming to achieve a wide range of co-benefits while meeting GHG reduction targets is the 'Green Tripartite' agreement between the Danish Government and key environmental and farmer organisations. This Agreement aims to not only contribute to meeting Denmark's GHG targets but also improve water quality, biodiversity, and public access to nature and to double organic farming.

Denmark's Agreement aims to achieve these goals through a large-scale system of taxes, subsidies and regulation, but many other jurisdictions also seek to maximise co-benefits simply by preferencing practices that deliver co-benefit when developing incentives for climate-friendly farming practices.

New Zealand's agricultural GHG reduction policy places relatively low importance on maximising co-benefits as agricultural GHG are reduced. A prominent example is the reliance on exotic monocultural afforestation.

Forestry and Vegetation

Forestry and vegetation are sometimes accounted for exclusively, with GHG coming from the land sector under Land-Use, Land-Use Change, and Forestry (LULUCF). At other times, forestry and vegetation are accounted for alongside direct agriculture GHG under the category agricultural forestry and other land-use (AFOLU). No matter the category chosen, increasing the integration of forestry and vegetation within farms is a standard policy across the jurisdictions examined.

Australia has adopted a combined approach to managing agriculture and forestry under its land-based sector plan (using the AFOLU category), recognising both the sequestration potential and emissions reduction opportunities. Similarly, Brazil's ABC+ Plan emphasises restoring degraded pastures and increasing forestry cover, aiming to enhance carbon sequestration and align with broader land-use strategies. Uruguay takes a holistic approach, considering the Agriculture, Forestry, and Other Land Use (AFOLU) category in its emissions inventory, reflecting the interconnected nature of land-based emissions and sequestration activities. Several jurisdictions incorporate afforestation and agroecology within their agricultural strategies, providing diverse approaches to incentivising the integration of trees on farms.

Compared to other countries, New Zealand has a unique system where forestry is included at the sectoral level in the ETS and serves as the primary economy-wide tool to offset GHG and meet New Zealand's parallel sets of GHG reduction targets.[9] The New Zealand ETS is unusual in having no limit on the amount of offsets that can be used by an ETS participant to meet surrender obligations and unusual in primarily incentivising fast-growing exotic tree species. New Zealand afforestation policies appear much more suited to large-scale forestry plantations rather than the incentivising the integration of forestry and vegetation within farms. In contrast, jurisdictions like the EU, UK, and the

[9] For more information on what types of forest faces obligations under the scheme or can voluntarily enter see Te Uru Rakau's information here: https://www.mpi.govt.nz/forestry/forestry-in-the-emissions-trading-scheme/about-forestry-in-the-emissions-trading-scheme-ets/how-forest-land-is-defined-in-the-ets/

US ensure that afforestation maximises environmental benefits such as biodiversity and water quality improvements and there is a greater focus on ensuring that farmers can access such policies.

Improving Soil Carbon

Improving soil health and soil carbon levels is a key goal in many of the agricultural GHG reduction strategies examined. Funding for farmers to measure the soil carbon levels of their farms, such as in Scotland, Northern Ireland, and Norway, is used to set a baseline for soil carbon levels and then to track any changes to these levels. Measuring soil carbon levels is not only funded by the Northern Irish Government but is a prerequisite if farmers wish to receive subsidies.

In other jurisdictions, activities that are shown to correlate with improved soil health and soil carbon levels are incentivised without the need to measure soil carbon levels directly on farms. These activities include no-till cropping, rotational grazing, cover cropping, and establishing pastures with diverse sward species.

Most jurisdictions have a strong emphasis on improving soil health. Prominent examples are Australia, with its National Soil Strategy; Brazil, which plans to restore 30 million hectares of degraded soil as part of its ABC+ plan; and Northern Ireland.

New Zealand is unusual among the jurisdictions examined, with a relatively small focus on promoting soil health and increasing carbon levels. Some practices incentivised or subsidised in other jurisdictions to encourage soil health, such as no-till cropping and rotational grazing, are common in New Zealand without such policies. Yet, others, such as soil monitoring and the use of biochar, appear to be less of a focus of government policy.

Agricultural GHG Reduction Research and Development

All jurisdictions examined are investing heavily in research and development to unlock technologies that meet GHG reduction targets without causing negative outcomes such as reduced food production and hampered rural development.

Japan is an example of a jurisdiction investing in agricultural GHG research and development. Japan prioritises agricultural R&D with its MIDORI Strategy, which includes funding technologies to reduce methane emissions in rice paddies and livestock. Japan’s investment in precision agriculture and methane-reducing technologies is part of its broader strategy to decarbonise its food systems, including investments in technologies such as electric on-farm transport.

Another example is the European Union (EU). The EU has dedicated significant funding under its Horizon Europe program to support innovations in sustainable agriculture,

focusing on carbon capture, improving soil health, and developing precision farming tools.

New Zealand is a leader in agricultural GHG reduction research and development. It invests in research and development directly and dedicates resources to coordinating and aligning international research and development initiatives through the GRA, often in funding partnerships with the agricultural sector. These coordination efforts appear to come at a relatively low cost ($34 million NZD over four years) and with a large potential to reduce global agricultural GHG.[10]

[10] https://globalresearchalliance.org/country/new-zealand/#:~:text=In%202020%2C%20the%20New%20Zealand,researchers%2C%20policy%20makers%20and%20farmers.

3. Jurisdiction Case Studies

The following section outlines the targets for reducing GHG in each jurisdiction. It details high-level strategies and policies in each jurisdiction to mitigate agricultural GHG, including the policies to be implemented and the practices that are regulated, incentivised or disincentivised.

The examination of each jurisdiction is not an exhaustive list but rather a high-level snapshot summary of key policies relevant to the agriculture sector.

New Zealand

GHG Reduction Targets

New Zealand's NDC (covering 2021-2030) is to reduce all GHG by 50 percent below 2005 levels by 2030. [11]

In addition to NDCs, New Zealand has domestic emissions reduction targets, designed to achieve the NDCs, and which take a split gas approach; these targets are:

1. To reduce biogenic CH_4 emissions by 10 percent below 2017 levels by 2030 and 24-47 percent below 2017 levels by 2050, and
2. To reduce all non-biogenic CH_4 GHG to net zero by 2050.

At the time of writing, the New Zealand Climate Change Commission and a government-appointed independent panel are separately undertaking reviews of the biogenic methane reduction targets.

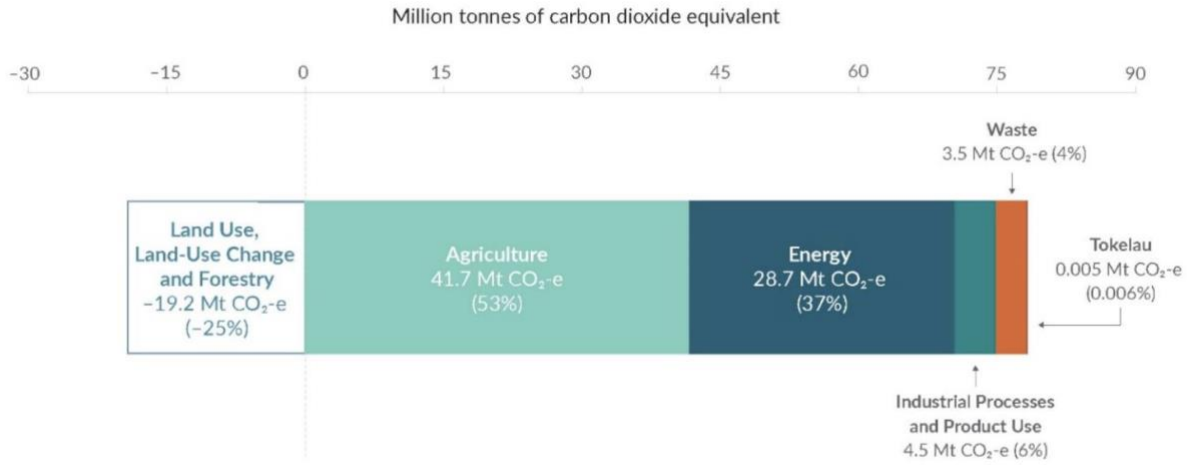
GHG Reduction Strategies

New Zealand is a developed economy with a large amount of renewable (mainly hydro) electricity generation and a large export-driven livestock agriculture sector. These characteristics have led to an unusual GHG inventory profile of almost half of all GHG, and about 90 percent of CH_4, coming from agriculture. This is shown in the below two figures[12]:

[11] The 2030 target is -50% if expressed using a 'point year target' rather than the more standard 'emission budget approach', https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/nationally-determined-contribution/

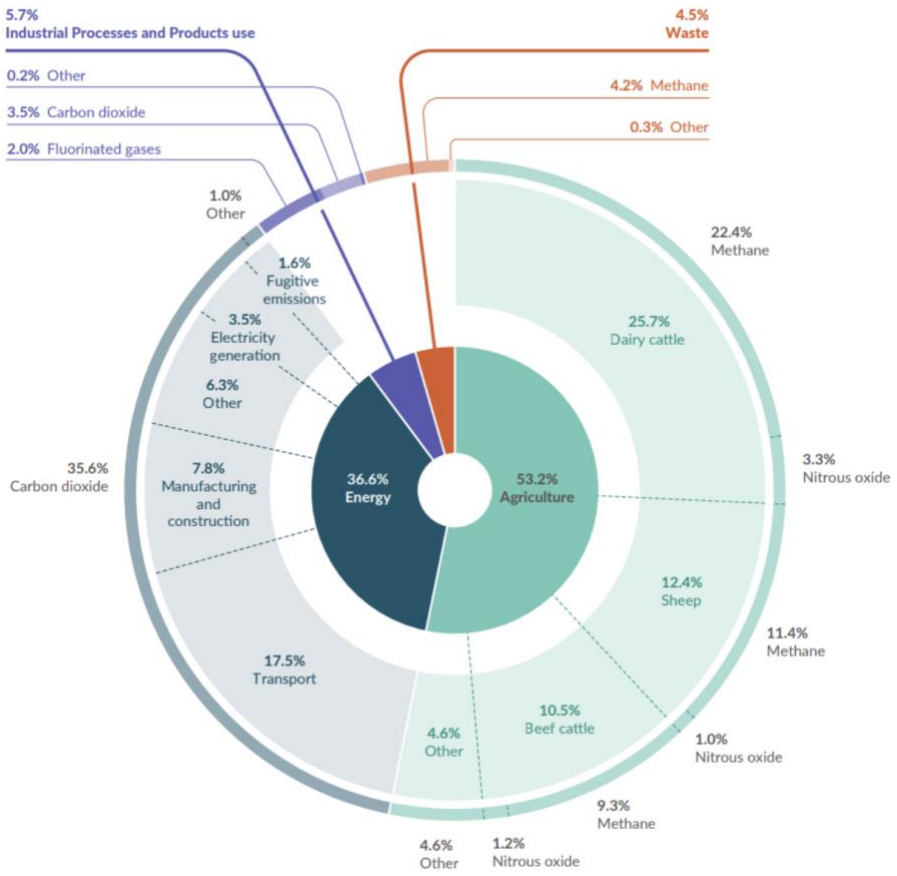
[12] https://environment.govt.nz/assets/publications/GHG-inventory-2024-Snapshot.pdf

Figure 1: Breakdown of Aotearoa New Zealand's emissions (in million tonnes of carbon dioxide equivalent [Mt CO_2-e]) by sector in 2022



Net emissions from the LULUCF sector are negative because the sector removes more greenhouse gases from the atmosphere than it emits.

Figure 2: Gross greenhouse gas emissions percentages in 2022 by sector, category and gas type



New Zealand's agricultural GHG policy focuses on production efficiency and regulation, with the government planning to implement agricultural GHG pricing by 2030 at the latest. Although the government supports the use of mitigation tools and technologies that ensure continued production, there is limited clarity on what this support entails.

At the time of writing, the New Zealand Government was reviewing feedback on its Second Emissions Reduction Plan (ERP2), a five-year plan designed to meet GHG reduction targets.[13] Covering the period from 2026 to 2030, ERP2 is the first emissions reduction plan released since the change of government in 2023.

Under ERP2, the New Zealand Emissions Trading Scheme (NZ ETS) is the primary means of achieving long-term net GHG reduction targets at the least cost. ERP2 also outlines several policies designed to complement the NZ ETS for industries included in the ETS and to reduce GHG for agriculture, the only industry not included in the NZ ETS. These policies are:

- Electrify NZ – reduce consenting burden
- Investigate carbon capture, utilisation and storage (CCUS)
- Target 10,000 electric vehicle (EV) chargers by 2030
- Better public transport
- Agricultural mitigation technologies and emissions pricing
- Waste Minimisation Fund
- Organic waste and landfill gas capture

The New Zealand Government expects to meet the first two ERPs; however, it also estimates that these ERPs will collectively fall 101 Mt CO_2e short of meeting New Zealand's 2030 NDC.

New Zealand has different approaches to international and domestic targets. No other jurisdiction examined has done this to the extent New Zealand has, and the distinction between international and domestic targets is rarely made outside New Zealand.

New Zealand's international NDCs adopt a strategy that allows full fungibility (lumping all GHG together) between biogenic methane (CH_4) and long-lived emissions and sets all-GHG net reduction targets. In contrast, New Zealand's domestic GHG reduction targets do not allow fungibility between biogenic methane (CH_4) and long-lived GHG and set separate targets for them. The domestic emissions budgets also do not separate out targets for CH_4 and other GHG.

Reducing agricultural GHG will be necessary if New Zealand is to meet its international NDCs or its domestic GHG reduction targets.

[13] https://environment.govt.nz/news/erp2/ . Note that New Zealand utilizes emissions budgets as a way to show progress towards the legislative goals. More information can be found here: https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reductions/emissions-budgets-and-the-emissions-reduction-plan/

Agricultural GHG reduction policies are highly political and have changed since the 2023 election. The previous government was committed to introducing a pricing system for agricultural GHG by 2025, but the new government has moved the date to 'no later than 2030'.

This cancelled pricing policy would have placed a price on agricultural methane and nitrous oxide, using the revenue generated to incentivise the use of some new technologies and to financially recognise some non-ETS eligible sequestration occurring on farms. Unlike the proposed Danish policy, the policy was to be revenue-neutral, with no additional funding from the government.

It is unknown how any new pricing system will be implemented or to whom it will be applied. The new government also ended the previous government's 'He Waka Eke Noa' group and formed the Pastoral Sector Group (PSG).[14]

In New Zealand, farmers do not receive subsidies, and domestic markets are not protected by tariffs, so redirecting producer support is not a means of reducing GHG.

In New Zealand, the ZCA targets have different accounting rules, and the methane component is a gross target that cannot be met through carbon removals. The long-lived gas targets are net targets, and the CH_4 targets are gross. This means that sequestration can only be counted against the long-lived gas target. So, while increasing afforestation on farmland or converting farms into forestry can aid in meeting national targets, it does not count against reducing agricultural emissions. Over time, it is likely that agricultural GHGs will become a greater proportion of the country's emissions profile.

ERP2 outlines the following policies to support agriculture contributing to national GHG reduction targets.

- *"Accelerating the development and commercialisation of emissions-reduction tools and technologies*
- *supporting clear and effective regulatory pathways for these tools*
- *standardising the estimation of farm-level emissions*
- *recognising on-farm carbon sequestration*
- *providing extension to support producers to make changes."*[15]

The government has also indicated their intent to expand recognition of other forms of sequestration beyond currently defined forests but details on this are limited.

New Zealand is also heavily investing in agriculture GHG reduction research and development. New Zealand agriculture GHG mitigation research and development is coordinated through the public-private Joint Venture 'Agri Zero NZ'.[16] Agri Zero NZ manages $191 million NZD, half provided by the New Zealand government and half by

[14] https://insidegovernment.co.nz/new-pastoral-sector-group-to-replace-he-waka-eke-noa/
[15] https://environment.govt.nz/publications/new-zealands-second-emissions-reduction-plan-discussion-document/pp.72. Note it is not clear what extension support this entails from central government.
[16] https://www.agrizero.nz/

large firms in New Zealand.[17] Agri Zero NZ works closely with the New Zealand Agriculture Greenhouse Gas Research Centre (NZAGRC), a New Zealand public agriculture research institution with the goal 'to *discover, develop and make available practical and cost-effective technologies and practices for New Zealand farmers and growers to reduce agricultural greenhouse gas emissions.".* [18] The New Zealand government allocates about $150 million NZD to the NZAGRC's domestic activities and additional funding for its International activities, including the GRA.[19]

New Zealand also serves as the secretariat for the Global Research Alliance on Agricultural Greenhouse gases (GRA), an organisation that was established in 2009. The GRA was established to '*bring together the world's best in agricultural greenhouse gas emissions research, aiming to expand knowledge in this area and accelerate the development of appropriate mitigation technologies and practices*".[20] The GRA now includes over 60 countries and 20 partner organisations.

Australia

GHG Reduction Targets

Australia has two NDCs:

1. To reduce all GHG by 43 percent below 2005 levels by 2030, and
2. To achieve net zero by 2050.[21]

At the time of writing, the Australian Government was consulting on an emissions reduction plan for the 'Agriculture and Land Sector. '[22] This will be one of six plans to achieve the 2050 economy-wide net zero target. There is no legislated agriculture-specific GHG reduction target in Australia. The current plan being consulted on does not propose adding any GHG or agriculture specific targets.

GHG Reduction Strategies

Agriculture makes up about 18 percent of net GHG in Australia, and about 15 percent if LULUCF GHG are excluded.[23]

Australia does not have an ETS or a price on GHG. However, despite this lack of an ETS or GHG price, two key policies share many of the characteristics of an ETS; the

[17] https://blog.bnz.co.nz/2024/06/bnz-latest-big-name-to-invest-in-agrizeronz#:~:text=AgriZeroNZ%20is%20a%20world%2Dfirst,'near%20zero'%20by%202040.
[18] https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/investment-funds/strategic-science-investment-fund/ssif-funded-programmes/new-zealand-agricultural-green-house-gas-research-centre#:~:text=for%20Primary%20Industries-,About%20the%20research,Grasslands%20Campus%20in%20Palmerston%20North.
[19] https://www.nzagrc.org.nz/about/funding/current-funding/
[20] https://www.nzagrc.org.nz/international-activities/global-research-alliance/
[21] https://unfccc.int/sites/default/files/NDC/2022-06/Australias%20NDC%20June%202022%20Update%20%283%29.pdf
[22] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan
[23] https://unfccc.int/documents/627765

Emissions Reduction Fund (ERF) and the Safeguard Mechanism. The ERF, is a voluntary scheme that rewards the adoption of technologies and practices that reduce or sequester GHG.[24] The Safeguard Mechanism requires Australia's largest industrial emitters (215 facilities that each emit more than 100,000 T CO_2e) to reduce GHG in line with targets; those that exceed requirements can trade with those that do not meet the required GHG reductions.[25]

Australian agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

Like New Zealand, Australia does not have significant agricultural subsidies that could be 'repurposed' to meet GHG reduction targets. Also, like New Zealand, Australia recently changed its government, but unlike New Zealand, the newly elected Australian Labor government has no plans to tax agricultural emissions or set a specific emission reduction target for agriculture. This is noted in the Agriculture and Land sector plan discussion document, which states:

> *"The emissions reduction targets set by the government are economy wide. There is no expectation there will be sector-specific emissions reduction targets. However, in considering the way forward it may be useful to consider goals or indicators, such as continuous improvements in emissions intensity, that can provide measures of progress."*[26]

The Australian Minister for Climate Change and Energy, Chris Bowen also spoke to this issue in a speech delivered to the Sustainable Agriculture Summit in May 2024, stating:

> *"What I want to do today is outline what I see as the three key principles that will have to underpin the Agriculture and Land Sector Plan…*
>
> *… First, agricultural decarbonisation must be achieved with the sector, not imposed on the sector.*
>
> *We're serious about making collaboration work. We want to talk about policies, incentives, opportunities, and challenges. We won't be imposing arbitrary sector wide targets or top-down approaches.*
>
> *Second, action on climate change is necessary to ensure food security, and action on climate change won't come at the expense of food security.*
>
> *We know that unchecked climate change is a huge risk to farm productivity and food security.*

[24] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/mitigation/cfi
[25] https://cer.gov.au/schemes/safeguard-mechanism#:~:text=The%20Safeguard%20Mechanism%20requires%20Australia's,must%20manage%20any%20excess%20emissions.
[26] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan, pp.21

> *But we are determined that the solutions and policies we propose will enhance food security, not damage it.*
>
> *Third, the agricultural and land sector will not be taken for granted to do the heavy lifting to offset emissions from other sectors that carry on with business as usual.*
>
> *We recognise the sector is an important source of carbon sequestration – and net land use is projected to be storing the equivalent of around 56 million tonnes of emissions a year by 2035. This provides economic opportunities for those farmers who are able and choose to pursue them, recognising that in-setting will be an important priority for farmers.*
>
> *But we're also very conscious of the land use issues with sequestration, including through carbon crediting, plus other demands for land use, such as feedstocks for low carbon fuels."*[27]

The Agriculture and Land sector plan' is one of the six sectoral plans under the 'Net Zero 2050' framework. A consultation document on the plan was released in November 2023, and at the time of writing, the Australian Government had not released a final version.[28]

Notably, agriculture is considered alongside the forestry sector under the category 'agriculture and the land'. This approach results in a consultation document that evaluates the risks and opportunities of both emissions categories together. Key extracts of the consultation document are:

"Undertaking plantings based on locally adapted planting protocols will ensure that the right species are planted for that area. This will increase the likelihood of successful outcomes, supporting climate resilience and enhancing co-benefits."[29]

> *"There will be trade-offs at the landscape scale that need to be considered in determining which lands are most appropriate for carbon stores, including aggregate impacts on agricultural production, food security and water availability (see section 5.2.4). Questions are also being raised about the extent to which sequestration offsets should be used within agriculture or sold to other sectors of the economy to offset their emissions. Climate change also needs to be considered given risks it presents to the capacity of land to accumulate and maintain stored carbon. For example, reduced water availability and increased fire risk can affect plant growth or cause direct losses of carbon stored in vegetation."*[30]

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[27]

[28] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan#toc_4

[29] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan,, pp.16

[30] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan, pp.16 -17

> *"Given Australian agriculture's export focus, the global context is highly relevant. Reducing emissions is a global challenge, and in line with the Paris Agreement, needs to be tackled in a way that does not threaten food production. As discussed in section 1.4, Australia has comparatively low emissions intensity beef and grain production and could play a role in supplying lower emissions intensive food into global markets (ABARES 2023a). Domestic and international opportunities and trade-offs around the use of land for carbon storage also need to be considered."*[31]

> *"There is also a strong interest from some parts of the industry in exploring alternative goals, as well as differentiated approaches to reporting on greenhouse gases, including methane. Reducing emissions of methane is important to limit peak warming scenarios and keep 1.5 degrees of warming within reach. Many countries, including the European Union and major agricultural commodity exporters such as the United States, Brazil and Indonesia, are prioritizing the reduction of methane. Agricultural methane makes up around 50% of Australia's total methane emissions. Reducing agricultural methane would contribute to Australia's commitment to the Global Methane Pledge, which aims to collectively reduce global methane emissions by 30% on 2020 levels by 2030."*[32]

The consultation document also includes the below four figures on current and future mitigation methods:

Table 1 Livestock technologies and practices

Established and scalable technologies and practices	Emerging technologies and practices
• Improved herd management	• Methane reducing feed supplements and forage feeds
• Improved pasture management	• Methane vaccines
• Genetics	• Early life programming
• Biogas capture and use systems	• Selecting for anti-methanogenic bioactives in forage and pasture species
• Application of urease inhibitors to manure	–
• Manure stockpile aeration, composting and pelletising	–

Table 2 Cropping and horticulture technologies and practices

Established and scalable technologies and practices	Emerging technologies and practices
• Slow-release and nitrification inhibitor coated fertilisers	• Plant genetics
• Optimised application in inputs including use of precision agriculture	• Low or zero carbon nitrogen fertilisers (from low or zero emissions hydrogen and ammonia production)
• Increased legumes in crop rotations	–
• Minimising field burning	–

[31] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan, pp.20
[32] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/ag-and-land-sectoral-plan, pp.21

Table 3 Fuel and energy technologies and practices

Established and scalable technologies and practices	Emerging technologies and practices
• On-farm renewable energy generation and integration with agricultural production systems, including solar grazing	• Other agrisolar applications, including with horticulture and apiculture
• Bioenergy generation, including manure bio-digestion and bagasse and wood cogeneration	• Battery electric and hydrogen fuel cells for on-farm machinery and vehicles
• Increased energy efficiency	• Greater utilisation of agricultural feedstocks for bioenergy and biofuel production
–	• Low or zero carbon fuel and gas production and use

Table 4 Carbon storage technologies and practices

Established and scalable technologies and practices	Emerging technologies and practices
• Planting and seeding native trees for carbon storage and other benefits	• Improving management of coastal (blue carbon) and freshwater (teal carbon) wetlands
• Farm forestry and plantation forestry for wood production	–
• Managing land to allow native forest to regenerate	–
• Cropping and pasture management practices including stubble retention, reduced or no tillage, cover cropping, pasture rejuvenation and use of green manures	–
• Strategic fire management in northern Australian	–

The approach of analysing the agriculture and land sectors together is not only taken by the Australian Government, a 2021 report by the Melbourne-based Grattan Institute also takes a similar approach.[33] This report states:

> *"This report considers the agriculture and land sectors together because more than half of Australia's land mass is used for agricultural activities. Agriculture sector emissions mainly come from animals, diesel use, fertiliser use, and crop residues. Land sector emissions are affected by the management of trees, plants, soil, and wetlands."*[34]

Australia does not have a price on GHG (including agriculture) but has a system in place to financially reward farmers for their carbon sequestration and emissions reductions, this is known as the Emissions Reductions Fund (ERF). The Australian Government describes the ERF as:

> *"Under the scheme, landowners and farmers who adopt approved ERF methods can earn Australian Carbon Credit Units (ACCUs). These units can be sold to the*

[33] https://grattan.edu.au/report/towards-net-zero-practical-policies-to-reduce-agricultural-emissions/ https://grattan.edu.au/report/towards-net-zero-practical-policies-to-reduce-agricultural-emissions/, pp. 11

government or on the secondary private market to generate additional income streams, while benefitting the environment."[35]

The ERF allows participants to gather credits for the following activities:

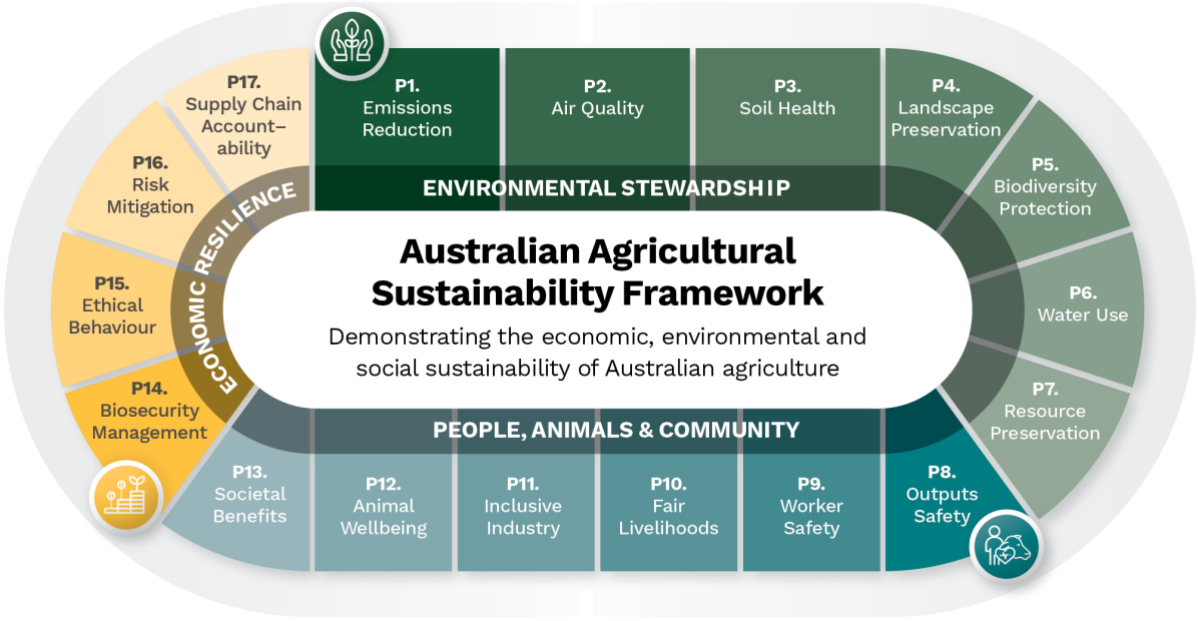
- *"Agriculture*
    - *Beef cattle herd management method*
    - *Estimating sequestration of carbon in soil using default values method*
    - *Estimation of soil organic carbon sequestration using measurement and models method*
    - *Fertiliser use efficiency in irrigated cotton method*
    - *Reducing greenhouse gas emissions in beef cattle through feeding nitrate containing supplements method*

- *Vegetation Management*
    - *Avoided clearing of native regrowth method*
    - *Designated Verified Carbon Standard projects method*
    - *Measurement based methods for new farm forestry plantations method*
    - *Plantation forestry method*
    - *Reforestation and afforestation 2.0 method*
    - *Reforestation by Environmental or Mallee Plantings – FullCAM method*
    - *Savanna fire management - 2018 emissions avoidance method*
    - *Savanna fire management - 2018 sequestration and emissions avoidance method*
    - *Tidal restoration of blue carbon ecosystems method"*[36]

Safeguards are also in place to avoid unsustainable large-scale plantation afforestation on productive farmland.[37]

The Australian Government financially supports standardising, measuring and harmonising voluntary industry sustainability initiatives through the Australian Agricultural Sustainability Framework (AASF). The Australian National Farmers Federation (NFF) leads the AASF, and the AASF is visualised in the below figure[38]

[35] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/mitigation/cfi
[36] https://www.dcceew.gov.au/climate-change/emissions-reduction/accu-scheme/methods
[37] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/climatechange/mitigation/cfi
[38] https://aasf.org.au/



Another noteworthy Australian initiative focused on agricultural and environment collaboration is the National Soil Strategy (2021 –2041). [39] Released in 2021, the strategy brings together a range of government, farming, academic and environmental stakeholders with the goal of improving soil health to achieve a wide range of benefits.

Objective 2d of the Strategy is to increase and maintain soil organic carbon. In November 2023, The Strategy released the first of four National Soil Strategy Action Plans, outlining four priorities. The first priority is to "*Develop an agreed national framework to support the measurement, monitoring, mapping, reporting and sharing of soil state and trend information to inform best practice management, decision-making, and future investment in soil.*"[40]

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's leading public science institution undertaking research into agriculture and climate change.[41] This research has included studying the effects of the seaweed Asparagopsis on livestock emissions and productivity. After positive results, CSIRO patented the practice and developed the research into the 'Future Feed' company.[42]

Canada

GHG Reduction Targets

Canada has two NDCs. They are:

1. To reduce GHG 40-45 percent of 2005 levels by 2030, and

[39] https://www.agriculture.gov.au/sites/default/files/documents/national-soil-strategy.pdf
[40] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/natural-resources/soils/national-soil-action-plan
[41] https://www.csiro.au/en/work-with-us/industries/agriculture
[42] https://www.csiro.au/en/research/animals/livestock/futurefeed

2. To achieve net zero GHG by 2050

Canada has no overall agriculture sector GHG reduction target.[43]

In 2021, the Canadian Government announced a set of climate policies and targets.[44] These targets and policies included a target to reduce absolute levels of GHG emissions arising specifically from fertiliser application by 30 percent below 2020 levels by 2030.[45]

GHG Reduction Strategies

Canada, a developed economy, attributes 80 percent of all emissions to the energy sector and 10 percent to agriculture. Emissions pricing is Canada's primary method of meeting its overall emissions reduction targets, implemented through a direct carbon tax on fuel use and an output-based pricing system that allows industrial emitters some flexibility in trading of units. However, neither agriculture nor forestry face a carbon price in Canada, and there are no plans to introduce one. Instead, agricultural policies are focused on incentives, as outlined below.

The most comprehensive document outlining Canada's policies to reduce emissions is the 2021 'Canada's Climate Actions for a Healthy Environment and a Healthy Economy' document.[46] The document outlines several measures aimed at reducing agricultural emissions, focusing on financial incentives to encourage farmers to adopt specific, voluntary behaviours and practices.

A core focus for Canada is to achieve a 30 percent reduction in nitrous oxide emissions from fertiliser and methane emissions across all sectors by 2030 relative to 2020 levels.

The policy to reduce fertiliser nitrous oxide remains in a consultation stage. A 'What We Heard' document published by the Canadian Government summarises the wide range of feedback received and the policy options still being explored. The focus remains on incentives, rather than pricing, to achieve the target.[47]

The Canadian Federation of Agriculture (CFA) has published a FAQ and expects the policy to result in support for voluntary measures to farmers, stating:

> *"How does Government plan on reaching this 2030 target?*
> *By increasing support for a number of existing approaches, including:*

[43] https://www.oag-bvg.gc.ca/internet/English/parl_cesd_202404_05_e_44472.html
[44] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/actions-healthy-environment-economy.html
[45] https://agriculture.canada.ca/en/department/transparency/public-opinion-research-consultations/share-ideas-fertilizer-emissions-reduction-target/discussion
[46] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/actions-healthy-environment-economy.html
[47] https://agriculture.canada.ca/en/department/transparency/public-opinion-research-consultations/share-ideas-fertilizer-emissions-reduction-target/discussion

- *Increased use of enhanced efficiency fertilisers and inhibitors*
- *Broader use of cover cropping and pulse crops, where applicable*
- *Transitioning from fall to spring applied fertiliser and increasing split application*
- *Greater adoption of precision agriculture techniques*
- *Nutrient management planning and funding for precision nutrient application technologies"*[48]

Agriculture is included in the 30 percent 2050 methane reduction target, but the oil and gas sector is the dominant focus of policies designed to meet this target. The oil and gas sector has been set the additional target of reducing methane by 75 percent of 2012 levels by 2030.[49] Canada has a large oil and gas industry; therefore, agriculture only makes up 27 percent of all Canadian methane emissions.

The 2022 document *'Faster and Further: Canada's Methane Strategy'* outlines Canada's plan to reduce methane.[50] Agricultural methane will be reduced with significant funding, including:

- *"$185 million to accelerate co-development, testing, adoption, dissemination, and monitoring of technologies and practices that sequester carbon and/or mitigate GHG emissions.*
- *$670 million to support immediate on-farm action to tackle climate change, including through actions to reduce methane emissions.*
- *$495.7 million to create an enabling environment for the development and adoption of clean technologies."*[51]

Canada is also developing protocols that will enable farmers to earn carbon credits for reducing emissions on farms, specifically:

- *"Protocol for Livestock Feed Management is being developed, which will credit methane reductions from livestock produced through enteric fermentation.*
- *Protocols for Livestock Manure Management and Anaerobic Digestion are also planned for subsequent development."*[52]

[48] https://www.cfa-fca.ca/fertilizer-emission-reduction-strategy-faq/
[49] https://www.pembina.org/blog/achievable-fair-amendments-canadas-methane-regulations#:~:text=These%20amendments%20support%20Canada's%20goal,serious%20associated%20air%20quality%20impacts.
[50] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reducing-methane-emissions/faster-further-strategy.html
[51] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reducing-methane-emissions/faster-further-strategy.html
[52] https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reducing-methane-emissions/faster-further-strategy.html

In 2022, Canada also began consultation on a 'Sustainable Agriculture Strategy' (SAS). The SAS aims to set a policy direction to improve various environmental indicators, including emissions reduction.[53] At the time of writing, the SAS was not finalised, but a summary of feedback was available.[54] The SAS does not propose repurposing or removing the subsidies and trade barriers that advantage Canadian farmers.

Canadian farmers do not receive large-scale subsidies directly for farming organically, but funding is available to assist with certification.[55]

At the provincial level, funding is available in Nova Scotia, Newfoundland and Labrador to protect soil health by implementing a nutrient plan, cover cropping or rotational grazing. [56]

While Canada has an emissions price on fuel, farmers are exempt from this price.[57] A bill is also proposed to enable farmers to receive an exemption for the emissions price faced on the energy used to carry out agricultural practices such as drying grain, irrigating and heating barns.[58]

The United States

GHG Reduction Targets

The United States (US) and its member states have committed to two NDCs. They are:

1. To reduce GHG 50-52 percent below 2005 levels by 2030
2. To achieve climate neutrality by 2050.[59]

The US has no agriculture-specific agricultural GHG reduction targets at the federal level, but California has set an agriculture-specific target, namely:

- To reduce methane from dairy and livestock by 40 percent below 2013 levels by 2030.

Other states have set state-level GHG reduction targets and have implemented policies to reduce agricultural GHG.

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[53] https://agriculture.canada.ca/en/department/transparency/public-opinion-research-consultations/sustainable-agriculture-strategy/what-we-heard-report-sustainable-agriculture-strategy

[54] https://agriculture.canada.ca/en/department/transparency/public-opinion-research-consultations/sustainable-agriculture-strategy/what-we-heard-report-sustainable-agriculture-strategy#e1

[55] https://acornorganic.org/groworganic/funding#:~:text=Canadian%20Organic%20Trade%20Association%20(COTA,costs%20up%20to%20%241000%20maximum.

[56] https://ofcaf.perennia.ca/

[57] https://www.canada.ca/en/revenue-agency/services/tax/excise-taxes-duties-levies/fuel-charge/relief.html

[58] https://www.taxpayer.com/newsroom/majority-of-canadians-want-carbon-tax-scrapped-on-farms

[59] https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%2021%202021%20Final.pdf#:~:text=URL%3A%20https%3A%2F%2Funfccc.int%2Fsites%2Fdefault%2Ffiles%2FNDC%2F2022

GHG Reduction Strategies

The United States (US) is the world's largest economy and the second-largest emitter of GHG. Agriculture accounts for about 10 percent of US GHG.

The US does not have a federal price on emissions and instead relies on state-based emissions pricing, private initiatives and Federal subsidies and regulations.

One example of a US state taking a proactive approach to agricultural GHG is California. California has a cap-and-trade ETS that covers GHG from the transport, power, building, and industrial sectors.[60]

Agriculture is not included in the ETS, but Californian farmers can apply for grants to reduce GHG by implementing technologies such as biodigesters and 'non-digester' practices that reduce methane.[61] In 2023, the Californian Government made $48 million USD available for such grants, and farmers could apply for up to $1.6 million USD.[62] These farmers can then also apply for carbon credits for the reduction in their methane emissions from using this technology under the Low Carbon Fuel Standard policy.[63]

US agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

At the federal level, US farmers have access to a wide range of subsidies that reduce emissions in the 'agricultural' section of the national inventory and emissions on farms but not in the 'agriculture' section of the US emissions inventory, such as by supporting renewable electricity generation.

These subsidies are funded through the 'Farm Bill', a large piece of legislation that sets out key policies relating to agriculture and food assistance. The Farm Bill's funding for the Natural Resources Conservation Service (NRCS) is most relevant to climate policy.[64]

The NRCS provides funding for farmers to undertake a range of Climate-Smart Agriculture and Forestry (CSAF) Mitigation Activities. These CSAF Mitigation Activities include:

- Brush management to improve wildlife habitat,
- Reduced till and no-till cropping
- Cover cropping
- Establishing diverse pastures
- Afforestation to improve habitat

[60] https://icapcarbonaction.com/en/ets/usa-california-cap-and-trade-program
[61] https://www.grants.ca.gov/grants/2023-dairy-digester-research-and-development-program/
[62] https://www.grants.ca.gov/grants/2023-dairy-digester-research-and-development-program/
[63] https://ww2.arb.ca.gov/sites/default/files/2022-04/dairy-ws-session-9-CARB.pdf
[64] https://www.fsa.usda.gov/programs-and-services/farm-bill/index

- Establishing riparian margins and buffer strips
- Upgrading irrigation infrastructure
- Applying mulch
- Converting cropland to grassland to reduce soil erosion
- Establishing wildlife corridors
- Undertaking livestock grazing management that benefits plant productivity
- Transitioning to organic farming
- Undertaking livestock grazing to improve soil carbon.[65]

The NRCS also provides funding for the following CSAF Mitigation Activities if additional steps are followed in implementation:

- Waste storage structures
- Biogas capture infrastructure
- Prescribed burning
- Converting machinery to electric-powered
- Converting farm vehicles to electric-powered
- Replacing irrigation channels with pipes
- Switching from high to low-pressure irrigation systems
- Variable rate irrigation
- Replacing sprinkler heads
- Draining rice paddies
- Replacing pumps with high efficiency pumps
- Adjusting livestock diets to reduce GHG
- Adding additives to livestock diets to reduce GHG
- Restoring rare or declining natural communities (such as beaver dams)
- Wetland restoration,[66]

The NRCS also provides for the Regional Conservation Partnership Program (RCPP), a 'partner-driven approach to conservation that funds solutions to natural resource challenges on agricultural land'.[67] The USDA describes the RCPP programme as:

> *"RCPP projects fall under two different categories: RCPP Classic and RCPP Alternative Funding Arrangements (AFAs). RCPP Classic projects are implemented using NRCS contracts and easements with producers, landowners and communities, in collaboration with project partners. Through RCPP AFAs, NRCS provides funding to partners to support conservation activities with eligible producers and landowners on eligible land. RCPP AFA funding reimburses partners for conservation activities done for or on behalf of producers, landowners, or other entities."*[68]

[65] https://www.nrcs.usda.gov/sites/default/files/2023-10/NRCS-CSAF-Mitigation-Activities-List.pdf
[66] https://www.nrcs.usda.gov/sites/default/files/2023-10/NRCS-CSAF-Mitigation-Activities-List.pdf
[67] https://www.nrcs.usda.gov/programs-initiatives/rcpp-regional-conservation-partnership-program
[68] https://www.nrcs.usda.gov/programs-initiatives/rcpp-regional-conservation-partnership-program

The RCPP's collaborative approach is well-funded, aims to achieve a range of environmental outcomes, and has been widely adopted by US farmers. In 2023, over $1 billion USD was provided to RCPP projects, and these projects included:

- *"77 climate-focused projects ($1.02 billion in funding).*
- *22 projects focused on water quantity and conservation (more than $338 million in funding).*
- *Three RCPP Classic projects are led by Tribes (more than $58 million in funding).*
- *16 projects support the protection and restoration of wildlife corridors ($216 million in funding).*
- *10 projects focus on urban agriculture ($123 million in funding)."*[69]

Farmers and landowners in some USA states may also be able to generate carbon credits from forestry activities, which often come with prescriptive requirements for broader social and biodiversity co-benefits.[70]

The most significant recent piece of legislation designed to reduce GHG in the USA is the 2022 Inflation Reduction Act (IRA), a misnomer and a 700-page piece of legislation that will spend hundreds of billions of dollars subsidising a wide range of climate-friendly practices, technologies and infrastructure projects.[71]

The IRA includes the following provisions directly relating to agricultural emissions:

- An additional $19.5 billion USD towards the NRCS.
- An additional $14 billion to support developing and directly subsidising renewable energy and biofuels infrastructure in rural areas.[72]

The US Farm Bill needs to be updated in 2024, and negotiations are underway. As a part of these negotiations 'Advancing climate policies' have been named as a priority issue by Democrats.[73]

The US Government is coordinating the many initiatives and policies designed to reduce agricultural emissions through the United States Department of Agriculture (USDA) Climate Smart Agriculture and Forestry Strategy. The USDA is currently consulting on the strategy but, in a 90-day progress report, emphasises the voluntary and partnership nature of the strategy, stating:

> *"It will be multi-pronged and centred on voluntary incentives that benefit producers and landowners. We will look across climate science and research, forest health, outreach and education, existing programs, and new and emerging markets to advance climate-smart agriculture and forestry. All of this must be*

[69] https://storymaps.arcgis.com/stories/2968b2ee360e464f93f1b1eae108b533
[70] https://ww2.arb.ca.gov/sites/default/files/2021-10/nc-forest_offset_faq_20211027.pdf
[71] https://www.wri.org/update/brief-summary-climate-and-energy-provisions-inflation-reduction-act-2022
[72] https://www.usda.gov/media/press-releases/2024/08/16/biden-harris-administration-invests-domestic-biofuels-and-clean
[73] https://www.vnf.com/key-farm-bill-reauthorization-priorities-officially-laid-on-the-table

> *done in partnership with landowners, producers, state and local governments, Tribes, and other stakeholders across agriculture and forestry."*[74]

In mid-2024, the USDA approved the use of the livestock feed GHG inhibitor Bovaer for use in the US, Canada, and Mexico.[75] The maker of Bovaer, DSM, has partnered with Elanco to distribute Bovaer and Elanco plans to link the use of Bovaer to the creation of carbon credits, stating:

> *"Dairy farmers incorporate Bovaer into their rations and quantify the effect using carbon market-friendly tools like UpLook™ by Elanco, an insights-based engine designed to quantify greenhouse gas emissions reductions. The tool utilizes on-farm data and peer-reviewed science to identify key drivers of an operation's carbon footprint and track the progress of sustainability efforts. UpLook connects seamlessly to Athian, the first-of-its-kind livestock carbon inset marketplace. This seamless process allows farmers to quantify their emissions reduction efforts and certify carbon credits for sale. In addition to the carbon marketplace, the U.S. Department of Agriculture has awarded $89 million in funding to support farms using technologies like Bovaer to reduce their methane emissions."*[76]

The USDA has also recently completed a report for Congress detailing the status of voluntary carbon markets and the potential role the USDA could play in providing data on areas such as soil carbon stocks.[77]

The United Kingdom

GHG Reduction Targets

The United Kingdom (UK) has committed to two NDCs. They are:

1. To reduce GHG to 68 percent below 1990 levels by 2030, and
2. To achieve climate neutrality by 2050.[78]

The UK has no agriculture-specific GHG reduction targets, stating:

> *"There are currently no sector-specific targets for emission reductions, and due to the nature of agricultural production, it is unlikely the agricultural sector as a whole will be able to achieve zero greenhouse gas emissions. The sector could contribute towards the net zero target however, through reducing direct*

[74] https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf
[75] https://www.elanco.com/en-us/insights/elanco-announces-fda-has-completed-review-of-bovaer-first-in-class-methane-reducing-feed-ingredient-for-u-s-dairy-industry
[76] https://www.elanco.com/en-us/insights/elanco-announces-fda-has-completed-review-of-bovaer-first-in-class-methane-reducing-feed-ingredient-for-u-s-dairy-industry
[77] https://www.insideenergyandenvironment.com/2023/11/usda-releases-carbon-markets-assessment-setting-stage-for-technical-assistance-program/
[78] https://unfccc.int/sites/default/files/NDC/2022-06/UK%20Nationally%20Determined%20Contribution.pdf

emissions from farming, increasing carbon sequestration on farmland, and reducing emissions from other sectors by producing renewable energy/fuels. The main emissions are methane from livestock (mostly ruminants – cattle and sheep) and nitrous oxide from manures and mineral fertiliser use."[79]

GHG Reduction Strategies

The UK is a developed economy, and about 10 percent of total emissions are from agriculture. The UK left the EU in 2020 and has since designed alternatives to key EU policies such as the EU ETS and EU CAP.

After leaving the EU, each constituent country of the UK replaced the EU CAP with another large-scale agricultural support policy; these policies are in various stages of development and are:

- The Environmental Land Management Scheme (ELMS) in England
- The Sustainable Farming Scheme (SFS) in Wales
- The Farm Sustainability Payment (FSP) in Northern Ireland
- Preparing for Sustainable Farming (PSF) Scheme in Scotland.[80]

These schemes are slowly replacing Basic Scheme Payments (BPS), the policy used to administer EU CAP funds to UK farmers. The PSF Scheme is intended to assist farmers in gathering data and focusing more on carrying out environmental-related activities.

Overall, UK agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

The UK has an ETS, but agriculture is not part of it and there are no intentions to include it.

England

The English ELMS policy is gradually replacing the Basic Agricultural Payments (BAP). It provides £2.4 billion annually to farmers via the Sustainable Farming Incentive (SFI), the Country Stewardship (CS) policy and the Landscape Recovery policy. The SFI and CS policies broadly pay farmers for carrying out environmental activities while also farming (the government plans on merging these two policies), while the Landscape Recovery policy pays farmers for undertaking large-scale land use change to benefit the environment.[81]

Activities that qualify for payment under the SFI policy are extensive and include:

- Testing soil organic matter
- Maintaining a herbal ley
- Carrying out No-till cropping

79 https://committees.parliament.uk/writtenevidence/105593/html/#:~:text=In%20June%202019%2C%20the%20Government,10%25%20agricultural%20fuel%20use.

80 https://www.gov.scot/news/continuing-cap-for-scotlands-farmers/

81 https://www.nfuonline.com/updates-and-information/everything-you-need-to-know-about-elms/

- Maintaining a riparian margin
- Converting to organic farming
- Providing habitat for native birds
- Cover cropping
- Producing a nutrient management report
- Grazing grassland with cattle
- Removing cattle from grassland in Autumn and Winter
- Precision farming
- Managing grassland to reduce nitrogen leaching.[82]

English farmers can apply to receive these payments and sign an agreement to carry out the activity for the duration of the contract, generally three years.

Wales

The Welsh Sustainable Farming Scheme (SFS) will be introduced in 2025, and the BPS will be phased out from 2025 to 2029.

The SFS will be voluntary, but farmers that opt into the scheme must have at least 10 percent of their farm managed as habitat and at least 10 percent in tree cover. SFS participants must also carry out 17 tasks that include undertaking a farm plan, testing soil, maintaining cover crops and managing pests.[83]

Farmers who opt-in to the SFS can also optionally receive payments for carrying out several actions that include:

- Growing crops to reduce bought-in feed
- Capital support to lower ammonia emissions by better animal waste management
- Capital support to reduce the GHG of farm machinery
- Plant trees or hedgerows
- Establish riparian margins
- Establish public walking paths
- Establishing rotational cropping.[84]

Northern Ireland

In Northern Ireland, the Farm Sustainability payment (FSP) will replace the BAP in 2026 following a one-year transition period. The FSP is intended to be a basic income supplement for farmers. The Northern Irish Government wants to decrease funding for this program over time as funding for other schemes within the overall 'Farm Support and Development Program (FSDP) increases.[85]

[82] https://www.gov.uk/find-funding-for-land-or-farms
[83] https://www.gov.wales/sites/default/files/consultations/2023-12/sustainable-farming-scheme-consultation-document_0.pdf#page=15
[84] https://www.gov.wales/sites/default/files/consultations/2023-12/sustainable-farming-scheme-consultation-document_0.pdf#page=85
[85] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Future%20Agricultural%20Policy%20Decisions%20for%20Northern%20Ireland%20%28Final%29%20%28002%29.pdf

To qualify for the FSP, farmers need to meet a number of requirements, including participation in the Soil Nutrient Health Scheme (SNHS). The Northern Irish Government describes the SNHS as:

> *"DAERA is investing £37 million in the SNHS over four years. This scheme provides farmers with the nutrient status of every field across their farm and a baseline estimate of the amount of carbon stored in their soils, hedgerows, and trees. Ultimately, the aim of the SNHS, which is running until 2026, is to improve sustainability and efficiency in the farming sector."*[86]

'Farming with Nature' is another FSDP scheme set to be introduced by the Northern Irish Government alongside the FSP. 'Farming with Nature' plans to pay farmers for undertaking sustainable farming practices such as the following:

- Reducing the number of older cattle for slaughter
- Improve suckler cow productivity
- The use of methane-reducing feed additives
- The use of more environmentally efficient cattle (to be progressed through the Ruminant Genetics programme)
- The use of urea inhibitors
- The appropriate application of fertilisers and slurry
- The establishment of grassland swards with legumes and herbs that reduce fertiliser use
- Peatland rewetting
- Producing biomethane and biohydrogen from agricultural waste
- Forestry
- Agroforestry
- The establishment of hedgerows
- Soil carbon[87]

Scotland

Scotland is currently providing farmers with payments that mirror the EU CAP in an interim basis.[88] The Scottish Government has stated that when the new agricultural support regime is implemented in 2025, at least half of all payments will be tied to improving biodiversity and reducing emissions.[89]

[86] https://cawood.co.uk/blog/the-soil-nutrient-health-scheme-in-northern-ireland-whats-changed/#:~:text=This%20scheme%20provides%20farmers%20with,efficiency%20in%20the%20farming%20sector.

[87] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Future%20Agricultural%20Policy%20Decisions%20for%20Northern%20Ireland%20%28Final%29%20%28002%29.pdf

[88] https://www.gov.scot/news/continuing-cap-for-scotlands-farmers/

[89] https://www.ruralpayments.org/topics/agricultural-reform-programme/preparing-for-sustainable-farming--psf--full-guidance/

The Scottish PSF scheme aims to help farmers prepare for the new agricultural support scheme in 2025. The PSF provides funding for farmers to carry out a carbon audit, soil mapping, and analysis, as well as to provide animal health and welfare interventions.[90]

Scotland also incentivises farmers to improve environmental outcomes via the Agri-Environment Climate Scheme (AECS).[91] The AECS subsidises farmers for:

- Slurry storage infrastructure,
- Organic farming
- Irrigation infrastructure
- Rotation cropping
- Riparian margins
- Establishing biodiversity habitat
- Wetland management
- Hedgerows
- Pest control.[92]

In addition to the four devolved EU CAP replacement policies being rolled out in the UK, the 2023 'Carbon Budget Delivery Plan' includes an exhaustive list of practices that the UK Government expects to reduce emissions in the future (both costed and uncosted).[93]

The European Union (EU)

GHG Reduction Targets

The EU and its member states have committed to two NDCs. They are:

1. To reduce GHG 55 percent below 1990 levels by 2030, and
2. To achieve climate neutrality by 2050

In 2024, The European Commission recommended setting a net target of reducing GHG by 90 percent by 2040.[94] There are reports that an earlier draft of this plan included a target for agriculture to reduce non-CO_2 emissions by 30 percent of 2015 levels by 2040, but there was no target to reduce agricultural GHG in the final version.[95] To become law, this 2040 target needs to be approved by the new European Commission, the European Council and the European Parliament.

[90] https://www.ruralpayments.org/topics/agricultural-reform-programme/preparing-for-sustainable-farming--psf--full-guidance/
[91] https://www.ruralpayments.org/topics/all-schemes/agri-environment-climate-scheme/
[92] https://www.ruralpayments.org/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/
[93] https://assets.publishing.service.gov.uk/media/6424b2d760a35e000c0cb135/carbon-budget-delivery-plan.pdf
[94] https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en
[95] https://www.euractiv.com/section/agriculture-food/news/eu-commission-backtracks-on-agricultural-emissions-cuts/

Along with these EU-wide NDCs, there are member state-level National Energy and Climate Plans (NECPs), a plan published by each EU member on how it will achieve climate targets.[96]

Each EU member state must complete a NECP every two years, and the second set of final NECPs must be filed by 30 June 2024. However, only four EU member states (Sweden, Denmark, the Netherlands and Finland) submitted these updated plans on time. Austria has still not submitted a draft updated NECP, missing the 30 June 2023 deadline by over a year.[97]

GHG Reduction Strategies

The EU is the third largest GHG emitter in the world, and agricultural emissions make up about 10percent of the total. The EU was the first jurisdiction to introduce an ETS, and the EU plans to meet its GHG reduction targets through a combination of pricing and regulation.

The European Commission commissioned a study in 2023 on how to price agricultural emissions.[98] The independent study examined five options for establishing an ETS separate from the existing EU ETS, including agricultural emissions and carbon sequestration. At the time of writing, no decision has been made to include either agriculture or forestry in the EU ETS, but political momentum has stalled.

EU agriculture GHG policy is currently based on incentives and regulations; there are no plans to price agricultural GHG at this stage. Rather than using pricing, the EU is aiming to reduce agricultural GHG through subsidies.

The EU CAP was reformed in 2021 to support farmers based on production and area and to support environmental goals.

The 2023 – 2027 EU CAP has 10 broad objectives that include 'climate change action', 'environmental care' and 'conserve landscapes and biodiversity'.[99] Each EU member country implements the EU CAP differently through 'Strategic Plans'.

Of particular note is the inclusion of DSM's Bovaer methane inhibitor in the Flanders region of Belgium and Slovenia, which subsidise its use by 25 and 60 euros per cow per year, respectively.[100]

[96] https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en
[97] https://ember-climate.org/insights/in-brief/draft-necps-put-eu-shortofrepowereu/
[98] https://climate.ec.europa.eu/news-your-voice/news/looking-how-mitigate-emissions-agriculture-2023-11-13_en
[99] https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27/key-policy-objectives-cap-2023-27_en
[100] https://www.farmersjournal.ie/news/news/methane-reducing-feed-additive-could-cost-110-cow-yearly-735391

Several conditional requirements are common among members. These conditional requirements focus on soil carbon and are; maintaining a minimum amount of soil cover, maintaining permanent pastures and protecting wetlands.[101]

The current EU CAP also contains provisions for 'Eco Schemes'. The European Commission describes Eco Schemes as:

> *"Eco-schemes support farmers who adopt or maintain farming practices that contribute to EU environmental and climate goals. Through eco-schemes, the EU rewards farmers for preserving natural resources and providing public goods, which are benefits to the public that are not reflected in market prices."*[102]

Actions that Eco Schemes can financially support also vary significantly between EU members but include:

- Organic farming
- The reduced use of pesticides
- Reduced use of synthetic nitrogen fertiliser
- Soil sampling
- Rotational cropping
- Precision fertiliser or plant protection application
- Increasing crop sward diversification
- Cover cropping
- Intercropping with pollinator-friendly crops
- Use of advanced slurry spreading technology
- Use of a nutrient plan.[103]

A third aspect of the EU CAP relevant to climate policy is rural development initiatives. 35 percent of an EU member's rural development funding must go to initiatives with a climate or environmental benefit. Member states can spend rural development funding on programs that contribute towards a broad range of goals, including:

- *"Enhancing the viability and competitiveness of all types of agriculture, and promoting innovative farm technologies and sustainable forest management;*
- *promoting resource efficiency and supporting the shift toward a low-carbon and climate resilient economy in the agriculture, food and forestry sectors;*

[101] https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/climate-change_en#cap-actions
[102] https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/eco-schemes_en
[103] https://onlinelibrary.wiley.com/doi/10.1111/1746-692X.12352

- *restoring, preserving and enhancing ecosystems related to agriculture and forestry."*[104]

It is unclear how effective these measures are in driving behaviour change, but a report on the previous EU CAP period (2014 to 2020) found that the 104 billion euros allocated to climate mitigation, about 24 percent of CAP spending, had little effect on agricultural emissions.[105] The current funding rural development funding period is from 2021 to 2027.

The final report of the Strategic Dialogue on the future of EU agriculture was released in September 2024. The Strategic Dialogue, launched in January 2024 by President of the European Commission Ursula von der Leyen, brought together 30 stakeholders in the agriculture sector (including farmer organisations, agribusiness, environmental NGOs and trade unions) to shape a shared vision for EU farming.

The final report, titled "A *shared prospect for farming and food in Europe"* will be used to guide a vision document produced in the first 100 days of the new von der Leyen Presidency.[106] Recommendations of the report include:

> *"Financial support to environmental and climate actions will need to substantially increase annually throughout the following two CAP periods, starting from the current share of budget for eco-schemes and agri-environmental and climate instruments…*
>
> *A Temporary Just Transition Fund should be established outside the CAP to complement support for the sector's swift sustainability transition. The public and private sectors should better cooperate to mobilize capital for projects that enable both small- and large-scale farmers and food system stakeholders to transition towards sustainable practices and s system…*
>
> *While recognizing that an ambitious policy is needed, the Strategic Dialogue considers it is premature to draw any definitive conclusions on a potential future Emissions Trading System for agriculture and calls the European Commission to further work with stakeholders and experts to assess the feasibility and relevance of such a system. Fundamental concerns of such a system are also identified."*[107]

[104] https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development_en
[105] https://op.europa.eu/webpub/eca/special-reports/cap-and-climate-16-2021/en/#:~:text=The%20CAP%20supports%20farmers%20who,land%20ineligible%20for%20direct%20payments.
[106] https://ec.europa.eu/commission/presscorner/detail/en/ip_24_4528
[107] https://agriculture.ec.europa.eu/document/download/171329ff-0f50-4fa5-946f-aea11032172e_en?filename=strategic-dialogue-report-2024_en.pdf

Along with regulations related to the provision of subsidies under the EU CAP, several environmental regulations impact European farmers and include climate action as a potential benefit. These regulations are complex and include:

- The Biodiversity Strategy for 2030
- The Farm-to-Fork Strategy
- The Circular Economy Strategy
- The Forest Strategy
- The Nitrates Directive
- The Water Framework Directive
- The Soil Thematic Strategy
- The Sustainable Use of Pesticides Directive
- The Renewable Energy Directive
- The Habitats Directive
- The Regulation on Deforestation Free Supply Chains
- The Nature Restoration Law

The 'Horizon Europe' program is the main public funding initiative for research and development in the EU. The current funding period the is from 2021 to 2027 and provides 95.5 billion euros. The overall program is divided into 'clusters', and the sixth cluster is 'Food, Bioeconomy, Natural Resources, Agriculture and Environment', which is allocated 9 billion euros.[108] In addition to cluster six, Horizon Europe also includes the EU Mission: 'A Soil Deal for Europe', with a budget of around €825 million .[109]

Ireland

GHG Reduction Targets

Ireland has committed to two NDCs. They are:

1. To reduce GHG by 51 percent below 2018 levels by 2030, and
2. To achieve climate neutrality by 2050.[110]

Ireland has also set the following agriculture-specific GHG reduction targets:

- To reduce overall agricultural GHG by 25 percent below 2018 levels by 2030. As no sequestration is included in this category, the target could be considered as 'gross'.
- Sitting below this overall agricultural target are more specific targets, namely:
    - To limit total synthetic nitrogen fertiliser use to 800 000 tonnes by 2025 and 2030 (from 408,000 t in 2018)

[108] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-6-food-bioeconomy-natural-resources-agriculture-and-environment_en
[109] https://eu-cap-network.ec.europa.eu/horizon-europe-creating-knowledge-and-innovation-sustainable-agriculture-forestry-and-rural_en
[110] https://www.climate-resource.com/tools/ndcs/countries/irl?version=

- To replace 80-90 percent of Calcium Ammonium Nitrate (CAN) with protected Urea by 2025 and 90 - 100 percent by 2030
- Finishing beef cattle at 24-25 months average by 2025, and 22 – 23 months by 2030
- Produce up to 1 TWh of Biomethane by 2025, 5.7 TWh by 2030
- Target 250,000 ha of organics by 2025, 450,000 ha by 2030
- Target 360,000 ha of tillage (horticulture and arable) by 2025, 400,000 by 2030[111]

Ireland has not set a 2030 sectoral LULUCF target (although it is expected to be between 37 percent and 58 percent below 2018 levels). LULUCF includes GHG from 'Land Use, Land-Use Change and Forestry', and while not including direct agricultural GHG the category includes GHG from farming on carbon-rich drained soils or from deforestation. While not having an overall LULUCF target in place, Ireland has set the following sub-sectoral targets for the LULUCF sector:[112]

- Afforestation rate of 8,000 ha per year to 2025 and 2030
- Plant 45,000 ha of cover crops by 2025 and 75,000 ha by 2030
- 60,000 ha of cereal area to incorporate straw directly into soil by 2025 and 85 000 ha by 2030
- 200, 0000 ha of mineral grassland managed better to improve sequestration, and 450, 000 ha by 2030
- 25,000 ha of grasslands on drained organic soils with reduced management intensity, 80,000 ha by 2030
- 33,000 ha of peatlands rehabilitated with 35,900 ha by 2030.[113]

While several initiatives aim to reduce enteric methane emissions, no specific goals are set for reducing them or promoting practices to reduce GHG.

GHG Reduction Strategies

Ireland is a developed economy with a large agriculture and relatively small industrial sectors. Agriculture comprised 37 percent of Ireland's total emissions in its provisional 2023 emissions inventory.[114] As a member of the EU, Ireland's domestic aviation, maritime, energy and industrial emissions are priced via the EU ETS.[115]

Ireland's 2024 Climate Action Plan outlines its overall GHG reduction strategy.[116] This Plan sets specific sectoral and sub-sectoral targets to contribute toward Ireland's overall target and details policies to meet these sectoral targets.

[111] https://assets.gov.ie/296414/7a06bae1-4c1c-4cdc-ac36-978e3119362e.pdf, 285
[112] https://www.teagasc.ie/environment/climate-action/the-climate-challenge/
[113] https://assets.gov.ie/296414/7a06bae1-4c1c-4cdc-ac36-978e3119362e.pdf, pp.319
[114] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/agriculture/
[115] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/
[116] https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Irish agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

The 2024 Climate Action Plan outlines actions to help meet these targets, including:

- Subsidise the establishment of multi-species swards and clovers in pastures
- Funding organic farm advisors
- Improved nitrogen use through nitrate regulations, including a compulsory liming program, use of low-emission slurry spreading, grassland management training, nutrient management plans, and soil sampling.
- Review the synthetic nitrogen fertiliser cap
- Subsidise adoption of low emissions slurry spreading systems;
- Supporting the transition to organic farming.
- To continue the support of the 'Green Breed' program to breed low-methane livestock
- Putting in place policy incentives for low emissions feed and fertiliser once available
- Support through land use change, including through 'incentivised voluntary livestock reductions.'
- Subsidise the conversion to organic farming by EU CAP subsidies
- Subsidise the conversion to tillage (horticulture and arable) farming by EU CAP subsidies
- Mandate the use of indigenously produced biomethane
- Create a 'carbon farming framework'

The Carbon Farming Framework is a government policy designed to facilitate a market to recognise land-based carbon sequestration in areas including soil carbon, forestry and peatlands.[117]

Irish farmers can also access livestock agriculture support programs such as the Beef Environmental Efficiency Programme – Suckler (BEEP – S), the National Dairy Beef Welfare Scheme and the Sheep Improvement Scheme.[118] These policies are primarily designed to improve animal welfare but reference environmental co-benefits.

The measures designed to achieve Ireland's agricultural reduction targets are also detailed in the 2020 document. 'Ag Climatise - A Roadmap towards Climate Neutrality'.[119]

The Netherlands

GHG Reduction Targets

[117] https://www.gov.ie/pdf/?file=https://assets.gov.ie/271336/32f6d188-b9a5-44ed-afa5-0d4f98b2a2ae.pdf#page=null
[118] https://www.gov.ie/en/service/a52418-beef-environmental-efficiency-pilot-beep/
[119] https://www.gov.ie/en/publication/07fbe-ag-climatise-a-roadmap-towards-climate-neutrality/

The Netherlands has two NDCs, they are:

1. To reduce all GHG 49 percent below 1990 levels by 2030, and
2. To reduce all GHG 95 percent below 1990 levels by 2050.[120]

The Netherlands has an agriculture sector GHG target of 6mt CO_2e by 2030. Within this overall target for agriculture, there is a target to reduce N2O emissions by 12-70 percent (depending on the region) and to reduce methane emissions by 30percent by 2030.[121] These targets can also be expressed as a CO_2e target of 25percent for the agriculture and horticulture sectors and a 58percent reduction for the land sector based on 2021 levels.

The Dutch Government has also legislated a 'Climate Agreement' which includes 'innovation tracks' for:

- *"The reduction of greenhouse gas emissions in the production of food and non-food by 2050;*
- *the advancement of the national and regional extent to which activities are land-based, in parallel with the creation of closed cycles;*
- *the net production of renewable energy from the agriculture, horticulture and forestry sectors;*
- *the organisation of Dutch land and water surfaces for carbon capture and use, cutting the climate impact of purchasing decisions by Dutch consumers in half by 2050."*[122]

The 2023 elections resulted in a change in the Dutch Government, and many commentators expect a new Government to alter the above agricultural environmental policies.[123]

GHG Reduction Strategies

The Netherlands is a developed economy with a large export-orientated agriculture sector. Agriculture makes up about 14 percent of total emissions.[124] As a member of the EU, domestic aviation, maritime, energy and industrial emissions are priced via the EU ETS.[125]

Dutch agriculture GHG policy is based on incentives, regulations and voluntary farm buy-outs; there are no plans to price agricultural GHG at this stage.

[120] https://www.government.nl/topics/climate-change/climate-policy
[121] https://fas.usda.gov/data/netherlands-government-presents-national-program-reduce-nitrogen-greenhouse-gas-emissions
[122] https://www.klimaatakkoord.nl/
[123] https://www.freiheit.org/shine-coming-new-dutch-government-it-has-even-started
[124] https://www.researchgate.net/figure/Trends-of-greenhouse-gas-emission-by-agriculture-in-the-Netherlands_fig3_331658719#:~:text=Although%20its%20agricultural%20system%20is,its%20food%20system%20a%20key
[125] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

A key piece of climate policy in the Netherlands is the 2019 'Climate Agreement'. This agreement was signed by the Dutch Government, industry groups, and environmental NGOs to meet the Netherlands' NDCs. It is 247 pages long and comprehensively outlines targets, strategies, and policies to meet climate targets.

More information on the Netherlands' overall climate strategy can be found in its NECP submitted to the EU.[126]

The Dutch Climate Agreement takes a holistic approach to the agriculture and land sector, aiming to reduce emissions and achieve other goals. The goals of the agriculture section of the Agreement are:

- *"The reduction of greenhouse gas emissions in the production of food and non-food by 2050;*
- *the advancement of the national and regional extent to which activities are land-based, in parallel with the creation of closed cycles;*
- *the net production of renewable energy from the agriculture, horticulture and forestry sectors;*
- *the organisation of Dutch land and water surfaces for carbon capture and use; cutting the climate impact of purchasing decisions by Dutch consumers by half by 2050."*[127]

The Agreement is also explicit that the Paris Agreement is primarily concerned with reducing emissions, but not at any cost, stating:

> *"This vision, and the corresponding innovation tracks, will operationalise the targets and objectives of the Paris Agreement – which, in addition to climate adaptation and mitigation, also deal with eradicating world hunger and the conservation of ecosystems and forests – for the Netherlands in qualitative terms."*[128]

The Agreement focuses on reducing agricultural emissions in ways that extend beyond the 'agricultural' sector under UNFCCC accounting guidelines, stating:

> *"The aim for 2030 consists of achieving a CO_2-eq reduction of 6 Mt in the Netherlands. In addition, climate gains can be made through the contribution of energy generation, less intensive tillage and more sustainable trac tors and through limitation of the import of feedstocks from abroad. This is also in line with the government's aim to draw up an additional 0.5 Mt in land use emissions. This additional commitment of the parties to the Sector Platform will furthermore contribute to a potential increase of the national reduction target to 55% by*

[126] https://commission.europa.eu/publications/netherlands-final-updated-necp-2021-2030-submitted-2024_en
[127] https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands, pp.124
[128] https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands

> *2030. Agriculture and horticulture do not always get recognition for their contribution to carbon reduction."*[129]

The Agreement expresses a preference for 'technical measures over measures that curb volumes' and includes funding for the following technical measures through to 2030:

- 252 million euros for livestock measures including
  - Precision fertiliser application
  - Low emissions dairy housing
  - Lifespan extension and selection of dairy cattle
- 100 million euros for livestock farmers farming near environmentally sensitive areas
- 276 million euros to reduce emissions from 'peat meadow areas'
- 28 million euros to reduce emissions from agricultural soils
- 51 million euros to reduce emissions from forestry
- 250 million euros to reduce emissions from greenhouse horticulture
- 13 million euros to reduce emissions from food waste

The Agreement chapter covering agriculture and Land-Use (chapter 4) is complex and detailed and is open to the value judgements and trades necessary to meet the stated goals. A novel approach taken in the agreement is the expressed preference for measures that involve the 'closure of cycles at the smallest and most appropriate scale possible'; this refers to the need to close cycles in areas such as nutrients and waste.

As an EU member state, Dutch farmers receive subsidies through the EU CAP; in the Netherlands, the CAP subsidies include voluntary 'eco-activities that use EU CAP 'Eco Scheme funds. Dutch Government websites that provide information on CAP schemes only have information in Dutch, and DeepL has been used to translate text into English. In the Netherlands, there are 25 very prescriptive 'eco activities' for which pasture livestock farmers can receive funding. including:[130]

- Planting nitrogen-fixing crops
- Minimising pesticide and fertiliser use
- Precision application of fertiliser
- Maintaining non-productive woodland, grassland or buffer strips
- Enabling cows to graze at least 1500 or 2500 hours.[131]

The 'Quality Boost for Nature and Landscapes' (SKNL) program also funds Dutch farmers to improve the environment. SKNL will subsidise farmers for:

[129] https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands, pp.126
[130] https://www.rvo.nl/onderwerpen/glb-2024/eco-regeling/eco-activiteiten#overzicht-eco-activiteiten
[131] https://www.rvo.nl/onderwerpen/glb-2024/eco-regeling/eco-activiteiten#overzicht-eco-activiteiten

- The investment required to improve an area's natural quality, such as 'planting a forest, digging a pond, or creating a nature-friendly bank.'
- The loss of land value if productive agricultural land is covered into unproductive land for environmental purposes.[132]

The Netherlands also provides subsidies to voluntarily buy out livestock farmers who are farming in areas with high nitrate levels.[133] This program is called the 'National Termination Scheme for livestock farming locations with peak loads' (Lbv-plus), and funding includes subsidies for the government to buy out farmers up to 120 percent of the value of lost productive land and 45 euros per square metre of the animal shelter.[134] The USDA estimates the total cost of this buy-out policy to be about 1 billion euros.[135]

At the time of writing, it is expected that the newly elected 2024 Dutch Coalition government, including the 'Netherlands Farmers Citizen Movement party', will ease environmental regulatory pressures on farmers, but it is unclear how.[136]

Denmark

GHG Reduction Targets

Denmark has committed to two NDCs. They are:

1. To reduce GHG by 70 percent below 1990 levels by 2030, and
2. To achieve climate neutrality by 2045.[137]

In 2021, the Danish Government set a target to reduce agricultural emissions by 55-65 percent below 1990 levels by 2030.[138]

Legislation known as 'The Green Transition for the Agriculture Sector' and a recent 'Green Tripartite" agreement between the Danish Government and key environmental and farmer organisations outline a commitment to implement many environmental targets by 2030 to meet the overarching Danish and agricultural-specific climate targets.

These targets include:

- The Green Transition for the Agriculture Sector

[132] https://www.rvo.nl/subsidies-financiering/kwaliteitsimpuls-natuur-en-landschap-sknl
[133] https://www.rvo.nl/onderwerpen/agrarisch-ondernemer-minder-stikstofuitstoot
[134] https://www.rvo.nl/subsidies-financiering/lbv-plus
[135] https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Dutch%20Parliament%20Approves%20Law%20to%20Reduce%20Nitrogen%20Emissions_The%20Hague_Netherlands_12-28-2020
[136] https://www.euronews.com/my-europe/2024/05/17/first-ruling-farmer-protesters-to-shake-blocs-agriculture-policy
[137] https://klimaraadet.dk/en/analysis/denmarks-climate-targets#:~:text=The%20current%202030%20target%20is,compared%20to%20emissions%20in%201990.
[138] https://stateofgreen.com/en/news/denmark-sets-binding-2030-climate-target-for-agriculture/

  - To restore 100,000 ha of peatlands by 2030.
  - To double of organic farming by 2030.
  - To reduce nitrogen discharge from agriculture into coastal environments by 10,800 t by 2027.[139]

- Green Tripartite Agreement
  - To rewet 140,000 hectares of carbon-rich lowland soils by 2030
  - to support the creation of 250,000 ha of new forests by 2045
  - To double the organic agricultural farming area by 2030
  - To set aside 20 percent of its land for nature and biodiversity by 2030.
  - To ensure 2/3 Danish local municipalities are compliant with the EU's Water Framework Directive by 2027, and all compliant by 2030.
  - A mapping exercise is undertaken, and based on the results, a decision is made to protect groundwater sources for drinking by 2027.[140]

GHG Reduction Strategies

Denmark is a developed economy with a large export-oriented agriculture sector. As a member of the EU, domestic aviation, maritime, energy and industrial emissions are priced via the EU ETS.[141] Denmark plans to meet its climate targets through pricing, subsidies and regulation.[142] Agriculture accounts for about 28 percent of total GHG in Denmark.[143]

More information on Denmark's overall climate strategy can be found in its NECP submitted to the EU.[144]

Danish agriculture GHG policy is based on incentives and regulations; there are plans to price some agricultural GHG by 2030.

Danish farmers currently receive a number of subsidies for undertaking activities designed to reduce agricultural GHG, including:

- Organic farming
- Improved grazing of grassland to improve biodiversity
- Establishing a wetland
- Setting aside grassland
- Switching to producing-plant-based foods
- Establishing habitat
- Cover cropping
- Converting cropland to permanent grassland

[139] https://en.fvm.dk/news-and-contact/focus-on/the-agreement-on-a-green-transition-of-the-agricultural-sector
[140] https://lf.dk/media/qqcacwwp/aftale-om-et-groent-danmark.pdf
[141] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/
[142] https://ens.dk/en/our-responsibilities/energy-climate-politics/danish-climate-policies
[143] https://www.carbonbrief.org/qa-how-denmark-plans-to-tax-agriculture-emissions-to-meet-climate-goals/#:~:text=Agriculture%20contributes%20around%2028%25%20of,livestock%20production%2C%20the%20report%20says.
[144] https://commission.europa.eu/publications/denmark-draft-updated-necp-2021-2030_en

- Keeping bull calves for longer and subsidising the slaughter of steers, heifers and bulls
- Reduced ammonia from waste storage
- Reduced pesticide use
- Reduced energy use
- Precision farming
- Afforestation[145]

Earlier this year, Denmark announced its plans to tax some agricultural emissions in 2030. This tax was a component of an agreement struck between the government, NGOs and farmers, known as the 'Green Tripartite'.

Despite widespread media coverage on the agreed policy to introduce a tax on Danish agricultural emissions, only a Danish version of the text is available at the time of writing titled '*Aftale om et Grønt Danmark'*.[146] This text has been translated using *DeepL*.

The Agreement aims not only to reduce agricultural emissions but rather to holistically achieve a suite of environmental outcomes such as reduced nitrogen loss to coastal waters and increased biodiversity. The goals of The Agreement include:

- to contribute to Denmark reducing overall emissions by 70 percent below 1990 levels by 2030 and reaching net zero by 2045
- to create the financial framework for 140,000 hectares of carbon-rich lowland soils, including marginal areas to be set aside by 2030
- to support the creation of 250,000 ha of new forests by 2045. This requires a tripling of the current afforestation rate.
- a doubling of the organic agricultural farming area by 2030
- to support Denmark 'setting aside' 20 percent of its land for nature and biodiversity.
- 2/3 of Danish local municipalities will be compliant with the EU's Water Framework Directive by 2027, and all will be compliant by 2030. This will reduce the amount of nutrients lost by point source contamination.
- a mapping exercise is undertaken, and based on the results, a decision is made to protect groundwater sources for drinking by 2027.

To meet these goals, The Agreement details a series of taxes and subsidies, namely:

- **Taxes**
    - From 2030, a 72 NZD t CO_2e tax on livestock GHG, increasing to179 NZD t CO_2e by 2035. A discount rate of 60 percent of the national average GHG intensity for each animal class will be applied to this price, rendering the average effective price 29 NZD t CO_2e and 72 NZD t CO_2e in 2030 and 2035, respectively.

[145] https://lbst.dk/tilskud/tilskudsguide?page=6
[146] https://lf.dk/media/qqcacwwp/aftale-om-et-groent-danmark.pdf

  - From 2028, a 10 NZD t CO_2e tax on GHG on 'carbon-rich low-lying soils' (sometimes referred to as peatlands).
  - From 2028 a 179 NZD t CO_2e tax on lime application will be phased in and fully operational by 2030.

- **Subsidies**
  - 5.25 billion NZD fund to subsidise afforestation.
  - 2.39 billion NZD) fun to subsidise biochar
  - In 2028 a 179 NZD t CO_2e subsidy for avoided GHG from reduced fertiliser use.
  - In 2028 a methane feed inhibitor subsidy. Details not yet announced.

If it is assumed that the goals of the policy are met, the best available modelling (scenario 3b from the policies included in the 'Expert Group' report on which the Agreement was based) estimates the following impacts:[147]

- Emissions leakage of 3.5 percent to 12.3 percent
- To have no impact on the volume of crop production
- To decrease the value of crop production by 1.1 percent
- To decrease the volume of cattle production by 4.7 percent
- To decrease the value of cattle production by 2.1 percent
- To decrease the volume of pig production by 3.4 percent
- To decrease the value of pig production by 2.6 percent
- 50 percent of the tax applied to cattle to be passed through to consumers.
- 26 percent of the tax applied to pigs to be passed through
- To cost the Danish economy 2.125 billion DKK (approx. 507 million NZD)[148]
- To reduce 2.4 Mt CO_2e of GHG
- To tax the average dairy cattle 700 DKK (approx. 167 NZD)
- To tax the average non-dairy cattle 175 DKK (approx. 42 NZD)
- To tax the average sheep 50 DKK (approx. 12 NZD)
- To tax the average lamb 25 DKK (approx. 6 NZD)
- 3 percent of crop farmers to be highly threatened by bankruptcy
- 12 percent of cattle farmers to be highly threatened by bankruptcy
- 3 percent of pig farmers to be highly threatened by bankruptcy
- To reduce the profit of conventional crop farmers by 2 percent
- To reduce the profit of conventional dairy farmers by 19 percent
- To reduce the profit of conventional pig farmers by 4 percent[149]

Design elements, such as the 60percent incentive-based rebate and no requirement for the scheme to be revenue neutral, result in the Danish proposal differing significantly from what the New Zealand Government proposed in 2022. Some of those differences are highlighted in the table below

[147] https://skm.dk/media/tngh1b4r/green-tax-reform-final-report.pdf
[148] This cost is for the 2030 year upon implementation; it is expected to change over time as farmers respond to the incentives.
[149] The impact on profit for sheep or beef farmers was not modelled in table 7.27

Design element	October 2022 New Zealand Government proposal[150]	June 2024 Denmark proposal
Start date	Pilot in 2024 Start in 2025	Pilot in 2027 Start 2030
Net cost to taxpayer	Revenue neutral	507 million NZD in 2030
Point of obligation	Interim processor level then farm level	Farm level
Primary purpose (both taxes are modeled to achieve these targets)	10% reduction in biogenic methane by 2030 and contribute to a net zero long lived emissions goal	55-65% agriculture reduction by 2030 (CO_2e)
Tax Price (NZD/ t CO_2e)	\$2.86 to \$5 CH_4 \$10.86 N_2O	\$10 peatlands \$29 livestock
Reduction price (NZD/ t CO_2e)	\$50 NZD for activities that qualify for 'incentive payment' paid for by the tax	\$179 for the reduced use of fertiliser. Significant funding for land use change Other subsidies funded by taxpayer
Revenue Recycling	Yes	Yes
Estimated impact on production	-18% to -20% lamb +5% to -14% beef -4% to -5% dairy	- 4.79% cattle - 3.4% pigs 0% crops
Estimated impact on farm profitability	-6% to -7% dairy -18% to -24% sheep and beef 0% to -1% other	-19% dairy - 4% pigs -2% crops
Land value change	Unknown	-6%[151]
Split gas approach	Yes	No
Tax offset by significant subsidies	No	Yes
Leakage	65%	3.5% to 12.3%

If taxes and subsidies do not meet the proposed policy's goals, the proposed policy's text includes expropriation as a viable tool.

Norway

GHG Reduction Targets

[150] https://environment.govt.nz/assets/publications/Pricing-agricultural-emissions-consultation-document.pdf
[151] Based on Green Tax Reform Expert Group second report's Model 3b

Norway has committed to two NDCs. They are:

1. To reduce GHG by 50-55 percent below 1990 levels by 2030, and
2. To achieve climate neutrality by 2050.[152]

In addition, two targets impact Norwegian farmers directly:

- To reach net zero in the 'land sector' by 2030.
- To reduce agricultural emissions by five million tCO_2e from 2021 to 2030 (approximately 10 percent below Business-as-Usual). This equates to an approximate 20 percent reduction in agricultural emissions by 2030. This commitment is based on a voluntary deal between farmer organisations and the government.[153]
- This target does not include forestry emissions but does include emissions that occur in the agriculture sector but are credited to other sectors in UNFCCC guidelines (such as reduced transport emissions by the electrification of farm transport). The government expects about 4Mt CO_2e to come from UNFCCC 'agriculture' emissions.

GHG Reduction Strategies

Norway is a developed country with a large hydroelectricity industry, a large oil and gas industry and a small agriculture industry primarily serving its domestic market. To meet GHG reduction goals, Norway is implementing a strategy of pricing, subsidies and regulations. Agriculture accounts for about 9.5 percent of total emissions in Norway.

While not a member of the EU, as a member of the European Economic Area (EEA), Norway participates in the EU ETS, pricing domestic aviation, maritime, energy and industrial emissions.[154]

In addition to the EU ETS, Norway also has a long-standing carbon tax applied to certain emissions from industries not covered by the EU ETS, including oil and gas industrial emissions, transport, heating and some industrial emissions.[155] The only type of fossil fuel emissions (or mineral emissions) not facing a price in Norway are emissions from using LPG in horticultural greenhouses.

Agriculture is not included in the Norwegian ETS.

Norwegian agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

[152] https://unfccc.int/sites/default/files/NDC/2022-11/NDC%20Norway_second%20update.pdf#:~:text=URL%3A%20https%3A%2F%2Funfccc.int%2Fsites%2Fdefault%2Ffiles%2FNDC%2F2022

[153] https://www.mdpi.com/2071-1050/12/6/2506#B1-sustainability-12-02506

[154] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

[155] https://www.norskpetroleum.no/en/environment-and-technology/emissions-to-air/#:~:text=The%20carbon%20tax,-Norway%20was%20one&text=For%202023%2C%20the%20tax%20rate,13.67%20per%20standard%20cubic%20metre.

The Norwegian Government has also widely supported the application of the carbon tax as a price floor to industries covered by the EU ETS.[156] A comprehensive source for Norwegian climate policy is its Climate Action Plan submitted to the EU.[157]

The Norwegian Climate Action Plan discusses Agriculture and Forestry together and details several measures to reduce emissions. The Plan notes the many benefits agriculture provides to Norway that are difficult to quantify and notes many technical issues of importance to farmers that are excluded from many similar documents in other jurisdictions, including:

> *"Agricultural areas can provide important climate benefits in the form of CO_2 removals and methane oxidation in soils. Farming methods such as livestock husbandry that make use of grassland and pasture also maintain open landscapes and thus a higher ground albedo than in areas that become overgrown with shrubs and trees. The albedo of a surface is an expression of its ability to reflect light. Higher ground albedo counteracts global warming."*[158]
>
> *"... The effects of various measures described in the mitigation analysis for Norway 2021–2030 cannot currently be registered in the emission inventory. This applies for example to carbon sequestration in soils, the use of catch crops and drainage of agricultural soils. This is because methods for calculating the effects of these measures on emissions have not yet been developed or because there is insufficient data."*[159]

The Plan regularly references the potential long-term impacts of government guidance on reducing food waste and emissions-intensive animal products, quoting sections of the letter of intent signed between the government and farmer organisations:

- *"achieve the target of reducing food waste by 50% by 2030;*
- *persuade the Norwegian population to change their food habits so that they are as far as possible in line with dietary advice from the Directorate of Health."*[160]

[156] https://bellona.org/news/carbon-accounting/2021-02-norway-proposes-e200-per-ton-co2-tax-by-2030
[157] https://www.regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf
[158] https://regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf, pp.12
[159] https://regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf, pp.127
[160] https://regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf, pp.121

The Plan summarises the dietary recommendations of the Norwegian Government as:

> *"a varied diet including plenty of vegetables, fruit and berries, whole-grain foods and fish, and limited amounts of processed meat, red meat, salt, sugar and saturated fats... recommendations for a healthy diet coincide to a large extent with those for a more sustainable diet.*[161]*"*

Collaborative efforts between Norwegian farmers and the government, as set out in the 'Letter of Intent', are the key means of reducing agricultural emissions in the Plan. The Plan also includes provisions the government is considering if insufficient progress is made towards meeting the 5Mt CO_2e 2030 target:

> *"If there is insufficient progress, the Government will consider the introduction of new policy instruments. The Government will, therefore, assess the introduction of a tax on mineral fertilisers to reduce nitrous oxide emissions from soils. The assessment will look at the possible effects of the tax both on greenhouse gas emissions and on agricultural production, other effects, and how the tax could be introduced."*[162]

Norwegian farmers are heavily reliant on barriers to imported goods and government subsidies.[163] Food security and self-sufficiency are the core reasons for these subsidies, but the Norwegian Government also uses the policy as a lever to reduce GHG in the sector. Government subsidies are based on annual negotiations between the government and farmer organisations, and environmental practices are a key component of subsidies.[164]

The Agreement is publicly available, but only in Norwegian and DeepL was used to translate the 2024 Agriculture Agreement into English.[165] The 2024 Agreement applies to the 2025 calendar year and largely focuses on production-based subsidies but also provides development subsidies for:

[161] https://regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf, pp.128 - 129
[162] https://regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf, pp.66
[163] https://www.oecd-ilibrary.org/docserver/20b14991-en.pdf?expires=1725306218&id=id&accname=guest&checksum=6DC2556AF448626D4B754B8BB97C3886
[164] https://www.nibio.no/en/news/how-much-do-norwegian-farmers-earn#:~:text=In%20Norway%2C%20every%20April%2C%20a,income%20and%20average%20national%20income.
[165] https://www.regjeringen.no/contentassets/03cbb8535e6d4136ad6410fb1df36e54/jordbruksavtale-2024-2025.pdf

- 237 million NOK for Value creation programme for renewable energy and technology development in agriculture
- 5 million for the great Norwegian green promise
- 23 million NOK for Biogas
- 15 million NOK for Action plan for pesticides
- 4 million NOK for PRESIS - Precision farming in practice
- 220 million NOK for Special environmental measures in agriculture (SMIL)
- 40 million NOK for Climate and environment program
- 275 million NOK for forestry
- 10 NOK for MethaneHUB.

Organic farming is also subsidised in Norway.[166] Norwegian farmers can use livestock feed additives such as 3NOP, but these are not subsidised.[167]

The 11 Norwegian municipal counties also play a key role in agricultural GHG reduction policy. One example is the county of Vestfold and Telemark. The county of Vestfold and Telemark provides 34 grants that farmers can apply for [168]These grants include grants that reward:

- 100 NOK/ acre for grazing priority areas with cattle
- 10 NOK/ metre (max 2000 metres) for establishing habitat for pollinating insects
- 5 NOK/ metre to maintain stone fences or earth walls
- 10 NOK/ metre to maintain hiking trails on farmland
- 40 – 300 NOK/ acre to practice no-till cropping in autumn
- 10 – 44 NOK/ meter for riparian margins
- 50 NOK/ acre for spreading livestock manure
- 220 – 320 NOK/acre for planting cover crops
- 15 NOK/ kg of biochar spread

In addition to these measures, Norwegian farmers must comply with many regulations to reduce emissions. One example included in the 2019 'Letter of Intent' between the government and farmer organisations is a prohibition on additional cultivation of drained peatlands.

The Norwegian Strategy to meet agricultural GHG reduction targets emphasises collaboration, food self-sufficiency, and circularity. This was highlighted in a recent government document titled '*Norway's Path to a Sustainable Food System*'.[169]

[166] https://www.regjeringen.no/en/topics/food-fisheries-and-agriculture/mat/innsikt/okologisk-matproduksjon/id2357162/
[167] https://www.norfor.info/news/norfor-include-effect-of-methane-reducing-additives/
[168] https://www.statsforvalteren.no/vestfold-og-telemark/landbruk-og-mat/jordbruk/miljotiltak-i-jordbruket2/rmp-tilskudd/
[169] https://www.regjeringen.no/en/dokumenter/norways-path-towards-a-sustainable-food-system/id3040670/?ch=2

Israel

GHG Reduction Targets

Israel has committed to two NDCs. They are:

1. To reduce GHG by 27 percent below 2015 levels by 2030, and
2. To reduce GHG by 85 percent below 2015 levels by 2050.[170]

Israel has several initiatives to reduce agricultural GHG but no quantified numerical agriculture-specific targets.

GHG Reduction Strategies

Israel is a small, developed economy with a small agriculture sector focused on serving the domestic market. Agriculture accounts for about 7 percent of total emissions in Israel.

Israel's overall climate strategy is outlined in the '*National Action Plan on Climate Change 2022 – 2026*' . This Plan includes policies such as implementing a carbon price on fuel, ending coal use, and supporting sustainable public transport infrastructure development.

Israeli agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

Israeli agriculture policy emphasises self-sufficiency as a core policy of national security. Subsidies support Israeli farmers, and the industry also emphasises innovation and water efficiency. Israel recycles 90 percent of all water, sources 40 percent of its water from desalination plans and invented many water-saving technologies such as 'drip irrigation'.[171]

The National Action Plan on Climate Change only refers to agriculture in the context of adaptation. Likewise, a 2021 National Pathway document by the Chief Scientist of Israel stressed the importance of culturally diverse food security, the risks climate change poses to the region, and the need to ensure healthy and sustainable diets.[172]

[170] https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20update%20as%20submitted%20to%20the%20UNFCCC.docx

[171] https://blogs.timesofisrael.com/water-technology-and-agriculture-sustaining-israels-development/#:~:text=Sustainable%20Agriculture%3A%20A%20Pillar%20of%20Economic%20Strength&text=The%20integration%20of%20advanced%20technologies,to%20maximize%20efficiency%20and%20productivity.

[172] https://www.unfoodsystemshub.org/docs/unfoodsystemslibraries/national-pathways/israel/2021-09-19-en-israel-national-pathway-document.pdf?sfvrsn=b978ce71_1

The most recent major agricultural policy package was the 2021 agriculture reforms.[173] These reforms dramatically reduced tariffs on a wide range of agricultural products and increased subsidies to offset the impacts of increased competition on Israeli farmers.

These reforms included "NIS 120 million over four years for support and investments to encourage environmentally friendly agriculture'.

Up-to-date information on Israel's agriculture GHG mitigation policies is difficult to find; for example, Israel's Third Communication on Climate Change, submitted to the UNFCCC in 2018, does not contain information on agricultural GHG mitigation.[174]

However, Israel's Second Communication on Climate Change, submitted to the UNFCCC in 2010, lists mitigation efforts in the agricultural sector, including:

- 493 million NIS in investment grants to improve the environmental standards of dairy farmers (including subsidising waste storage infrastructure, drainage improvements and biogas production)
- The installation of cooling systems in dairy farms to improve efficiency and reduce methane
- The widespread use of efficient pressurised fertiliser application systems
- Subsidising the construction of water reservoirs
- The widespread use of minimal and no-till cropping
- Regulating the recycling of animal and sewage waste
- Subsidising private forestry.[175]

Organic farmers in Israel can also access bespoke subsidy packages.[176]

The ongoing war between Israel and Hamas and its supporters has diverted government resources away from many departments and projects, and this likely includes the agriculture GHG mitigation policy. The conflict also has immediate impacts on the country's agricultural industry. One example is the recent decision by Turkey (Israel's

[173] https://www.gov.il/en/pages/farmers_benefits
[174] https://unfccc.int/sites/default/files/resource/UNFCCC%20National%20Communication%202018.pdf
[175] https://unfccc.int/sites/default/files/resource/isrnc2.pdf
[176] https://www.agrifarming.in/how-to-start-organic-farming-in-israel-key-rules-business-plan-certification-and-challenges

third most significant source of agricultural imports) to ban all trade between the two countries.[177]

Uruguay

GHG Reduction Targets

Uruguay's updated NDCs take a novel approach; instead of only taking the more common form of an all-GHG target, the NDCs include GHG-specific, sub-sectoral and intensity-based targets. These include:

1. In 2030, to not exceed 9267 Gg, 818 and 32 Gg for CO_2, CH_4 and N2O, respectively. This is an approximate 8 percent, 32 percent and 29 percent reduction for CO_2, CH_4 and N2O from 1990 levels.
2. To reduce hydrofluorocarbon (HFC) emissions by 10 percent by 2030,
3. To reduce CH_4 levels in live weight beef production by 35 percent relative to 1990 levels by 2030,
4. To reduce N_2O levels in live weight beef production by 36 percent relative to 1990 levels by 2030, [178]

Uruguay has not set an NDC beyond 2030 but is likely to do so in the third round of updating NDCs in 2025.[179]

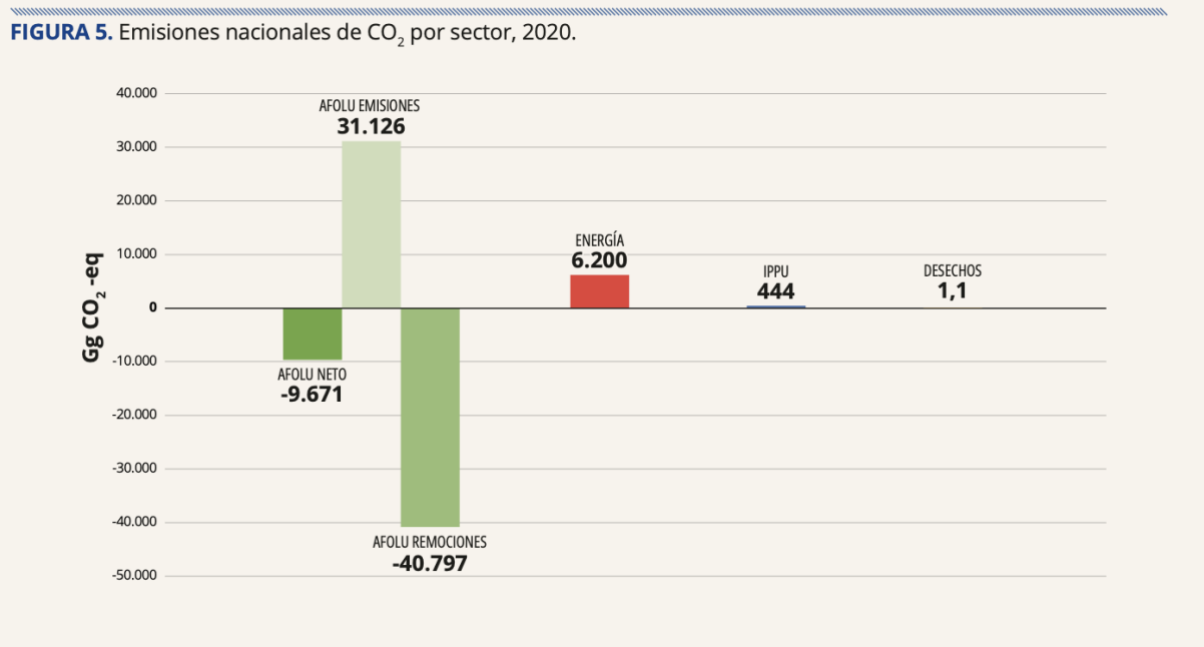
Uruguay is the only jurisdiction examined in this report that includes an intensity-based agricultural GHG target in its NDC. Uruguay also stands out as the jurisdiction that most prominently states the issues regarding the use of the GWP100 metric with respect to biogenic methane.

GHG Reduction Strategies

Uruguay is a small developing country with a large amount of renewable electricity generation (mainly hydro) and a large agricultural sector (mainly beef) that relies on access to international markets.

Agriculture in Uruguay is unsubsidised, and agriculture, forestry, and other land-uses (AFOLU) make up 75 percent of gross emissions, as shown in the figures below from Uruguay's GHG Inventory submitted to the UNFCCC.[180]

[177] https://fas.usda.gov/data/israel-israel-may-seek-new-sources-agricultural-imports-due-turkish-trade-ban
[178] https://unfccc.int/documents/624764 translated from Spanish to English using DeepL
[179] See https://unfccc.int/ndc-3.0 for an updated list of NDCs by country.
[180] https://unfccc.int/documents/636694



Uruguayan agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

Uruguay is clear that while it is committed to reducing GHG, it does not intend on doing so at the cost of food production, stating:

> *Additionally, since Uruguay cannot mitigate climate change at the expense of food production but rather work on improving the efficiency of the emissions per product in the sector, the country sets forth specific targets for beef production. This activity accounts for 78 percent of domestic CH_4 emissions (due to enteric fermentation) and 63 percent of domestic N2O emissions (due to manure left on pasture by grazing animals). These targets are presented as emission intensity per kilogram of beef (liveweight...*
>
> *The singular biological origin of these emissions (CH_4), in addition to the fact that the country cannot mitigate climate change at the expense of food production, poses a challenge to focus on emissions intensity reduction per product unit of food produced."*[181]

Uruguay is unusual among the jurisdictions examined in only using the GWP100 metric when necessary, regularly communicating GHG as absolute amounts, setting NDCs that don't use a GWP100 figure and including the GTP metric in its NDC. The GTP metric takes account of the different warming impact of methane to long-lived gases. This is noted in its updated NDC:

> *"In 2014 the IPCC pointed out that "the GWP metric is not directly related to a temperature limit, as the 2oC target, whereas some economic metrics and physical end-point metrics like the GTP may be more suitable for this purpose",*

181

> *thus calling upon further dialogue on the implications of the different metrics and to "provide metrics that can be useful to the users and policymakers". Due to the significant impact this discussion could have on priority assignment concerning mitigation policies, especially with regard to the agriculture sector, Uruguay has decided to submit its contribution sorted by gases."*[182]

Issues regarding the treatment of biogenic methane were also noted in Uruguay's Long-Term Strategy submitted to the UNFCCC in 2021.[183] This document was translated from Spanish to English using DeepL:

> *"CH_4 is a short-lived GHG, whose permanence time in the atmosphere is between 10-13 years, unlike CO_2, which has a permanence in the atmosphere of up to 1000 years. On the other hand, CH_4 emissions from livestock production, unlike fossil fuel emissions, have their origin in natural biological processes such as enteric digestion and are part of the biological cycle of the carbon. Therefore, the amount of CH_4 remaining in the atmosphere 10- 13 years after it was emitted is very low (Terra and Baethgen, 2021).*
>
> *Another important element to consider in the elaboration of a LCA is linked to the common metrics used for the quantification of non-CO_2 GHG emissions, in particular CH_4. The warming potential of methane is quite larger than that of CO_2, estimated at 28 times that of CO_2 over a 100- year period (AR5 IPCC, 2014). However, as the residence time in the atmosphere of the different GHGs is different, the warming potential should refer to that period of time.*
>
> *In this regard, the IPCC has evaluated and incorporated new common metrics in its AR5 (IPCC, 2014) and AR6 (IPCC, 2021), which may be more directly linked to a temperature limit and more useful for this purpose.*
>
> *Based on this, Uruguay maintains and reinforces its position that it is necessary to define common metrics that better reflect the relationship between emissions and temperature increase and that, as the IPCC points out, "can be useful for users and decision makers". This is why, in line with CDN1, the GHG emissions/removals scenarios of Uruguay's LCA are presented by gas.*
>
> *Taking these elements into consideration and in order to continue contributing to world food production, Uruguay's LCA proposes an ambitious scenario of CH_4 emissions stability by 2050 (Figure 33).*

Uruguay first introduced a National Climate Change Response Plan in 2009, and sector-specific policies followed, including the Climate Smart Agriculture Policy 2010.[184] These

[182] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Uruguay/1/INDC%20Uruguay%20(English-unofficial%20translation).pdf

[183] https://www.gub.uy/ministerio-ambiente/sites/ministerio-ambiente/files/2021-12/Estrategia_Clim%C3%A1tica_de_Largo_Plazo_Uruguay%202021.pdf

[184] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Uruguay/1/INDC%20Uruguay%20(English-unofficial%20translation).pdf

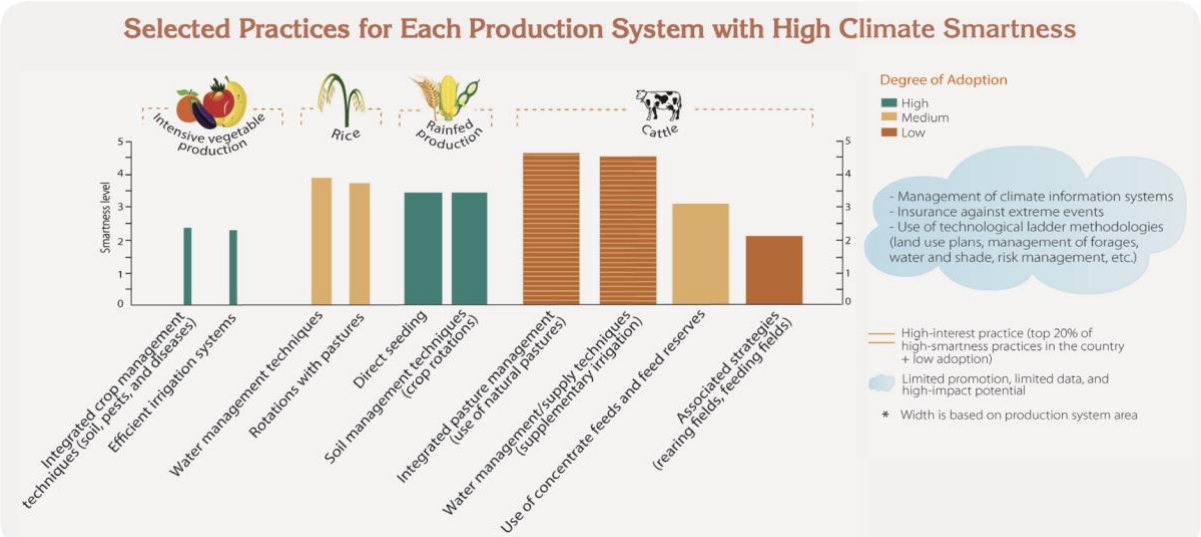
overarching policies have led to a range of initiatives and projects that achieved a wide range of positive outcomes for the agriculture sector, including emissions mitigation.[185] These measures have resulted in Uruguay having no net deforestation and an expected 33 percent decrease in the emissions intensity of beef production in 2030 from 1990 levels.

The World Bank is currently assisting Uruguay in implementing a number of policies to encourage '*Climate Smart Agriculture*' (CSA). These include the Project for the Sustainable Management of Natural Resources and Adaption to Climate Change (DACC). DACC assists farmers in adapting to the impacts of climate change while reducing emissions by encouraging the adoption of CSA, strengthening farming organisations and providing access to better, more up-to-date data.[186]

A 2016 report by The World Bank and the International Centre for Tropical Agriculture lists the following CSA practices in Uruguay:

- *"Integrated pasture management – natural pastures*
- *Water management/ supply techniques (supplementary irrigation)*
- *Use of concentrate feed and feed reserve es*
- *Associative strategies (rearing fields, feeding fields)*
- *Direct seeding*
- *Rotation with pastures*
- *Efficient irrigation systems*
- *Integrated crop management (soil, pests, and diseases)."*[187]

The assessment of each CSA practice is visualised in the below figure.[188]



[185] https://cgspace.cgiar.org/server/api/core/bitstreams/f8302546-80c4-4f58-b8d6-b6613980f2c0/content
[186] https://www.worldbank.org/en/news/press-release/2017/11/30/productores-rurales-uruguay-cambio-climatico
[187] https://cgspace.cgiar.org/items/de2d9874-c157-4ac5-bfcb-7fa377022f24
[188] https://cgspace.cgiar.org/items/de2d9874-c157-4ac5-bfcb-7fa377022f24

Uruguay also recently received a $350 million USD loan from the World Bank in which reduced interest rates were linked to Uruguay reducing the methane intensity of livestock production.[189]

Uruguay's updated NDC submitted to the UNFCCC references plans to increase soil carbon levels, stating:

> *"With regard to carbon in cropland soils, Uruguay has broadly introduced no till agriculture and has recently implemented mandatory conservation policies that reduce erosion and will promote an increase in biomass supply to the soil. Moreover, it is fostering the use of irrigation. The net impact of these measures can initially be estimated at about 100 Gg CO_2 captured by 2030."*[190]

Uruguay's updated NDC also notes that it would like to undertake the following additional mitigation actions related to agriculture, which are mainly aimed at improving emissions intensity:

"Reduce emissions intensity by enhancing productivity and efficiency in beef, dairy and rice production.

- *Reduce emissions intensity from manure left on pasture by grazing animals.*
- *Increase the total coverage of tree plantations.*
- *Increase the total coverage of native forests and reduce degradation.*
- *Increase carbon stocks in soils under natural grasslands.*
- *Increase land surface under irrigation.*
- *Reduce methane emissions in rice production through flood management and other* practices.
- *Efficient use of nitrogen fertilisers."*[191]

Brazil

GHG Reduction Targets

Brazil has committed to three NDCs. They are:

1. To reduce GHG by 48 percent of 2005 levels by 2025,
2. To reduce GHG by 53.1 percent of 2005 levels by 2030, and
3. To achieve net zero GHG by 2050.

[189] https://www.worldbank.org/en/news/press-release/2023/11/17/banco-mundial-uruguay-recibe-un-prestamo-pionero-que-premia-el-cumplimiento-de-ambiciosas-metas-ambientales

[190] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/ https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Uruguay/1/INDC%20Uruguay%20(English-unofficial%20translation).pdf /1/INDC%20Uruguay%20(English-unofficial%20translation).pdf

[191] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Uruguay/1/INDC%20Uruguay%20(English-unofficial%20translation).pdf, pp.7

Specific to agriculture, Brazil is implementing the second phase of the Plan for Adaption and Low Carbon Emissions in Agriculture (known as 'ABC+') from 2020 to 2030. Within ABC+ there are the goals to:

- To restore 30 million ha of degraded pastures by 2030
- To expand integrated crop-livestock forestry systems (ICLF) to 5 million ha by 2030
- To expand no till farming to 12.5 million ha by 2030
- To promote the use of biological nitrogen fixation on 13.5 million ha by 2030
- To establish 3 million ha of plantation forestry by 2030. [192]

Brazil has also made various targets regarding forestry including a goal of achieving zero deforestation by 2030.[193]

GHG Reduction Strategies

Brazil is a large developing economy with an export-driven agriculture sector. Agriculture makes up about 20 percent of total emissions and operates without significant government subsidies.

Brazilian agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

Brazil's overarching GHG mitigation strategy is the 2021 National Green Growth Program (PNCV). This program was built upon the 2008 National Plan on Climate Change (PNMC) and aimed to deliver environmentally sustainable economic growth for Brazil.[194]

Brazil's Key policy for reducing agricultural emissions is the 2022 'Brazilian Agricultural Policy for Climate Adaptation And Low Carbon Emission (Plano ABC+).[195] Plano ABC+ outlines Brazil's climate policy for 2020 to 2030 and is guided by three core principles:

- an integrated landscape approach
- a joint focus on emissions adaptation
- mitigation and incentivising the maintenance and expansion of Sustainable Production Systems, Practices, Products and Processes (SPS_{ABC}).[196]

The Plano ABC+ takes a holistic approach to landscapes and incentives but is also transparent about what specific actions it would like to incentivise; these are the '

[192] https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais/publicacoes/abc-english.pdf
[193] https://www.gov.br/mre/en/contact-us/press-area/press-releases/brazil-submits-its-nationally-determined-contribution-under-the-paris-agreement
[194] https://www.fao.org/faolex/results/details/en/c/LEX-FAOC166971/
[195] https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais/publicacoes/abc-english.pdf
[196] https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais/publicacoes/abc-english.pdf, pp. 14

Sustainable Production Systems, Practices, Products and Processes, referred to as SPS_{ABC} in the plan. These are listed in the plan and are:

"Practices for Reclaiming Degraded Pastures (PRDP); No-Tillage System (NTS), segmented into;

- *No-Tillage System (NTS), segmented into:*
  - *No-Tillage Grain Cropping System (NTGCS), and;*
  - *No-Tillage Horticultural System (NTHS).*
- *Integrated Systems (IS), segmented into:*
  - *Integrated Crop-Livestock-Forestry Systems (ICLF), and;*
  - *Agroforestry Systems (SAF).*
- *Forestry (FS);*
- *Bio-inputs, by:*
  - *Biological Nitrogen Fixation (BNF), and;*
  - *Plant Growth Promoting Microbes(sic) (PGPM).*
- *Irrigated Systems (IS);*
- *Waste Management at Animal Production (WMAP), and;*
- *Intensive- Cattle Finishing (ICF). "*[197]

Plano ABC+ aims to incentivise the uptake of these SPS_{ABC} on a very large scale, for example, by restoring 30 million ha of degraded pastures. This SPS_{ABC} will be undertaken to achieve several benefits, namely, improving water retention in the soil, increasing carbon stocks, reducing erosion, and increasing adaptability to drought.

A USDA report notes that access to subsidised loans was a key incentive used by the government in the predecessor to Plano ABC+.

> *"In 2010, the Ministry of Agriculture, Livestock, and Supply (MAPA) created the ABC Plan, a National Plan for Low Carbon Emission in Agriculture, which was scheduled to last for a decade, with a total budget of R$ 3.15 billion (US$ 1.5 billion). The ABC Plan centred on government-backed loans for producers to mitigate greenhouse gas (GHG) emissions in agriculture by improving the efficient use of natural resources, increasing the resilience of productive systems and rural communities, and enabling the agricultural sector to adapt to climate change"*[198]

Plano ABC+ continues financial incentives for $SPS_{ABC,}$ with the government allocating approximately R$ 340 billion for rural credit in 2022/23.[199] Plano ABC+ has an increased focus on monitoring and verifying emissions reductions, hoping to garner premiums for

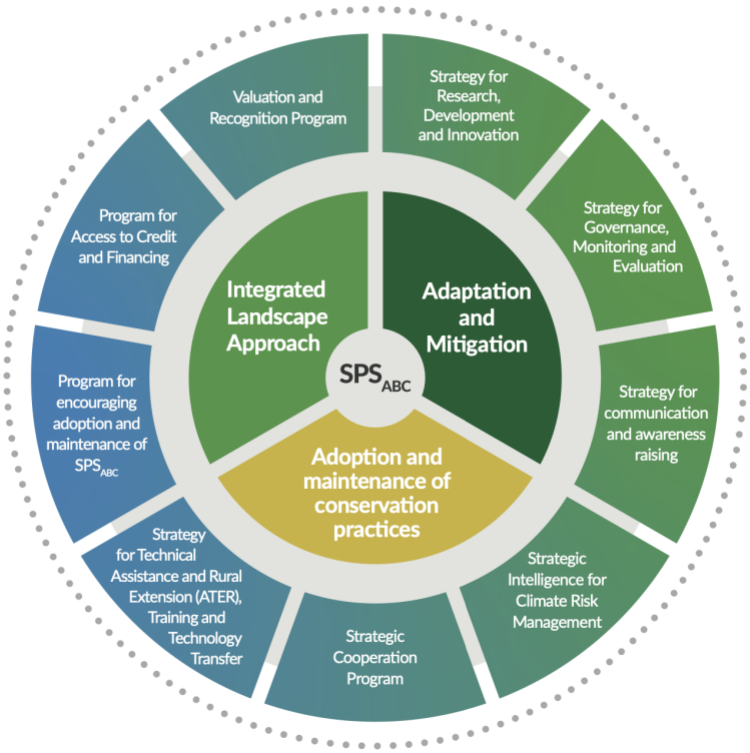
[197] https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais/publicacoes/abc-sumario-executivo-2022-ingles.pdf, pp. 17

[198] https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=ABC%20Plus%20-%20Brazil%27s%20New%20Climate%20Change%20Adaptation%20and%20Low%20Carbon%20Emission%20in%20Agriculture%20Plan_Brasilia_Brazil_05-08-2021.pdf

[199] https://www.climatepolicyinitiative.org/publication/contributions-to-sustainability-in-the-brazilian-agricultural-plan-2023-24/

Brazilian farmers and international recognition for Brazil. This is highlighted in the below figure from the plan.[200]

FIGURE 1. ABC+ Operational Plan Programs and Strategies.



The livestock feed additive 3NOP has been authorised for use in Brazil, but how the product is incentivised or counted in policy plans is unclear.[201]

Japan

GHG Reduction Targets

Japan has committed to two NDCs. They are:

1. To reduce GHG by 43 percent below 2013 levels by 2030, and
2. To reduce GHG by 85 percent below 2013 levels by 2050.[202]

[200] https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/planoabc-abcmais/publicacoes/abc-sumario-executivo-2022-ingles.pdf, pp.28
[201] https://agfundernews.com/dsm-secures-approval-for-methane-busting-cattle-feed-additive-in-brazil-chile
[202] https://unfccc.int/sites/default/files/NDC/2022-06/JAPAN_FIRST%20NDC%20%28UPDATED%20SUBMISSION%29.pdf

Japan's Green Growth strategy includes a goal for the 'agriculture, forestry and fisheries' industry to achieve zero CO_2 from fossil fuel combustion by 2050.[203] This is carbon dioxide emissions and not zero CO3e from all GHG.

Japan has set targets within the agricultural sector, namely:

- To reduce the methane emissions from rice paddies by 30 percent below 2013 levels by 2030,

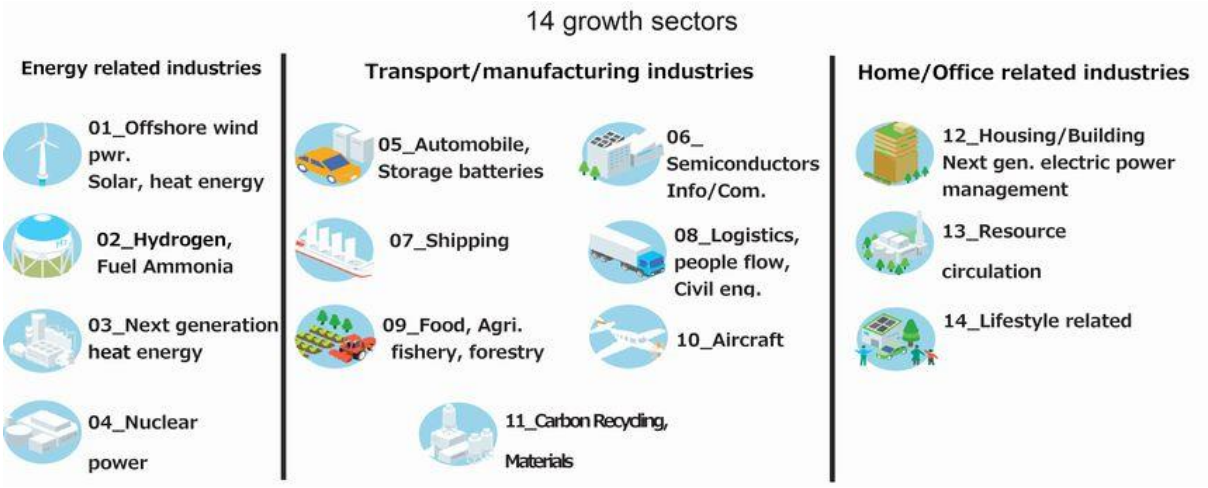
While Japan has no specific quantified emissions reduction target for the livestock sector, several policies aim to reduce these emissions.[204]

GHG Reduction Strategies

Japan is a large, developed economy with a small agricultural sector primarily serving the domestic market. Agriculture makes up only about 3 percent of total emissions, and the impacts of international competition are dulled for Japanese farmers with subsidies and high tariffs.

Japanese agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage. Japan has an ETS (the GX-ETS), but there are no plans to include agricultural GHG.[205]

Japan's overall GHG reduction strategy is summarised in its 2020 'Green Growth Strategy', and the 14 key points of this strategy are shown below.[206]



One of the 14 points in Japan's Green Growth strategy is the 'Food, agriculture, forestry, and fisheries industry'.[207] This strategy includes the following policies:

[203] https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/09_agri_r.pdf
[204] https://www.maff.go.jp/e/policies/env/env_policy/attach/pdf/index-9.pdf
[205] https://grjapan.com/sites/default/files/content/articles/files/gr_japan_overview_of_gx_plans_january_2023.pdf
[206] https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html
[207] https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/09_agri_r.pdf

- Switching horticultural greenhouses away from fossil fuels by 2050
- Switching agricultural machinery to electricity and hydrogen
- Promoting the use of wood and plantation forestry.

Japan also has a Strategy for Sustainable Food Systems, which includes the following 2050 goals:

- *"50 percent reduction in risk-weighted use of chemical pesticides by dissemination of the Integrated Pest Management and newly developed alternatives*
- *30 percent reduction in chemical fertilizer use*
- *Increase in organic farming to 1Mha (equivalent to 25 percent of farmland)*
- *At least 30 percent enhancement in productivity of food manufacturers (by 2030)*
- *Sustainable sourcing for import materials (by2030)*
- *90 percent and more superior varieties and F1 plus trees in forestry seedling*
- *100 percent of artificial seedling rates in aquaculture of Japanese eel, Pacific bluefin tuna, etc."*[208]

Japan plans to reach these goals through technological breakthroughs, promoting Japanese products, and providing positive incentives for farmers. The main piece of legislation used to enable this change was the 2022 Midori Act.[209] All actors along the Japanese food supply chain can receive incentives for emissions-reducing activities, and these are not limited to activities that fall under the UNFCCC 'agriculture' category.

Japanese farmers are incentivised to undertake the following activities:

- Applying compost
- Cover cropping
- Interplanting living mulch
- Organic farming
- Assisting other farmers to switch to organic farming
- Undertaking sod culture
- Charcoal application
- No-till cropping
- Extending mid-season drainage
- The use of slow-release fertiliser
- Integrated pest management

The Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) carried out a study to estimate the impacts of undertaking these activities. Estimations included the impact on soil carbon levels and the results are shown in the figure below.[210]

[208] https://www.maff.go.jp/e/policies/env/env_policy/04_Strategy_MIDORI_and_Climate-Smart_Agriculture.pdf
[209] https://www.maff.go.jp/e/policies/env/env_policy/04_Strategy_MIDORI_and_Climate-Smart_Agriculture.pdf
[210] https://www.maff.go.jp/e/policies/env/sustainagri/directpay.html

Kinds of activities		No. of cases surveyed	Amount of greenhouse gas emissions reduced per unit (tCO_2/ha/year)	Area of activities (ha)	Amount of greenhouse gas emissions reduction
Common national activities	Organic farming	237	1.04	11,610	12,074
	Applying compost	182	2.42	20,284	49,087
	Planting cover crops	167	2.14	16,867	36,095
	Living mulch	19	1.45	2,866	4,156
	Sod culture	15	1.22	66	80
	No-tillage farming	7	1.80	269	485
	Extending midseason drainage	21	3.33	3,324	11,053
	Autumn plowing	22	8.99	884	7,941
Regional activities	Raising and managing semi-natural grassland for bedding	1	1.33	1	2
	Communication disrupter+Weed sod culture	3	2.52	28	70
	Charcoal applicalture	19	1.31	183	240
	Slow-release fertilizer & reducing tillage	3	Slow-release fertilizer 0.5 reducing tillage 0.19	6	3 1
	Slow-release fertilizer & extending midseason drainage	6	1.26	5,045	6,357
	IPM & extending midseason drainage	14	1.53	6,669	10,228
	IPM & Autumn plowing	25	6.87	2,470	16,968

Total **154,837**

Japan also operates the 'J Credit Scheme'. This enables companies to generate credits for avoided, reduced or sequestered emissions, and these credits can be sold to companies who need to offset emissions in emissions trading schemes operating in Japan.[211]

The following forestry and agricultural activities can generate J Credits:

- Forestry
  - Forest management
  - Afforestation
  - Reforestation
- Agriculture
  - The use of low-protein feed for pigs
  - Livestock waste management
  - Use of nitrification inhibitors in fertiliser

[211] https://japancredit.go.jp/english/

- Use of biochar.[212]

South Africa

GHG Reduction Targets

South Africa has committed to three NDCs. They are:

1. To reduce GHG by 17 percent below 2010 levels by 2025,
2. To reduce GHG by 32 percent below 2010 levels by 2030,
3. To achieve net zero GHG by 2050.[213]

South African agriculture GHG policy is based on developing incentives and regulations; there are no plans to price agricultural GHG at this stage.

A recent report by the South African Government explicitly stated that agriculture has no emissions reduction target, yet also referenced a 2030 target for agriculture to reduce GHG by 3.37 Mt CO_2e relative to a BAU scenario.[214] It is unclear why both statements are given, but likely that the 3.37 Mt CO_2e target is an indicative goal rather than a binding target for agriculture.

GHG Reduction Strategies

South Africa is a large developing economy with a large agriculture sector. The South African agricultural sector makes up about 10 percent of total GHG in the country and South Africa is a net food exporter.

In July 2024 South Africa passed its Climate Change Act, the government describes the act as:

> *"The Climate Change Act is South Africa's first comprehensive legislation to encourage the development of an effective climate change response and states as its purpose "To enable the development of an effective climate change response and a long-term, just transition to a low-carbon and climate-resilient economy and society for South Africa in the context of sustainable development."*[215]

A 2024 report on Sectoral Emissions Targets (SETS) by the South African Ministry for Forestry, Fisheries and the Environment notes the limited policies currently in place to reduce agricultural emissions, stating:

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[212] https://japancredit.go.jp/english/methodologies/

[213] https://ndcpartnership.org/news/south-africa-takes-high-ambition-path

[214] https://www.gov.za/sites/default/files/gcis_document/202404/50571gon4763.pdf

[215] https://www.gov.za/news/media-statements/presidential-climate-commission-welcomes-signing-climate-change-bill#:~:text=The%20Climate%20Change%20Act%20is,and%20climate%2Dresilient%20economy%20and

> *"Currently, the only policy driving emissions reductions is the Post-2015 NEES. The Draft Conservation Agriculture Policy and the Conservation Agriculture Resources Act have the potential to guide widespread adoption of conservation agriculture, there are no specific targets or mechanisms to set targets."*[216]

Despite this lack of a target for agriculture, the report does set a quantified SET target for agriculture to cumulatively reduce GHG by 3.37 Mt CO3e relative to a BAU scenario from 2025 to 2030. In the year 2030, the target is to reduce agriculture GHG by 0.57 Mt CO_2e below BAU.

South Africa reports agricultural emissions in the categories Agriculture, forestry, and Other Land Use ('AFOLU) excluding Forestry and Other Land Use (FOLU)'In 2020 ', AFOLU excluding FOLU' GHGs were 40.8 Mt CO_2e.[217] Based on this data, a .47 Mt CO2e reduction below BAU by 2030 is equivalent to an approximate 1.5 percent reduction of 2020 levels, although it is not known what the 2030 BAU level is, which is likely to differ from the 2030 total.[218]

The 2024 report also details policies and measures (PAMs) proposed to further contribute to overall GHG targets. For agriculture, the listed PAMs are:

- *"Update the key policies to incorporate climate mitigation and carbon sequestration, including supporting measures (including the Conservation of Agriculture Resources Act, Climate Smart Strategic Framework and Climate Change Sector Plan*
- *Update policies with the following activities, where relevant:*
    - *Nitrogen inhibitors in crops*
    - *Updating fertiliser schedules*
    - *Increase availability of soil sampling,*
    - *standardise nitrogen testing.*
    - *Feed changes in livestock subsector.*
    - *Conservation agriculture*
    - *Sharing best practices across Provinces for climate mitigation*
    - *Provide training and capacity to extension officers to support smallholder farmers on zero-cost climate change mitigation options*
- *Develop a sector implementation plan to for (sic) applying climate mitigation activities."*[219]

The report also details the following PAMs for the 'Environment' SET that are relevant to farmers:

- *"5400 ha of temporary unplanted area (TUPs) planted. 15 000 ha approved for afforestation. 200 000 trees planted outside forests footprint.*
- *Development of a REDD+ Strategy for the country*
- *90 percent of wildfires suppressed*

[216] https://www.gov.za/sites/default/files/gcis_document/202404/50571gon4763.pdf , pp.25
[217] https://www.dffe.gov.za/sites/default/files/reports/8nationalgreenhousegasreport2022.pdf
[218] *AFOLU* is Agriculture Forestry and Other Lan Use. *FOLU* is Forestry and Other Land Use.
[219] https://www.dffe.gov.za/sites/default/files/reports/8nationalgreenhousegasreport2022.pdf, pp.32

- *Rehabilitation of 100 wetlands (9 603 ha)*
- *Thicket restoration (30 637 ha)*
- *2 500 ha of land for indigenous species cultivated. Wetlands of International significance designated. 17.7 percent in total land area under conservation (21 652 699 of 121 991 200 ha)"*[220]

Many of the PANs in Agriculture rely on the passing and implementation of The Draft Conservation Agriculture Policy. This Draft bill aims to increase the adoption of 'Conservation Agriculture' (CA). The policy broadly defines CA as the opposite of '*conventional or industrial agriculture*' and akin to 'agroecology'. The policy seeks the increased use of CA to achieve the following objectives:

- *"An increase in soil organic matter.*
- *Reduced green-house gas emissions due to less external inputs and more carbon sequestration.*
- *Increased water infiltration that reduces runoff, soil erosion and sedimentation, and improves surface and groundwater levels and quality – land rehabilitation.*
- *Increased commodity and livestock production, performance and resilience.*
- *Compliance to environmental legislation.*
- *Improved biodiversity and ecosystem functioning.*
- *Lower production costs."*[221]

To achieve these goals, the draft policy proposes that '*The State should provide visible, substantial support to government and private initiatives that promote sustainable or agroecological approaches'.*[222] The report focuses on principles rather than specific examples but lists the following practices:

- Minimising or preventing external inputs
- No-till cropping
- Sustainable grazing management that limits topsoil loss
- Cover cropping

The policy positions incentives as public funding to support farmers in carrying out public goods and proposes that the government consider implementing a carbon tax for farmers that use external inputs and emit GHG beyond a threshold. At the time of writing, the South African parliament had not approved the policy.

India

GHG Reduction Targets

India has committed to three NDCs. They are:

[220] https://www.gov.za/sites/default/files/gcis_document/202404/50571gon4763.pd, pp. 34
[221] https://cer.org.za/wp-content/uploads/2018/01/Draft-Conservation-Agriculture-Policy.pdf, pp. 10
[222] https://cer.org.za/wp-content/uploads/2018/01/Draft-Conservation-Agriculture-Policy.pdf, pp.11

1. To reduce GHG intensity of the Indian economy by 45 percent below 2010 levels by 2025,
2. To generate 50 percent of cumulative electricity power capacity by 2030
3. To sequester an additional 2.5 -3 CO_2e through forestry and tree cover by 2030, and
4. To reach net zero GHG by 2070.[223]

India has several initiatives to reduce agricultural GHG but no quantified numerical agriculture-specific targets.

GHG Reduction Strategies

India is a large developing economy with a large agriculture sector. India's agriculture sector primarily serves its large population and makes up about 18 percent of total emissions.

Indian agriculture GHG policy is based on incentives and regulations; there are no plans to price agricultural GHG at this stage.

In 2022, the Indian Government released 'India's Long-Term Low-Carbon Development Strategy' (LT – LEDS).[224] While released before India updated its NDCs, this strategy remains the most up-to-date comprehensive emissions mitigation policy document.

The LT-LEDS takes care to stress the importance of balancing emissions reduction with economic development in India and includes:

- Promoting renewables, nuclear and strengthening the grid
- Rational utilisation of fossil fuel resources, with due regard to energy security
- Encouraging fuel efficiency
- improved Encouraging improved fuel efficiency
- Promote resource efficiency within urban planning guidelines, policies, and bylaws.
- Process and fuel switching and electrification in manufacturing, as feasible and viable

Of most relevant to the agriculture sector, the LT–LEDS includes:

- Planning to reduce carbon capture and storage projects' negative socio-economic and environmental impacts and exploring public-private partnerships (PPPs).
- Restoring trees within and outside forests and better resourcing state forest departments

[223] https://www.pmindia.gov.in/en/news_updates/cabinet-approves-indias-updated-nationally-determined-contribution-to-be-communicated-to-the-united-nations-framework-convention-on-climate-change/
[224] https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf

Agriculture is only mentioned in the LT–-LEDS in the context of adaptation or ensuring that efforts to reduce emissions enhance climate adaptation and economic development. The following initiatives are noted in the strategy:

> *"Agricultural solar pumps are being promoted (MNRE, 2021). The consumption of energy in the agriculture sector is an important aspect to ensure the food security aspect of the country and the globe, as large energy consumption is required for irrigation pumps."*[225]

> *"The quantum of crop residues 11 major crops in the country was estimated to be around 683 million tonnes in 2018 (Jain et al., 2018). In most places, part of these residues is used for fodder or energy. These residues are a rich source of renewable organic carbon that can be used to produce fuel, chemicals, or petrochemical feedstocks. Biotechnological or thermochemical routes are being developed for efficient and sustainable use of these biomasses."*[226]

The 2022 LT - LEDs complement the 2008 National Action Plan on Climate Change (NAPCC).[227] The NAPCC is an overarching climate strategy and is made up of eight 'National Missions', namely:

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitat
4. National Water Mission
5. National Mission for Sustaining the Himalayan Eco-system
6. National Mission for a Green India
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge for Climate Change

The National Mission for Sustainable Agriculture (NMSA) program aims to improve the sustainability, productivity and adaptability of Indian agriculture.[228] The NMSA has environmental subsidies, which Indian farmers can access in addition to subsidies designed to protect incomes and increase production. Within the NMSA, five initiatives provide support for a wide range of activities, including:

- The integrated use of fertilisers
- Organic farming
- Biofertilisers and biopesticides
- Diversifying farming systems
- Efficient water infrastructure, such as drip irrigation
- No-till cropping

[225] https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf, pp. 27
[226] https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf, pp. 66
[227] https://dst.gov.in/climate-change-programme
[228] https://nmsa.dac.gov.in/

- Cover cropping
- Agroforestry
- Improved livestock husbandry
- Improved livestock feeding[229]

[229] https://nmsa.dac.gov.in/frmComponents.aspx

4. High-level Jurisdiction Comparison Tables

This section contains three tables that compare key elements of the 16 jurisdictions examined. In these tables it is necessary to simplify complex policies and issues to make high-level comparisons between jurisdictions possible. More information on the key components of the tables can be found in Chapter 3, 'Jurisdiction Case Studies'.

The first table broadly compares each jurisdiction's targets to reduce GHG, focusing on the targets most relevant to agriculture. Nationally Determined Contributions (NDCs) are a key component of this table.

NDCs are targets each signatory to the Paris Agreement publicly sets and outlines plans to implement. As the name suggests, unlike the Kyoto Protocol, there is no central body setting targets, and each signatory sets its own targets. The form and the quantum of the target are set by the Paris Agreement signatory. Many signatories have set all GHG and all sector targets (such as committing to net zero by 2050), while others opt for NDCs that are more specific (such as Uruguay committing to reducing the GHG intensity of beef production by 35 percent of 1990 levels by 2030). The bottom-up and party-driven nature of the Paris Agreement contrasts with the more prescriptive approach of the Kyoto Protocol, which it replaced.

Many jurisdictions then set increasingly specific sector, activity, or GHG-based sub-targets to meet NDCs or other overall climate goals. Plans, strategies, and policies are then developed to meet these sub-targets and achieve the overarching target. This section will detail the targets set for the case study jurisdictions and sub-targets relevant to the agriculture sector. This report is not an exhaustive list and only contains targets (be they NDCs or other GHG reduction targets) that are significant or relate to agriculture. The table below compares NDCs and some other GHG reduction targets; more information is included in the jurisdiction sub-sections in section three.

New Zealand is unusual among the jurisdictions examined in having domestic targets that significantly differ from its NDCs. These parallel sets of targets risk sending conflicting signals on GHG reduction and are in contrast to all other jurisdictions that use additional domestic targets to complement their NDCs and to guide sectoral or sub-sectoral policies.

Table 1: Overall emissions reduction targets and targets of importance to the agriculture sector

Jurisdiction	Short term GHG reduction target(s) and/or NDC(s)	Long term GHG reduction targets and/or NDC	Agricultural GHG targets (set in NDCs or in domestic legislation)	On track to meet NDC(s)?[230]	Methane specific Target?	Signatory to the Global Methane Pledge[231]
New Zealand	41% below 2005 levels by 2030	Net zero by 2050	No	No	10% below 2018 levels by 2030 24% -47% below 2018 levels by 2050	Yes
Australia	43% below 2005 levels by 2030	net zero by 2050	No	No	No	Yes
Canada	40 – 45% below 2005 levels by 2030	net zero by 2050	No	No	-40 – 45% of 2012 from oil and gas by 2025 and 75% by 2030, no target for agriculture	Yes
United States	50-52% below 2005 levels by 2030	net zero by 2050	No	No	No	Yes
United Kingdom	68% below 1990 levels by 2030	net zero by 2050	No	No	No	Yes

[230] Climate Action Tracker (CAN) is used to estimate if a country is on track to meet its target. CAN's rating of the target itself is not considered.

[231] The Global Methane Pledge was launched in 2021 and commits signatories to work together towards collectively reducing methane by 30% below 2020 levels by 2030. It does not necessitate setting domestic methane reduction targets.

Jurisdiction	Short term GHG reduction target(s) and/or NDC(s)	Long term GHG reduction targets and/or NDC	Agricultural GHG targets (set in NDCs or in domestic legislation)	On track to meet NDC(s)?[230]	Methane specific Target?	Signatory to the Global Methane Pledge[231]
European Union	55% below 1990 levels by 2030	net zero by 2050	No	No	No	Yes
Ireland	51% below 2018 levels by 2030	net zero by 2050	Yes -All Ag GHG 25% below 2018 levels by 2030 (net or gross?)	No	No	Yes
Netherlands	49% below 1990 levels by 2030	95% below 1990 levels by 2050	Yes Total agriculture and horticulture GHG 25% below and Land 58% below 2005 levels by 2030 (net or gross??)	No	No	Yes
Denmark	70% below 1990 levels by 2030	net zero by 2045	Total Ag emissions 55 - 65% below 1990 levels by 2030 (net or gross??)	No	No	Yes
Norway	50 to 55% below 1990 levels by 2030	net zero by 2050	Net zero by 2030 (land sector) 5Mt CO_2e reduction in agriculture emissions from 2021 to 2030 (including non-UNFCCC agriculture emissions	No	-45% of 2015 levels by 2025 in the oil and gas sector	Yes

Jurisdiction	Short term GHG reduction target(s) and/or NDC(s)	Long term GHG reduction targets and/or NDC	Agricultural GHG targets (set in NDCs or in domestic legislation)	On track to meet NDC(s)?[230]	Methane specific Target?	Signatory to the Global Methane Pledge[231]
			which are required to reduce by 4MtCO_2e) (net or gross??)			
Israel	27% below 2015 levels by 2030	85% below 2015 levels by 2050	No	No	No	Yes
Uruguay	In 2030, to not exceed 9.267, 818 and 32 Gt CO_2e for CO_2, CH_4 and N_2O, respectively. This is an approximate 8%, 32% and 29% reduction for CO2, CH_4 and N_2O from 1990 levels	Not set	No overall agriculture GHG target. Intensity based targets to reduce CH_4 and N_2O intensity of beef production by 35% and 36% of 1990 levels respectively.	No	Not to exceed 818 Gt by 2030	Yes
Brazil	48% below 2005 levels by 2025 53.1% below 2005 levels by 2030	net zero by 2050	No	No	No	Yes
Japan	43% below 2013 levels by 2030	85% below 2013 levels by 2050	Zero CO_2 for fossil fuel combustion by 2050 in agriculture, forestry and fisheries	No	No	No

Jurisdiction	Short term GHG reduction target(s) and/or NDC(s)	Long term GHG reduction targets and/or NDC	Agricultural GHG targets (set in NDCs or in domestic legislation)	On track to meet NDC(s)?[230]	Methane specific Target?	Signatory to the Global Methane Pledge[231]
South Africa	17% below 2010 levels by 2025 32% below 2010 levels by 2030	net zero by 2050	No, but recent report referenced a 2025 - 2030 cumulative target of agriculture to reduce GHG by 3.37 Mt CO_2e relative to a BAU scenario, including a 0.57 Mt CO_2e reduction in 2030.[232]	No	No	No
India	GHG intensity of the Indian economy by 45% below 2010 levels by 2025 Generate 50% of cumulative electricity power capacity by 2030 Sequester an additional 2.5 -3 CO_2e through forestry and tree cover by 2030, and	net zero by 2070	No	No	No	No

[232] This target represents a reauction of approximately 1.5% of 2020 agricultural GHG below BAU in 2030

Jurisdiction	Short term GHG reduction target(s) and/or NDC(s)	Long term GHG reduction targets and/or NDC	Agricultural GHG targets (set in NDCs or in domestic legislation)	On track to meet NDC(s)?[230]	Methane specific Target?	Signatory to the Global Methane Pledge[231]

The size, relative economic importance, and policy approach toward agriculture among the 16 jurisdictions vary significantly. For instance, countries like New Zealand, Ireland, and Uruguay that have a high proportion of their GHG emissions coming from agriculture (48, 40, and 75 percent, respectively), indicating the sector's major role in their overall emissions profile. Conversely, in countries like the UK, Japan and Israel, agriculture's share of total GHG emissions is much lower (3, 3 and 7 percent respectively).

While several countries like the United Kingdom, the European Union, and Norway have significant agricultural subsidies, others like New Zealand, Australia and Brazil have minimal direct subsidies. Only Denmark and New Zealand have plans to price agricultural emissions. There are a range of indicators on the size and relative economic importance of the agriculture sector in the 16 jurisdictions examined, it is also noted if these jurisdictions plan to implement a price on agricultural GHG or to reduce livestock numbers (Table 2).

Table 2: Size and policy landscape of agriculture sector

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
New Zealand	No	36.7	48%	7%	7%	Yes	5.9 million dairy cattle	Yes – by at least 2030	No incentives or plans

[233] 'Significant' is defined as 10% PSE for the10% 2020 to 2022 period as measured by the OECD in https://www.oecd-ilibrary.org/docserver/b14de474-en.pdf?expires=1723477331&id=id&accname=guest&checksum=484DB9978C78CNo2595B3CE1650E6702FE

[234] This category is limited to jurisdictions implementing policies with the stated goal of reducing livestock numbers. Policies that are implemented for other reasons but lead to reduced livestock numbers (e.g. The treatment of forestry in the NZ ETS) have not been included.

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
	0.7% PSE (2020-2022)						3.7 million beef cattle 25 million sheep 88, 000 goats		
Australia	No 4.3% PSE (2020-2022)	69.5	15%	3%	3%	Yes	2.1 million dairy cattle 28 million beef cattle 79 million sheep 2.4 million goats	No	No incentives or plans
Canada	No	59	10%	2%	2%	Yes	1.3 million dairy cattle	No	No incentives or plans

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
	9.4% PSE (2020-2022)						8.4 million beef cattle 800,000 sheep 230,000 goats		
United States	No 9% PSE (2020-2022)	567	10%	1%	1.3%	Yes	9 million dairy cattle 89 million beef cattle 5 million sheep 2.5 million goats	No	No incentives or plans
United Kingdom	Yes	46.5	10%	0.7%	1.5%	No	1.8 million dairy cattle	No	No incentives or plans

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
	19% PSE (2020-2022)						10 million beef cattle 21 million sheep 100,000 goats		
European Union	Yes 16% PSE	426	10%	1.5%	5%	Yes	19.7 dairy cattle 54 million beef cattle 58 million sheep 11 million goats	No	No incentives or plans
Ireland	Yes	21	40%	2%	5%	Yes	1.5 million dairy cattle	No	The need for voluntary livestock

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
	21% PSE (2018)[235]						800,000 beef cattle 4 million sheep 10,000 goats		reductions noted in the Climate Action Plan
Netherlands	No 7% PSE (2017)	26	15%	2%	3%	Yes	1.6 million dairy cattle 1.2 million beef cattle 800,000 sheep 500,000 goats	No	Large scale buyouts underway primarily to reduce nitrate levels

[235] Information on EU27 states is not made easily publicly available by either the OECD or the EU, a 2019 report by Mitchel and Baker was used, https://www.cgdev.org/sites/default/files/Mitchell-EU-Ag-Subsidies-Final.pdf No

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
Denmark	Yes 11% PSE (2017)	12.8	22%	1.5%	3%	Yes	600,000 dairy cattle 900,000 beef cattle 130,000 sheep 20,000 goats	Yes – Some agricultural GHG will be taxed in 2030, along with significant subsidies	Plan to introduce livestock GHG tax that will reduce livestock numbers
Norway	Yes 83% PSE (2020-2022)	4.7	10%	1%	2%	No	200,000 dairy cattle 100,000 beef cattle 900,000 sheep	No	No incentives or plans

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
							34,000 goats		
Israel	Yes 13.5% PSE (2020-2022)	7.5	7%	2%	3%	No	100,000 dairy cattle 50,000 beef cattle 300,000 sheep 30,000 goats	no	No incentives or plans
Japan	Yes 38% PSE (2020-2022)	37	3%	1.2%	3%	No	1.4 million dairy cattle 2.7 million beef cattle 20,000 sheep	No	No incentives or plans

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
							12,000 goats		
Uruguay	No 5% PSE No(2018 - 2022)[236]	22.5	75%[237]	8%	10%	Yes	800,000 dairy cattle 12 million beef cattle 6 million sheep 10,000 goats	No	No incentives or plans
Brazil	No 3.1% PSE (2020-2022)	421	20%	7%	10%	Yes	39 million dairy cattle 193 million beef cattle	No	No incentives or plans

[236] https://publications.iadb.org/en/agrimonitor-agricultural-policy-indicators-producer-support-estimate-pse-2023
[237] Uruguay inventory uses 'AFOLU' rather than 'Agriculture' and 'LULUCF'

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
							18 million sheep 9 million goats		
South Africa	No 4.5% PSE (2020-2022)	69	10%	3%	7%	No	1.6 million dairy cattle 12.5 million beef cattle 21.5 million sheep 5 million goats	No	No incentives or plans
India	No	649	18%	18%	42%	No	192 million diary cattle	No	No incentives or plans

Jurisdiction	Significant agricultural subsidies?[233]	Total Agricultural Emissions (Mt CO_2e GWP100)	Agriculture as percentage of total GHG (CO_2e GWP100)	Agriculture as percentage of GDP	Agriculture as percentage of employment	Net food exporter?	Approximate Livestock Numbers	Plans to price agricultural emissions?	Plans to reduce livestock production?[234]
	-15% PSE[238] (2020-2022)						111 million buffalo 74 million sheep 149 million goats		

[238] The OECD detail the manner in which the benefits to Indian farmers of subsidies are more than offset by the harm done by significant export restrictions in pp.344 of https://www.oecd-ilibrary.org/docserver/b14de474-en.pdf?expires=1723477331&id=id&accname=guest&checksum=484DB9978C78C2595B3CE1650E6702FE

A small minority of jurisdictions are planning on either pricing agricultural GHG or reducing livestock numbers, however all jurisdictions have plans and policies in place to reduce agricultural GHG (Table 2). There are a range of practices and technologies that have been identified by most jurisdictions as a means of reducing agricultural GHG while also achieving co-benefits and limiting negative outcomes. These practices and technologies are identified in a jurisdiction's strategy and then regulated, subsidised or incentivised to increase their use.

The term 'incentivise' describes a range of policies that encourage adopting a practice but are distinct from directly subsidising its use or adoption. Incentives include recognition in carbon markets, such as with soil carbon in Australia, and access to better credit, such as with livestock practices in Brazil. Table 3 highlights the treatment of a selection of common practices and technologies by the 16 jurisdictions examined.

Table 3: Policy approach for agricultural GHG mitigation and removals mechanisms

Jurisdiction	**Improved Grassland Management Practices**	**Improved Livestock Management Practices**	**Increased Soil carbon**	**Increased Forestry**	**Efficient Fertiliser Use**	**Livestock Feed additive or inhibitor Use**	**Increased Organic farming**	**Other**
New Zealand	Not incentivised or recognised	Not incentivised or recognised	Not incentivised or recognised	Can generate carbon credits,	Not rewarded	Plans to enable	No incentives	Deadline to price agricultural GHG has been shifted from 2025 to 2030.
Australia	Can generate carbon credits[239]	Can generate	Can generate	Can generate carbon credits, but	Somewhat Rewarded[242]	Plans to enable	No incentives	Agriculture GHG are often discussed

[239] https://www.dcceew.gov.au/climate-change/emissions-reduction/accu-scheme/methods
[242] https://www.dcceew.gov.au/climate-change/emissions-reduction/accu-scheme/methods

Jurisdiction	Improved Grassland Management Practices	Improved Livestock Management Practices	Increased Soil carbon	Increased Forestry	Efficient Fertiliser Use	Livestock Feed additive or inhibitor Use	Increased Organic farming	Other
		carbon credits[240]	carbon credits[241]	additional requirements in place to prevent negative outcomes				along with AFOLU GHG and described as the 'land sector'
Canada	Expected to generate carbon credits in future[243]	Expected to generate carbon credits in future[244]	Expected to generate carbon credits in future[245]	Management can generate carbon credits,	Expected to be subsidised in future[246]	Allowed. Expected to be subsidised	No direct incentives. Funding for certification	Farm fuel excluded from ETS
United States of America	Subsidised	Subsidised	Subsidies via activities	Subsidised if generating biodiversity benefits. Can generate carbon credits in	Can generate credits if biodiversity and other requirements are met	Allowed and Subsidised	Subsidised	Wide range of subsidies available to reduce on-farm non 'agricultural' GHG, such as

[240] https://www.dcceew.gov.au/climate-change/emissions-reduction/accu-scheme/methods
[241] https://www.dcceew.gov.au/climate-change/emissions-reduction/accu-scheme/methods
[243] https://www.cfa-fca.ca/fertilizer-emission-reduction-strategy-faq/
[244] https://www.cfa-fca.ca/fertilizer-emission-reduction-strategy-faq/
[245] https://www.cfa-fca.ca/fertilizer-emission-reduction-strategy-faq/
[246] https://www.cfa-fca.ca/fertilizer-emission-reduction-strategy-faq/

Jurisdiction	Improved Grassland Management Practices	Improved Livestock Management Practices	Increased Soil carbon	Increased Forestry	Efficient Fertiliser Use	Livestock Feed additive or inhibitor Use	Increased Organic farming	Other
				some states.				electrifying transport
United Kingdom	Subsidised in ENG, WLS, NI and SCT Carbon audit subsidised in SCT	Subsidised in ENG, WL and NI	Testing a subsidy requirement in ENG, WLS, SCT Testing a subsidy requirement in NI	Subsidised in ENG, WLS, NI and SCT	Subsidised in ENG, NI, SCT Plans to subsidise in WLS	Plans to enable from 2025	Subsidised in ENG, WLS, NI and SCT	A large amount of policy reform underway post-Brexit
European Union	Widely subsidised	Widely subsidised	Activities widely subsidised	Activities widely subsidised	Subsidised but not included in ETS	Allowed Subsidies in Flanders and Slovenia	Subsidised	Significant CAP reform being considered
Ireland	Subsidised	Subsidised	Work underway to enable farmers to generate carbon credits	Subsidised	Subsidised	Can be used. Not subsidised.	Subsidised	Nitrate issues from dairy a large focus

Jurisdiction	Improved Grassland Management Practices	Improved Livestock Management Practices	Increased Soil carbon	Increased Forestry	Efficient Fertiliser Use	Livestock Feed additive or inhibitor Use	Increased Organic farming	Other
Netherlands	Subsidised	Subsidised	Subsidised	Subsidised	Subsidised	Can be used. Not yet recognised or subsidised.	Subsidised	Policy focusses on 'closing cycles in agriculture at the smallest scale'
Denmark	Subsidised	Subsidised	Subsidised	Subsidised	Subsidised	Can be used but not yet recognised or subsidised, but plans to from 2030	Subsidised	Plans to implement large scale system of taxes and subsidies by 2030
Norway	Subsidised	Included in plans, unclear if subsidised	Included in plans, unclear if subsidised	Subsidised	Subsidised	Included in plan, unclear if subsidised	Subsidised	Farmers receive a large amount of their income from direct subsidies
Israel	Subsidised	Subsidised	Unclear if subsidized directly	Subsidised	Subsidised	Data not found	Subsidised	Recently introduced reforms to decrease

Jurisdiction	Improved Grassland Management Practices	Improved Livestock Management Practices	Increased Soil carbon	Increased Forestry	Efficient Fertiliser Use	Livestock Feed additive or inhibitor Use	Increased Organic farming	Other
								tariffs and increase subsidies
Japan	Subsidised The use of biochar can generate carbon credits	Subsidised Livestock waste management can generate carbon credits	Subsidised	Subsidised	Subsidised The use of nitrification inhibitors in fertiliser can generate carbon credits	Not mentioned in policies	Subsidised and increasing organic farming a key target	Focus on reducing non 'agricultural' farming GHG, such as electrifying transport
Uruguay	Incentivised with policy	Incentivised with policy	Incentivised with policy	Incentivised with policy	Referenced for future policies	Feed concentrates included in key policies to reduce GHG going forward	Not included in plan	Repeated references to the need to improve metrics for methane, GTP referenced. Each GHG as separate NDC target

Jurisdiction	Improved Grassland Management Practices	Improved Livestock Management Practices	Increased Soil carbon	Increased Forestry	Efficient Fertiliser Use	Livestock Feed additive or inhibitor Use	Increased Organic farming	Other
Brazil	Incentivised with policy	Incentivised with policy	Incentivised with policy	Incentivised with policy	Incentivised with policy	3NOP Authorised for use but unclear how tools will be used	Not included in plans	Strong focus on activities that improve soil carbon in plan
South Africa	Proposed incentives	Proposed incentives	Proposed enhanced soil sampling	Plans to incentivise	Plans to incentivise	Plans to incorporate in policy	Not mentioned in policy	Many of the practices are only referenced in a draft bill. It is unclear if this bull is likely to be passed and implemented.
India	Subsidised	Subsidised	Not included directly	Subsidised	Subsidised Biofertilisers and biopesticides	Not included in policy	Subsidised	Plans focus on the benefits of integrating the operations of small farms

Appendices

Voluntary Non-State Agricultural Emissions Reduction Targets

Fonterra has set a target of 30 percent GHG intensity reduction by 2030 and signed up to achieve net zero by 2050 with fellow Global Dairy Platform members.

In 2017, the Australian levy body Meat and Livestock Australia (MLA) announced a commitment to the red meat sector to achieve a 'climate neutral' target by 2030. This target takes a net approach using the GWP100 metric, but there have been recent calls by Cattle Australia to change the 'carbon neutral' target to 'climate neutral'.[247]

Canadian Beef Advisors aims to reduce emission intensity from primary beef production by 33 percent by 2030, while the Dairy Farmers of Canada aims to reach net zero by 2050.

The UK NFU has set the goal of reaching net zero GHG in England and Wales by 2040.[248]

Cargill Canada has set a target to reduce emissions by 30 percent by 2030, implementing regenerative agriculture practices and improved grazing management.

- The National Farmers' Federation – the peak national body representing Australia's farmers – supports an economy-wide aspiration of net zero by 2050 with some conditions. [249]
- The Red Meat Advisory Council (the federation of Australian red meat and livestock peak bodies), the Cattle Council of Australia (the peak body for cattle producers), and Meat and Livestock Australia (the industry's official marketing and research body) all support the goal of Australia's red meat industry becoming carbon neutral by 2030.[250]
-

Metrics and the Novel Treatment of Biogenic Methane

The Australian Government notes the issues surrounding methane and GWP100 but clearly wishes to follow an international approach.

> *"There is an ongoing discussion about whether a different metric, 'GWP*', should be used in national greenhouse gas accounting, which might better reflect the*

[247] https://www.theguardian.com/australia-news/article/2024/may/08/methane-emissions-australian-cattle-industry-suggests-shift-from-net-zero-target-to-climate-neutral-approach
[248] https://www.nfuonline.com/media/jq1b2nx5/achieving-net-zero-farming-s-2040-goal.pdf
[249] https://www.abc.net.au/news/2020-08-20/farmers-back-zero-emissions/12576806
[250] https://www.mla.com.au/globalassets/mla-corporate/research-and-development/program-areas/environment-and-sustainability/2689-mla-cn30-roadmap_d3.pdf

> *transient nature of short-lived greenhouse gases. Australia and the international community have not adopted this convention yet."*[251]

The Canadian Government sees the short-lived nature of methane as an opportunity to make short-term warming reductions, stating:

> *"Methane is classified as a short-lived climate pollutant, meaning it stays in the atmosphere for a short time compared to other gases like CO_2. As a result, actions to cut methane emissions will quickly lower their atmospheric concentrations and lead to a relatively quick climate response. Taking action to reduce emissions is one of the fastest, most cost-effective things we can do to fight climate change, protect our environment, and keep our air clean."*
> *https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reducing-methane-emissions.html*

Uruguay is the most active on the issue of metrics and methane, stating:

> *"In 2014, the IPCC pointed out that "the GWP metric is not directly related to a temperature limit, as the 2oC target, whereas some economic metrics and physical end-point metrics like the GTP may be more suitable for this purpose", thus calling upon further dialogue on the implications of the different metrics and to "provide metrics that can be useful to the users and policymakers". Due to the significant impact this discussion could have on priority assignment concerning mitigation policies, especially with regard to the agriculture sector, Uruguay has decided to submit its contribution sorted by gases."*[252]

[251] https://grattan.edu.au/wp-content/uploads/2021/08/Towards-net-zero-Practical-policies-to-reduce-agricultural-emissions.pdf, pp16

[252] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Uruguay/1/INDC%20Uruguay%20(English-unofficial%20translation).pdf