

- Breeding for traits that not only maximise productivity, but also animal health. Longevity and high fertility are traits that slow down stock replacement cycles and reduce the share of unproductive animals kept in the stock.
- Increasing the cow's life performance through a higher number of lactations reduces the ammonia emissions per production unit of milk.

DID YOU KNOW?
Healthy animals are good for climate and people's health.

5 | REDUCTION OF AMMONIA EMISSIONS FROM MINERAL FERTILISERS (NH₃)

Emissions from ammonium nitrate (NH₄NO₃) are usually much lower than from other nitrogen fertilisers like urea based ones. Using Germany as an example, urease inhibitors which reduces the volatilisation of ammonia must be added to urea fertilisers according to new legislations. Alternatively, these fertilisers need to be incorporated or injected into the soil immediately. In general, field irrigation following fertilisation helps to „wash“ the fertiliser into the soil and prevents from nitrogen losses.

6 | IMPROVED NITROGEN MANAGEMENT ON FARMS (NH₃)

Fertilisation recommendations based on soil and plant analyses provide guidance for assessing the nutrient requirements of arable crops and grassland. In this way, overfertilisation and thus unnecessary ammonia emissions can be avoided.

The difference of all nitrogen inputs into the farm (fertiliser, feed, litter, ...) minus the total nitrogen removal (products leaving the farm) should be as small as possible. In Germany, material flow and yard gate balances have to be applied since

2018 to all farms with more than 30 ha of land, if their animal stocking exceeds more than 2.5 livestock units per ha or if they have more than 2,000 pig fattening places.

DID YOU KNOW?
Minimising nitrogen surplus keeps air and water clean.

About Clean Air Farming

Clean Air Farming promotes knowledge and techniques that can reduce ammonia and methane emissions while encouraging the appreciation of quality food. Meat and dairy should be consumed with the same care they are produced, and not thrown away as food waste. There is enormous potential to reduce emissions from food production along the supply chain. But also the consistent implementation and improvement of the legal framework are necessary.

OUR GOALS

- Raising awareness among farmers associations and the food sector and developing a common position
- Improving the involvement of civil society organisations in legislative processes and in the implementation of national air pollution control programmes
- Extending the curriculum of agricultural training to inform future farmers about emission reduction measures and the impact of ammonia and methane
- Reducing food waste from meat and dairy products along the supply chain to increase overall resource efficiency in food production and reduce absolute emissions of methane and ammonia



Clean Air Farming (LIFE17 GIE/DE/610 Air & Agriculture) is funded by the LIFE programme of the European Commission. The project started in summer 2018 and will run until the beginning of 2022.

Further information on the project can be found at:

www.clean-air-farming.eu

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Project Partners

Environmental Action Germany e.V. (DUH)



DUH is a German, non-governmental environmental and consumer protection organisation and has been working for many years in the field of climate protection and air pollution control. Since 2015, DUH has been working on ammonia and methane reduction in various projects such as „Minus Methane“ and an information campaign to reduce the nitrogen surplus.

European Environmental Bureau (EEB)



EEB is Europe's largest association of NGOs dealing with environmental issues and nature conservation. It represents the views of some 15 million European citizens and stands for justice in environmental policy, sustainable development and participatory democracy.

France Nature Environnement (FNE)



FNE is the largest association of environmental organisations in France and consists of 13 thematic departments such as agriculture, environmental health, waste and transport. FNE acts to protect environmental resources, nature and human health.

The Lake Constance Foundation (LCF)



LCF is a private, non-profit environmental organisation that implements model projects at regional, national and European level. One of the foundation's central fields of activity is supporting environmentally friendly, climate- and biodiversity-friendly agriculture.

Deutsche Umwelthilfe e.V.

Bundesgeschäftsstelle Berlin
Hackescher Markt 4
10178 Berlin

www.duh.de

✉ info@duh.de
 🐦 [umwelthilfe](https://twitter.com/umwelthilfe)
 📘 [umwelthilfe](https://www.facebook.com/umwelthilfe)

Contact

Christine Hellerström
Project Manager Transport and Clean Air
 ☎ +49 30 2400867-738
 ✉ hellerstroem@duh.de

Jens Hürdler
Project Manager Transport and Clean Air
 ☎ +49 30 2400867-738
 ✉ huerdler@duh.de



clean air farming

Reducing Ammonia and Methane Emissions from Agriculture



Ammonia and Methane Emissions from Agriculture

Their impacts and what we can do about it

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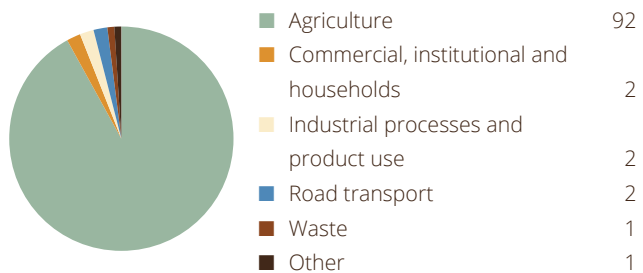


Sources of ammonia and methane from agriculture

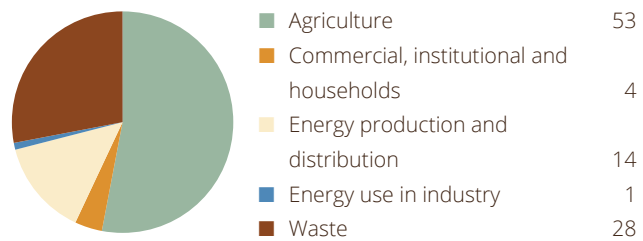
IN EUROPE, ABOUT 50 PERCENT OF METHANE EMISSIONS AND 90 PERCENT OF AMMONIA EMISSIONS COME FROM AGRICULTURAL ACTIVITIES.

The toxic gas ammonia (NH₃) results from the decomposition of organic matter like manure from cattle, pig and poultry farming and digestates from biogas plants, but also from urea based fertiliser. While methane emissions (CH₄) also originate from digestates and manure, the major agricultural source are the fore-stomachs of ruminants. Therefore, the meat and dairy producing sector offers the greatest opportunities to reduce emissions.

Sources of Ammonia in 2016 [%] (EU-28)¹



Sources of Methane in 2016 [%] (EU-28)¹



¹ European Union emission inventory report 1990-2016, 2018

What are the effects of these emissions?

AMMONIA

Ammonia reacts with nitrogen oxides and sulphur dioxide in the air and forms secondary particulate matter (PM_{2.5}). Due to its small diameter, this fine dust penetrates deep into the respiratory tract where it causes lasting damage. Thus, it is responsible for **lung and cardiovascular diseases**, negative effects on the **central nervous and the reproductive system**, and numerous other diseases. In 2015, about 391,000 premature deaths² in Europe were attributable to the exposure of PM_{2.5}. Additionally, the dry and wet deposition of ammonia results in **eutrophication and acidification of natural ecosystems**, leading ultimately to a loss of biodiversity. Especially low-nutrient landscape systems such as marshlands and forests suffer from the nitrogen input.

METHANE

Methane is not only a short-lived greenhouse gas with a 28 times higher global warming potential (GWP100) than CO₂. It also affects local air quality as ozone (O₃) is formed in photochemical processes from methane and nitrogen oxides. **Ground-level ozone** causes severe health impacts and damages plants. It leads to **asthma, chronic respiratory diseases, allergies and cardiovascular diseases** or exacerbates these diseases. In 2015, ozone was responsible for about 16,400 premature deaths² in Europe. In addition, it affects natural, agricultural and forestry land and leads to considerable **harvest losses**.

² European Environment Agency, „Air Quality Report“, 2018



Emission reduction opportunities

1 | IMPROVED STORAGE OF SLURRY, MANURE HEAPS AND DIGESTATES (NH₃ & CH₄)

Both ammonia and methane emissions can be reduced by minimizing the surface of exposed organic matter:

- Covering of slurry pits and silos with a roof, a floating cover, floating bodies (plastic, straw or bark) or a naturally forming floating cover
- Reduction of slurry channels
- Cooler outdoor storage instead of underfloor storage of manure
- Anaerobic co-digestion of manure and other organic waste residuals for generation of biogas as a source of renewable energy on-farm or supplied to local industry. If pasteurized, digestate can be spread on fields.

Also solid manure should be stored as dry and covered as possible in order to reduce emissions.

2 | LOW-EMISSION TECHNIQUES FOR SPREADING FARM MANURE (NH₃)

Improved application techniques cover the slurry with soil directly at or immediately after application or reduce the exposed surface of the fertiliser:

- Drag hose or drag shoe method
- Injection method, e.g. cultivator
- Immediate incorporation; Incorporation within a few minutes could avoid up to 90 percent ammonia losses in the field.
- Dilution of liquid manure by at least 50 percent at low temperatures, e.g. via irrigation systems.

3 | ACIDIFICATION OF SLURRY (NH₃)

By acidifying the slurry from a naturally high pH value to a neutral level, the outgassing of ammonia is reduced by at least 50 percent. In conventional agriculture this is achieved by adding sulphuric acid. The sooner the acid is added the more efficiently nitrogen is kept inside the manure. Thus, acidification in stables offers a high reduction potential.

4 | EMISSION REDUCTION STRATEGIES THROUGH OPTIMISED FEEDING AND KEEPING OF LIVESTOCK (NH₃ & CH₄)

In the case of ruminants, nitrogen excretion is highly dependent on the crude protein content of the feed. The feed composition and feed management thus have an influence on the resulting ammonia emissions per livestock unit or production unit (1 L milk). Nitrogen excretion can be reduced by feeding the animals according to their performance. Emission reduction per production unit requires good animal husbandry and good animal health so that feed can be used optimally.

The following methods help to reduce methane and ammonia emissions through optimised feeding and husbandry:

- The use of low protein raw materials
- Reduction of excess protein supply by adhering to current feeding recommendations. That also means a better adaptation of the feed composition to the needs of the farm animal, e.g. according to lactation stage, age and weight of the animals, etc.

DID YOU KNOW?

Low-emission techniques improve fertiliser quality.