Levegő Munkacsoport

The Cost-effectiveness of Reducing Methane Emissions from Agriculture

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Methodology

Agricultural methane emissions mainly originate from two sources: methane emissions from ruminant digestion and methane produced from animal manure. Both sources fall within areas where novel and often still experimental solutions—tested only at laboratory or semi-industrial scale—are being explored as means to reduce agricultural emissions.

This chapter is a quantitative, mainly economic approach to solutions that are not yet operational in practice, only in laboratory or pilot settings, without established production capacity or operational experience. Thus, the simplest cost-benefit analysis (CBA) method can be used with due caution, because the aim of the analysis is to compare all the costs and benefits of an innovation, including externalities. We try to convert external costs - environmental damage, social impacts - into monetary value. The benefits include a reduction in methane emissions and, if there are any, an accounting of other benefits. The result of the analysis is a net benefit indicator that shows whether the technology is economically and environmentally worthwhile.

One of the best tools for such research would be life cycle analysis (LCA), but for laboratory or semi-industrial innovations where full-scale manufacturing capacity has not yet been established, LCA is often not feasible due to a lack of accurate data on the full life cycle of the innovation. LCA analyses the environmental impacts of the manufacturing, transport, use and disposal phases, but these are not yet defined or only estimated at the early development stage. At the early stage of development, the environmental impacts of manufacturing, transport, use, and disposal are either undefined or only roughly estimated, making the LCA results speculative and unreliable. Therefore, LCA is used more for the analysis of mature technologies. It is worth adding that the chosen CBA (cost-benefit analysis) method also faces similar challenges for laboratory or semi-industrial innovations where mature manufacturing capacity is not yet available. CBA aims to summarise the full costs and benefits of a technology, but at the early development stage, these data are often uncertain, incomplete, or entirely unavailable.

I. Feed Options and Their Domestic Applications

Changing the composition of ruminant feed, in particular to reduce methane production, has many potential benefits, but also entails costs. Methane, as a greenhouse gas, is a major contributor to global warming, so optimising agricultural practices is essential for sustainability. In animal nutrition, practices are generally divided into two categories:

- changing the composition of the feed
- the administration of feed supplements

For now, we will not mention solutions that are currently considered technologically distant, such as genetically modified ruminants to reduce methane emissions, or vaccine-assisted inhibition.

1. Feeding and its costs

Among the basic principles of modern animal nutrition, the preservation of animal health, the maximisation of production potential and the reduction of environmental impact are key. The best results can be achieved by combining basic feed with targeted feeding to meet the needs of the animals. Basic feed covers the essential share of animals' energy and nutrient requirements, while targeted feeding is used to address differences between animals with different utilities and performance levels.

Basic feed provides a basic part of the energy and nutrient needs of animals. Its main components are silage, grain crops, hay and grazing. Silage, for example in the form of maize or alfalfa silage, is an energy-rich and storable fermented feed source, particularly important during periods of intensive production. The high fibre content of hay helps digestion and prevents digestive problems. Grazing has a complementary role, especially in extensive livestock production, where animals have natural access to the nutrients they need. This is generally not feasible in intensive indoor systems, though there is a growing niche demand in Hungary for meat and milk from extensively raised animals.

Targeted feeding is adapted to production objectives and individual livestock. Vitamins, minerals, probiotics and methane-reducing agents such as 3-NOP play a key role in this. These additives not only support health but also significantly improve feed utilisation while contributing to environmental objectives.

A balance of protein, fibre and carbohydrate intake is essential. Protein is essential for muscle building, milk production and reproductive functions, but excessive intake can cause environmental stress. In addition to soy meal, modern practices use alternative protein sources such as bone meal, fish meal and insect meal. Fibre is essential for a healthy digestive system, while carbohydrates are the main source of energy. Fast fermenting carbohydrates can result in high milk yields, but the balance of these nutrient components is critical to avoid digestive problems. It is worth noting that feed supplements that are frequently lead to such digestive issues despite their methane-reducing intent.

In the following, I will try to give an approximate estimate of the cost of feeding the domestic ruminant herd (2025 conditions).

At the end of 2023, our ruminant population will be 862,000 cattle, of which 403,000 will be dairy cattle and 907,000 sheep.[1] These figures are used as a basis for estimating the cost of feeding ruminants.

1 https://www.ksh.hu/stadat_files/mez/hu/mez0027.html

Table 1. Estimates of the approximate cost of feeding domestic cattle and sheep flocks based on data from the KSH

Species	Daily feed consumption (kg)	Feed cost (Ft/kg)	Annual cost per animal (HUF)	Total annual cost (HUF)
Milking cows	20-25	100-150	730,000-1,368,750	630-1,180 billion
Fattening cattle	15-20	100-150	550,000-1,100,000	550-950 billion
Total cattle	-	-	-	1,180-2,130 billion
Ewes	1.5	100-150	55,000-110,000	
All sheep	-	-	-	50-100 billion

Livestock farmers spend approximately **HUF 1200-2300 billion** on animal feed every year. The feeding discipline and equipment of Hungarian livestock farms is below the Western European level. Recognising this, the Hungarian government and the European Union have launched a number of support programmes to modernise livestock farms and increase their competitiveness. Under the Rural Development Programme, significant funds are provided for the improvement of livestock farms, including the modernisation of feeding technologies.[2]

Addendum: methane production in the rumen

The formation of methane in the rumen of ruminants is a natural by-product of fermentation processes, mainly by methanogenic archaea. The microflora of the rumen, consisting of bacteria, protozoa and fungi, break down the fibre content of the feed. This process produces hydrogen (H_2) and carbon dioxide (CO_2), the accumulation of which could inhibit fermentation processes. Methanogenic archaea, however, use the hydrogen and carbon dioxide to form methane (CH_4), which the animal releases into the atmosphere as a rumen gas. The formation of methane is therefore a consequence of the pre-digestion of fibre and is only represents just one component of the complex chain of processes occurring in the rumen during digestion. There is not space in this paper to discuss this in more detail, but the article by Wirth et al. (2018) discusses the pathways of rumen metabolism in more detail.

If methane production is reduced, e.g. by methane inhibitors, but other processes are not affected, the level of dissolved hydrogen in the rumen may increase. This can upset the digestive balance, as the removal of hydrogen is key to maintaining the efficiency of the fermentation process. Hydrogen accumulation can slow down the activity of micro-organisms, reduce the utilisation of

2 https://magyarmezogazdasag.hu/2021/04/09/az-allattarto-telepek-korszerusitese-versenykepesseg-zaloga/?utm_source=chatgpt.com

fermentation products and thus impair the energy utilisation of animals. Redirecting the accumulated hydrogen to other pathways would be an excellent way to replace methane with other useful compounds from the hydrogen in the rumen. One possible alternative is to promote the Wood-Ljungdahl pathway, in which acetogenic bacteria convert hydrogen and carbon dioxide into acetate, providing a more useful end product for the animal. However, if this pathway is not adequately supported, the digestive efficiency of animals can be significantly reduced, which can have a negative impact on milk production and weight gain. Therefore, to effectively implement methane reduction strategies, it is essential to consider alternative uses of hydrogen. Based on the literature review, recent studies have sought to integrate this alternative pathway alongside methane inhibition, though success has not yet been achieved (Ungerfeld, 2015)

1.1 Changing the feed

Research has shown that different feeds can have different effects on methane production. For example, high fibre forages such as grass can reduce methane production, while high carbohydrate forages such as maize can increase it (Kim et al, 2013). However, the introduction of such feed changes may have upfront costs that make the transition difficult, for example, by increasing the purchase price of feed due to different composition, or, or by using more expensive alternatives to more economical feeds (Palangi & Lackner, 2022). Based on the latter study, economic benefits are expected that may be associated with claiming carbon credits for the resulting methane emission reductions, which may provide an economic incentive for farmers. Such subsidies are already available in Australia, for example.

Vegetable oils such as sunflower oil or rapeseed oil are often used to increase the fat content of feed. The cost of adding such oils depends significantly on market prices and sources of supply. It can be estimated that the purchase price of these oils could be between $200 and $500/tonne, based on current market conditions and domestic purchase prices.[3] Another option is to reduce the fibre content, but this may cause acidification of the rumen pH and deterioration of the milk's textural values. It is not easy to determine the direct costs of this because it is only a question of shifts in emphasis in the feeding system, where the aim is to reduce fibre content and to introduce additional oil and fat. All these changes in feed can be envisaged without additional costs. There is a risk and difficulty in breaking the habit, because the established "recipe" for forage has spread, and in the case of fibre fodder, especially grass hay, even large farms have not adapted to climate change and therefore still tend to mow the first crop at the end of May, which in many cases results in stunted, protein-poor, fibre-rich grass hay.

1.2. *External costs of changing feeding practices*

A fibre-deficient feeding regime can cause two digestive disorders, *acidosis* and *ketosis*.

Acidosis is an unfavourable condition in the rumen of ruminants, which is a significant reduction in pH. It occurs mainly when animals consume excessive amounts of easily fermentable

3 Repcedara for feed is available at 260 Ft/kg.

carbohydrates such as starch, while their diet lacks adequate fibre. The micro-organisms in the rumen then carry out rapid fermentation, leading to the formation of significant amounts of lactic acid. The lack of fibre reduces cud-chewing (rumination) and with it the rumen's natural acid-neutralising mechanism: saliva production. In the long term, acidosis can cause inflammation, foot-end disease, reduced milk production and shortened productive life of the animals.

Ketosis is another metabolic disorder that primarily develops as a result of negative energy balance, especially during the early stage of lactation. In the early stages of milk production, cows' energy requirements sometimes exceed the energy intake from feed, especially when the diet is rich in fat but deficient in fibre. Under these conditions, the body breaks down fat reserves, leading to the formation of ketone bodies. If the amount of ketone bodies is too high, it has a toxic effect on the body, resulting in loss of appetite, loss of milk yield and weight loss. A diet low in fibre and high in fat and protein aggravates this condition, as the digestive balance is upset and the rumen's microbial flora cannot adapt properly to the altered composition of the feed. As with acidosis, ketosis reduces the life span and productivity of cows, causing significant economic losses.

Both diseases reduce the number of lactation cycles and often result in the premature culling of animals that could have completed at least one additional cycle. The cost of early culling in the Hungarian cow herd can impose a significant economic burden on farmers, especially if it is caused by problems resulting from a high-fat, low-fibre diet, such as acidosis or ketosis. It takes about 9 months to raise a heifer, during which time the animal consumes 10-12 kg of dry matter (silage, hay, concentrates) per day. The cost of feed is estimated at between 100-150 HUF/kg at current prices. Thus the total cost of rearing a heifer is between 270,000 and 486,000 HUF. This cost can be reduced if no mistakes are made in the feeding of a reared heifer and the animal survives 3 lactation cycles, because the rearing period of 9 months will be relatively shorter compared to the time available for production.

If a cow completes only one or two lactations instead of the average three, additional heifers must be raised to replace her. In the Hungarian dairy herd of 403,000 cows, if 10% of the population (approximately 40,300 cows) are subject to early culling, the feed costs associated with raising the necessary replacement heifers would range between HUF 10.88 billion and HUF 19.59 billion. This amount reflects only the cost of feed and does not account for production losses (such as lost milk yield), veterinary expenses, or the long-term economic consequences of culling.

1.3. Impact and cost of feed supplements

Asparagopsis taxiformis (a species of red algae) and 3-NOP (3-nitroxypropanol) are methane-inhibiting feed additives designed to reduce methane emissions from ruminants. Asparagopsis contains bromoform, which suppresses the activity of methanogenic micro-organisms in the rumen. 3-NOP directly inhibits the action of the enzyme methyl-coenzyme M reductase (MCR), which is responsible for methane formation. Although both supplements are environmentally beneficial, potential negative effects on animal metabolism have also been raised. In the case of Asparagopsis, residues of bromoform may appear in milk or meat, raising food safety concerns. For 3-NOP, some studies have reported long-term alterations in the composition of the rumen microflora, which may negatively affect digestive efficiency.

Asparagopsis taxiformis and 3-NOP have demonstrated the highest efficacy in laboratory experiments (showing 40–80% inhibition; cf. Asparagopsis: Indugu et al. 2024; 3-NOP: Hristov et al. 2015), but under real-world agricultural conditions, the results have been significantly more modest. In laboratory settings, the controlled environment and precisely defined dosing allowed these inhibitors to achieve their maximum effectiveness. In contrast, in agricultural practice, the variability of feed mixtures, dosing difficulties, and individual animal differences frequently lead to lower methane reduction rates than those observed in the laboratory. As a result, there is a significant discrepancy between laboratory results and in situ measurements (Glasson et al. 2022; Maigaard et al. 2023). In the case of Asparagopsis, studies have identified a significant accumulation of hydrogen in the rumen fluid. This indicates that while the methane inhibitor compound is active, the hydrogen—normally a substrate for methane formation—remains in the rumen and is not redirected into alternative metabolic pathways (Romero et al. 2024).

Of the two feed supplements, 3-NOP is already commercially available, but its price cannot yet be determined, as it is not widely available and is currently marketed only in a few countries. 3-NOP is marketed under the trade name *Bovaer®*, developed by DSM to reduce methane emissions from ruminants. However, the economic implications of its use are still under investigation, as the product has only recently been approved, and there is no long-term experience with its application. In fact, we not only lack usage experience, but there is also no truly scaled-up product with established supply and manufacturing capacity. Therefore, any attempt to price the product at this stage would be hypothetical.

Both feed additives may have adverse effects on the metabolism of ruminants. Methane production in the rumen is driven by archaea. Inhibitors either suppress the activity of these archaea or act directly on the methane-producing enzymes. Such interventions—targeting a single element of a complex biological system—may achieve the desired effect in the short term, but can also trigger harmful processes elsewhere in the system as a consequence of systemic changes. In the case of both additives, research has shown that such adverse effects have indeed occurred.

II. Methane Emission Reduction during Manure Management

The main paper on methane emissions from agriculture discusses in several points the techniques that are expected to reduce the amount of methane released from manure on livestock farms. These include traditional methods (such as aeration and covering manure storage) as well as modern approaches (such as cooling of manure and its use for biogas production).

1. Separation of the liquid phase of the manure

Separating the solid and liquid phases of manure is an effective method of manure management, as it allows a more targeted use of the different fractions and reduces the environmental impact. The costs of implementing such systems can be as follows.

A herd of 500 pigs produces 1-1.5 $m^3$of dilute manure, while 100 cattle excrete about 4-6 tonnes of manure and about 1 $m^{(3)}$ of urine.[4] As some of these cannot be separated, even in modern livestock farms, the total amount of manure is soaked in urine and separation must be carried out on the total amount. The purchase cost of a separator is between 1 and 1.5 million HUF per unit, a medium sized unit is required for farms of this size. The equipment has to fit into the farm's working schedule, as its daily 1–2 hour operation is either not automated or only partially automated. It consumes about 4-5 kW of electricity during its operation, resulting in approximately 10 kWh of extra electricity use per day[5] , which adds up to an annual cost of around 200,000–240,000 HUF — not including the cost of additional physical labour.

2. Covered Manure Storage Facilities

Covering manure storage facilities is a simple and low-cost method for the short-term reduction of methane emissions. Cover materials such as sawdust, straw, or geotextiles are often used and can be sourced at relatively low cost. For example, the price of sawdust or straw typically ranges between 5,000 and 15,000 HUF per tonne, and the annual cost of covering a small manure storage unit may be estimated at around 50,000 to 200,000 HUF. The covering can be done either manually or with mechanical assistance.

However, the effectiveness of this method is limited. Although the cover reduces oxygen ingress and methane leakage, the methane generated by anaerobic processes in the manure does not break down in the absence of adequate processing and temperature. Consequently, a large portion is released when the manure heap is disturbed or turned. Therefore, covering serves primarily as a short-term emission reduction tool and does not prevent the long-term effects of methane formation. For these reasons, manure storage covering should be considered a supplementary method, to be used in combination with more effective methane reduction technologies, such as the conversion of methane into biogas.

3. Utilisation of Biogas from Manure Management on Livestock Farms

Installing a biogas plant with adequate operational safety requires a significant capital investment, typically in the range of hundreds of billions of HUF, and annual operating costs are also substantial. Using methane as an energy source offers considerable environmental benefits by reducing greenhouse gas emissions, but the initial investment costs remain prohibitively high.

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4 https://www.nive.hu/Downloads/Szakkepzesi_dokumentumok/Bemeneti_kompetenciak_meresi_ertekelesi_eszkozrendszerenek_kialakitasa/20_1375_003_101030_30.pdf

5 https://pj-water-treatment.en.made-in-china.com/product/idkAwDZVyjhT/China-Manure-Solid-Liquid-Separator-Machine-Animal-Waste-Chicken-Cow-Pig-Dung-Dewatering-Machine.html

4. Immediate Application of Manure without Maturation

At first glance, abandoning manure storage and applying fresh manure immediately may appear to be an effective methane reduction strategy, as it avoids emissions associated with storage. However, this approach faces numerous practical and agronomic limitations.

One of the main issues is that for most of the year, arable land is under cultivation, which makes fertilisation impossible during that time. Fresh manure can only be applied to stubble fields — typically in a narrow window after harvest, lasting around one month annually. Even then, the manure must be incorporated into the soil immediately to minimise ammonia loss and odour emissions. This limited timeframe is insufficient to ensure the proper management and utilisation of the farm's total annual manure volume.

Moreover, immediate application poses serious logistical challenges. It would fundamentally disrupt the daily routines of livestock farms, as manure management would have to be continually aligned with the timing of fieldwork. This would require additional labour and transport capacity, significantly increasing costs.

From a chemical perspective, the use of fresh, unmatured manure is also disadvantageous. Its high ammonium content and low pH exert an acidifying effect on soils, which in the long run can reduce microbial activity, damage soil health, and increase nutrient leaching. Furthermore, the rapid evaporation of large quantities of ammonia can result in significant nitrogen losses, which are detrimental both environmentally and economically.

If we wish to assess the impact of poultry farming — which differs in certain respects from cattle and pig farming — on methane emissions from manure, we must first evaluate its contribution assuming equal methane emissions per unit, which can be done by comparing livestock population sizes.

The Hungarian poultry population in the country is 35 million, according to the latest figures from the Hungarian Central Statistical Office (KSH)[6] for 2023. The manure emissions of poultry farming can be compared with cattle using the livestock unit (LSU) conversion method. A livestock unit (LSU) is a statistical accounting concept, corresponding to 500 kg of live animal weight.[7] In this system, one head of cattle equals 0.8 LSU, a chicken 0.004 LSU, and a turkey 0.13 LSU. The poultry population corresponds to 140,000 LSU, which is roughly equivalent to 112,000 cattle, with methane emissions per tonne of manure being similar to those from cattle.[8] As shown in the baseline study, the uncertainty in cattle-related methane emissions is around 50%, which is considerably greater than the total estimated methane from poultry manure. Therefore, at present, methane emissions from poultry manure are not considered a significant factor.

6 https://www.ksh.hu/stadat_files/mez/hu/mez0029.html
7 https://www.ksh.hu/docs/hun/agrar/html/fogalomtar.html
8 We know this from experience with biogas power plants, see https://www.medgyesegyhaza.hu/adat/htmlfiles/Biog%C3%A1z%20tech%20le%C3%ADr%C3%A1s.pdf (page 9)

III. Reducing Emissions by Reducing Meat Consumption

The proportion of people following a vegetarian diet in Hungary has increased in recent years and currently stands at around 4%. This rate is lower than the European average of 5%, but in Switzerland, for instance, it reaches as high as 25%.[9]

Beef consumption in Hungary is relatively low, approximately 3 kg per person per year, and most domestic production is exported. A decrease in demand for beef—e.g. as a result of a higher proportion of vegetarians—would likely have only a moderate impact on domestic beef production.
The expansion of vegetarian diets and the decline in beef demand in Hungary could lead to a moderate decrease in the beef cattle population in the future, though not to a large extent. If the proportion of vegetarians increased from the current 4% to, say, 6–8%, and this led to a proportional reduction in domestic beef consumption, a decline of about 5–10% in the Hungarian beef cattle population could be expected. In the long term, this could mean the disappearance of 15–30 thousand beef cattle from the system. However, since Hungarian beef production is strongly export-oriented, the decline in domestic demand could be partially offset by stable or growing demand from foreign markets, meaning that the overall decline in the herd may be smaller.
If this estimate is accepted, the total direct methane emissions from cattle would decrease by approximately 5%, as beef cattle make up about half of the national herd.[10]

IV. Restructuring the Agricultural Support System

The area-based support system under the European Union’s Common Agricultural Policy (CAP) is designed to enhance the income security of farmers while encouraging more sustainable agricultural practices. The current system is structured around two pillars: Pillar I includes direct payments allocated on a per-hectare basis, while Pillar II covers rural development and environmental supports.

The most important element of Pillar I is the basic payment, which can be claimed for all eligible land. However, access to this payment requires compliance with certain environmental and sustainability criteria. These include adherence to the GAEC (Good Agricultural and Environmental Condition) standards, which mandate, for example, the maintenance of soil cover, the application of water protection measures, and land-use regulations aimed at preserving biodiversity.

Previously, one of the most significant environmental components of area-based payments was "greening," which required farmers to implement specific environmental practices such as diverse crop rotation or the designation of ecological focus areas. In the new CAP framework, however, greening has been replaced by the Eco-scheme, a system based on ecosystem services. This scheme offers farmers the opportunity to voluntarily adopt more sustainable farming practices, such as reducing fertiliser use, implementing precision agriculture, or maintaining soil cover. The

9 https://tudas.hu/a-hus-nelkuli-etrend-terjedese-megallithatatlan/
10 It should be noted that cull dairy cows are also sent to slaughter, but their herd rotation follows a 2-3 year cycle, while beef cattle rotation is about 1.5 years.

Eco-scheme is intended to provide financial incentives to support farmers in transitioning to more environmentally friendly production models.

A key feature of the Eco-scheme introduced under the new CAP is that it no longer functions as an additional payment but rather as a prerequisite for receiving the full amount of area-based support. In other words, farmers do not simply receive extra money for applying sustainable practices—they must fulfil specific sustainability requirements as a condition for receiving the full basic payment. This structure acts as a strong incentive: instead of being an optional bonus, the adoption of sustainability practices becomes a binding requirement for receiving the full amount.

Previous agri-environmental subsidies (AES), such as Hungary’s AKG scheme, were designed to financially incentivise the uptake of sustainable agricultural practices. However, research by Baráth et al. (2024) found that these subsidies did not lead to measurable improvements in environmental efficiency. The study showed that the eco-efficiency of farmers participating in the AKG did not significantly differ from that of farmers who did not receive such subsidies, suggesting that the support scheme did not effectively promote the adoption of environmentally friendly practices. One possible reason is that farmers often pursued subsidies without actually changing their farming methods, or that the subsidies were not sufficiently targeted and tailored to the specific conditions of individual farms. It is worth noting, however, that the cited study does not claim that no change occurred—only that the change was not statistically significant.

It is likely that policymakers have recognised these issues. The European Union’s CAP has long included sustainability requirements in area-based support, initially through greening and now via the Eco-scheme mechanism. But under the new framework, these mechanisms no longer merely offer incentives—they can also be used to impose penalties, as full access to funding now depends on meeting sustainability commitments. Farmers who are unable or unwilling to make such commitments will receive reduced payments.

Based on this logic, a similar mandatory sustainability component could be integrated into livestock support schemes, specifically targeting methane emissions. Under such a system, farmers raising beef cattle, dairy cows, or pigs would be required to implement certain methane reduction technologies or feeding practices in order to receive the full amount of livestock-based subsidies—much like how soil conservation or biodiversity standards are tied to land-based payments.

The requirements could include a variety of methane mitigation options, adapted to the size and technological level of each farm. Commitments could include, for example, the use of feed additives (e.g. 3-NOP or Climate Protective Feed, if trials prove successful), the adoption of manure treatment technologies (e.g. covered storage, acidification, or separation), or incentives for processing manure in biogas plants.

Such a reform would not only help reduce methane emissions but also steer the sector in the long term toward more sustainable and efficient livestock production. In addition, restructuring the support scheme would have clear market benefits: farmers who already use advanced manure management and feeding technologies could gain a competitive edge. In line with CAP principles, farms making greater sustainability commitments could receive higher support intensity, thereby accelerating the sector’s adaptation to climate targets.

As with area-based payments, there would be a basic level of support that would require nothing more than credible verification of the number of animals. The total amount would be composed as follows:

	Milking cow	Fattening cattle	Pigs
Item number	60%	70%	70%
CH4-reducing feeding	30%	20%	
Manure management	10%	10%	30%

An important consideration in the design of the proposed new support scheme is to ensure that, beyond providing basic income support, it also incentivises farmers to adopt methane-reducing technologies. To this end, the allocation of the support amount could be tailored to different branches of livestock farming, taking into account that methane emissions arise from different sources and in different magnitudes depending on the animal species.

For dairy cows, 60% of the support would be provided as basic income support, 30% would be allocated to encourage methane-reducing feed practices, and the remaining 10% would be dedicated to improving manure management technologies. Since a significant share of methane emissions in dairy cows occurs during rumination, feed-based reduction has a high mitigation potential, justifying a greater share of support for this purpose. However, manure management is also important, especially on larger farms, where anaerobic digestion of slurry represents a substantial source of methane emissions.

For beef cattle raised for fattening, 70% of the support would serve as basic income aid, 20% would promote feed-based methane mitigation, and 10% would support manure management improvements. Since fattening cattle have a shorter life cycle and a different feeding regime compared to dairy cows, methane emissions from enteric fermentation are relatively lower. Consequently, feed-based methane reduction would carry less weight in the support structure.

In the case of pigs, methane emissions are not linked to intestinal fermentation but instead originate from the anaerobic degradation of slurry. Therefore, 70% of the support would be designated as basic income aid, while 30% (potentially up to 35%) would be allocated to improving manure management. Feed-based methane mitigation would not be relevant in this context. Since slurry systems are standard in pig farming, increasing the manure management support share could incentivise farmers to implement best practices from the outset of farm planning—in the hope of achieving more efficient operations and accessing higher agricultural support.

This support structure would encourage farmers to implement methane mitigation measures while preserving the economic viability of livestock production. The exact ratios could be fine-tuned based on available technologies and cost-benefit analyses, but the direction is clear: subsidies should no longer serve merely as optional incentives for environmental add-ons, but rather become conditional requirements for sustainable livestock production—mirroring the Eco-scheme logic introduced in area-based payments.

In a second phase, the specific investment support environment, the Rural Development Programme (RDP), should offer farmers the opportunity to install the necessary capital-intensive equipment for manure treatment with the help of targeted subsidies. This phase should also support the domestic production of feed additives. Manure management technologies—such as slurry separators, aeration systems, and, on larger farms, biogas units—require substantial initial investment. However, in the long run, they reduce methane emissions and improve the overall sustainability of livestock farms.

Proposed Areas of Support under the Rural Development Programme

The following areas are proposed for targeted investment support within the framework of the Rural Development Programme (RDP), aimed at enabling farmers to implement cost-effective methane mitigation technologies. These measures would allow for coordinated improvements in feeding practices, manure management, and emission reduction, making livestock farming more sustainable and economically efficient.

a) Support for the domestic production of methane-reducing feed additives
Objective: To promote domestic manufacturing and R&D to ensure farmers have access to affordable methane-reducing feed additives, such as 3-NOP or seaweed-based compounds.
Form of aid: Investment support for building production capacity and calls for R&D projects.

b) Construction of covered manure storage facilities
Objective: To reduce anaerobic decomposition, which is one of the largest sources of methane emissions during manure storage.
Form of aid: Non-repayable grants for the modernisation of existing storage or the construction of new, covered manure storage facilities.

c) Support for the purchase of manure fraction separators
Objective: To separate slurry into solid and liquid fractions, thereby reducing anaerobic decomposition and improving manure management efficiency.
Form of aid: Equipment grants covering 50–70% of the cost for farmers.

d) Additional aid for implementing aerated manure management systems
Objective: To introduce aerated storage systems, which mitigate methane production by creating an oxygen-rich environment.
Form of aid: Technological investment support and operating cost subsidies.

These calls would create an integrated system for methane mitigation that combines feed innovations with improved manure handling. Such a support structure not only helps reduce emissions but also contributes to a more competitive and resilient agricultural sector.

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