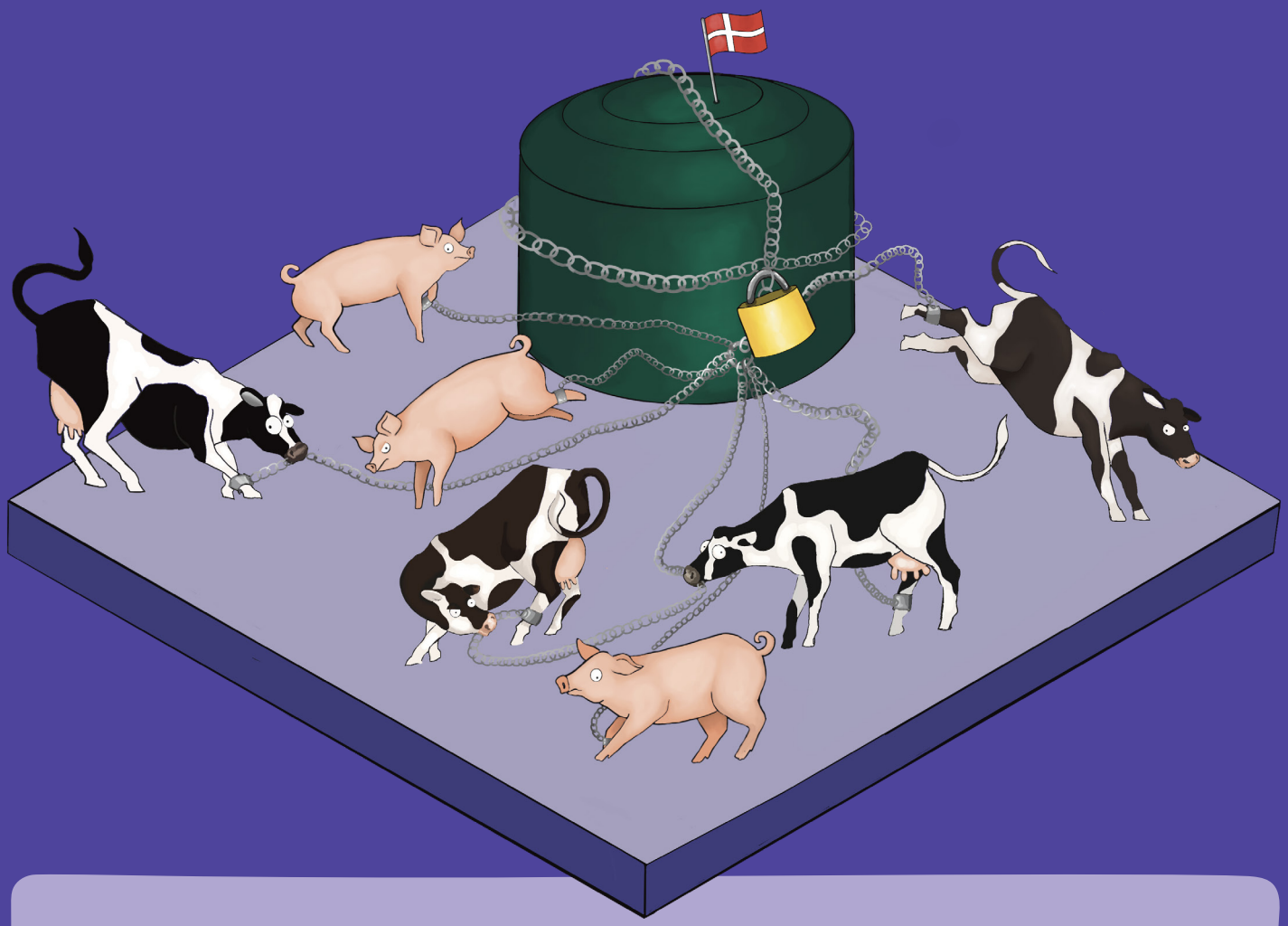
# Denmark's dystopian dash for biogas

## Driving intensive animal production, jeopardising the country's climate leadership



To tackle the climate crisis and protect public health, we must reduce farm animal numbers. Instead, the rush for biogas props up factory farming and locks in pollution. Denmark claims climate leadership, but its current biogas strategy is moving in the wrong direction.

NOAH
Friends of the Earth Denmark

FOODRISE

# Summary[a]

- Danish biogas and animal production data show that against an overall reduction trend, the **municipalities with the largest biogas production capacity are also those with the highest increases in pig or cattle numbers over the last 15 years**. The top 4 largest municipalities in terms of biomethane/electricity production saw an increase of 8% in pigs and those ranking 5-8 saw an increase of 5% in cattle between 2010 and 2024.
- Foodrise and NOAH's analysis exposes how Denmark's push to ramp up biogas – with a 50 PetaJoule target from 2035, heavily reliant on animal manure – will fatally weaken its climate leadership by entrenching **"factory farm gas"**, locking in industrial animal production, and jeopardising Denmark's green credibility.
- The **Danish Tripartite Agreement requires an agricultural emissions reduction of 55-65% by 2030**. Given the **scientific consensus** that **significantly reducing farmed animal numbers** is essential to **prevent climate catastrophe,** such reductions are the only way for Denmark to sustainably reach its target.
- However, our research shows that to meet the **2030 biogas target set out in the government's 2025 climate projection, cattle and pig numbers in Denmark would need to remain roughly stable (94% of today's numbers).** Three-quarters of current cattle and pig production would be locked in to achieve the 2050 biogas target.
- Biogas production gives rise to significant upstream and downstream environmental impacts, yet we estimate that **almost 20 times more new funding is being allocated to biogas —** which drives intensive animal rearing —**than is available under the Plant-based Food Grant (part of the Danish Plant-based Action Plan).**
- The geographical concentration of animals goes hand in hand with growing industrialisation reflected in an **increase in the number of animals per farm**. For example, in 2024, there were fewer than 2,000 pig farms compared to over 5,000 pig farms in 2010 – **a reduction of over 60%.** Over the same time period, the average number of pigs per farm **more than doubled from 2,600 pigs to nearly 6,000 pigs per farm.**
- Denmark's dystopian dash for factory farm gas could see the rise of **the industrial mass-production of "energy pigs" and "energy cows"** reared at least partly for their manure rather than as a food source **in high density farms with little regard to animal welfare, the environment, or the health of local communities.**
- **Denmark's leadership** on phasing out climate-damaging energy crops and fossil fuels **is undermined by the need to feed 85% of its cereal production to farm animals and to import over EUR 850 million[1] of animal feed ingredients,** such as soybeans from South America, as well as agricultural **fertilisers** to the tune of **EUR 420 million**.
- **Manure-fed biogas targets must and can be reduced significantly to ensure Denmark achieves its overall climate change mitigation ambitions**, including a just transition to less animal agriculture and more plant-based protein production.

In this report we use the term "factory farm gas" as a generic term to refer to the gas resulting from the anaerobic digestion of animal manure from highly industrialised animal production, which can be combusted in Combined Heat and Power plants, or upgraded to biomethane to be injected into the gas grid. To pin down further the scope of intensive factory farming, the European Industrial Emissions Directive (Directive 2010/75/EU, amended by 2024/1785[2]) provides guidance. It applies to farms that confine more than 40,000 poultry, 2,000 production pigs, or 750 sows. Disturbingly, cattle farming still is excluded completely from its scope. However, the EU Commission will need to assess and report on cattle emissions by the end of 2026, possibly accompanied by a legislative proposal[3].

**Across Europe, Denmark is hailed as a "sustainable" biogas and biomethane champion – but this reputation deserves closer scrutiny.**

a Sources for the data in this summary are available in the main text. Or, if preferred, a fully referenced copy of this summary can be found in part 1 of the technical annex.

# Denmark's crucial leadership with the Plant-Based Action Plan

Denmark's Plant-Based Action Plan represents true climate leadership: by accelerating plant-based protein production and consumption, the country is acting on the clear scientific evidence that this is one of the fastest, most effective ways to slash emissions and boost public health.[4]

**"If Danes were to eat according to climate-friendly dietary guidelines[b], they would gain more healthy years of life, the country would see a saving of DKK 12 billion (EUR 1.6 billion) in health costs and reduce its climate footprint by 31–45 per cent."**

Danish Action Plan for Plant-based Foods[5]

# Almost 20 times more new funding is being allocated to biogas than under the Plant-Based Food Grant

The Danish government has allocated about EUR 90 million (DKK 675 million) to fund plant-based projects from farm to fork between 2023-30[6]. In contrast, an estimated EUR 1.7 billion is being made available for supporting the production of upgraded biogas – which can be injected into the gas grid – in new plants and through the extension of existing plants[c 7]. Even taking into account the EUR 77.8 million (DKK 578.5 million) that Denmark has allocated for eco-schemes and crop diversification (*"especially the proportion of legumes and crops for human consumption"*[8], but also applicable for animal feed) under its current Common Agricultural Policy (CAP) Plan for 2023-2027, an astonishing imbalance remains.

# Denmark's biogas boom hinges on a manure gold rush — with the government aiming to collect 50% of all manure by 2030 and industry pushing for 85%, locking in factory farming under the banner of 'green' energy

The bulk of Danish biogas plants take agricultural feedstock, of which 75% is manure in terms of volume[9]. Both the Danish government and the biogas industry plan to significantly increase the **"manure collection rate"**[10]. This refers to the percentage of total animal manure that is collected compared to the total amount produced by animals. Currently, **only about 1/3 of total manure produced is collected for biogas**. Government and industry have substantially different assumptions about how much the collection rate will or can be increased in the future:

- According to the recent government "Climate Status and Outlook" (2025), **around half of all manure produced will be collected as biogas feedstock in 2030**, supported by methods such as *"rapid sluicing out liquid manure from livestock buildings"*[11]. By **2050, collection rates are assumed to be double what they were** 2024 (at least 63% of total manure produced – see technical annex part 4.2 for information on why this number may be higher).
- The biogas industry, on the other hand, aspires to **collect 85% of total manure** produced from 2030 onwards[12].

b According to the Danish "Official Dietary Guidelines – good for health and climate", meat consumption should be limited to **350 grams per week**, while the intake of pulses should be increased to **100 grams per day**. For more information, see: Ministry of Food, Agriculture and Fisheries of Denmark. 2021. The Official Dietary Guidelines – good for health and climate. https://foedevarestyrelsen.dk/Media/638194807769097944/Danish_Official_Dietary_Guidelines_Good_for_Health_and_climate_2021_PRINT_ENG__webtil.pdf

c This is on top of support through existing schemes, so the total amount is even higher.

# The upscale of factory farm gas goes hand in hand with an intensification of animal production: Against an overall reduction trend, 8 Danish municipalities with the highest biogas production saw increases in either pig or cattle numbers between 2010 and 2024.

According to Danish biogas and animal production data, between 2010 and 2024, pig and cattle numbers reduced much faster in municipalities with zero biogas production, compared to those with medium and high biogas production. Going against the overall reduction trend, the **8 municipalities with highest biogas production saw increases in either pigs or cattle**[13]**.**

During the same period, the proportion of manure produced that was collected as biogas feedstock rose starkly from 6% in 2010, to 32% in 2024[14].

| | Change in pig and cattle numbers between 2010 and 2024 | |
|---|---|---|
| Municipalities with: | Pigs | Cattle |
| Zero biogas production (28 municipalities) | -19% | -15% |
| Biomethane/electricity production up to 500TJ (24 municipalities) | -12% | -10% |
| Biomethane/electricity production over 500TJ (17 municipalities) | -6% | -6% |
| Municipalities ranking 1-4 nationally in terms of biomethane/ electricity production | 8% | -10% |
| Municipalities ranking 5-8 nationally | -2% | 5% |

*In the 4 municipalities with the 8% increase in pig numbers, cattle numbers reduced in line with the national average (10% compared to 9% national average). In the 4 municipalities with the 5% increase in cattle numbers, pig numbers remained nearly the same (2% reduction compared to the national average reduction of 11%).*

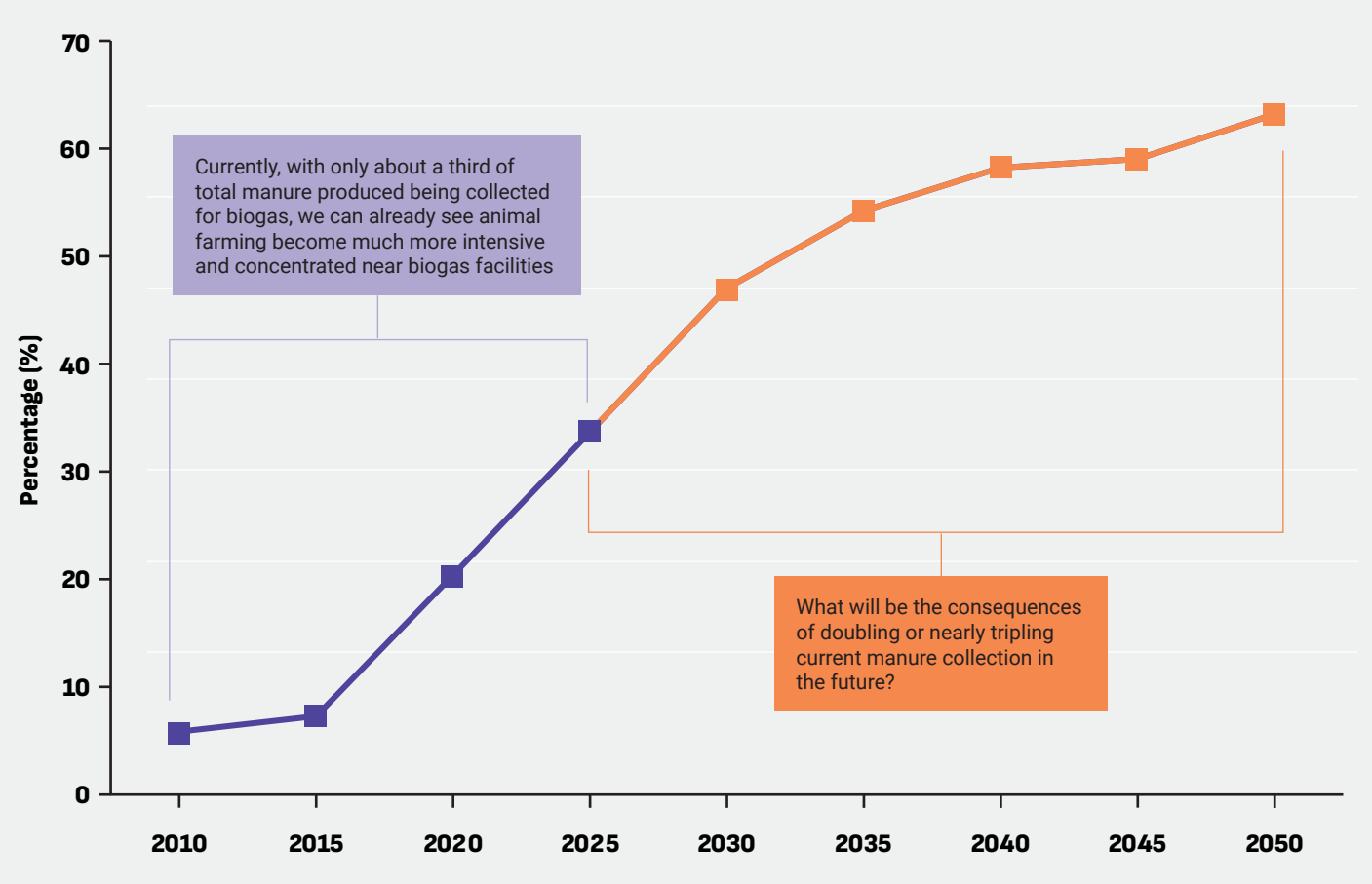
*See technical annex part 2 for information on the data sources and calculations behind this table.*

*Note that municipalities in the capital/ Copenhagen region are not considered here.*

This geographical concentration of animals goes hand in hand with growing industrialisation reflected in an **increase in the number of animals per farm**. For example, in 2024, there were fewer than 2,000 pig farms compared to over 5,000 pig farms in 2010 – **a reduction of over 60%.** Over the same time period, the average number of pigs per farm **more than doubled from 2,600 pigs to nearly 6,000 pigs per farm**[15] **–** with major consequences not only for animal welfare, but also, as NOAH unveiled, *"the environment and communities living next door. Smell, air pollution, sound and heavy traffic on small village roads are part of their everyday life. Neighbours report various health issues such as* ***headaches, nausea and lung problems due to the air pollution from the pig factories"***[16].

# Higher manure collection targets likely to drive further intensification

**Graph:** Pig and cattle manure collected for biogas feedstock as a percentage of total pig and cattle manure produced, according to Danish government data[17].



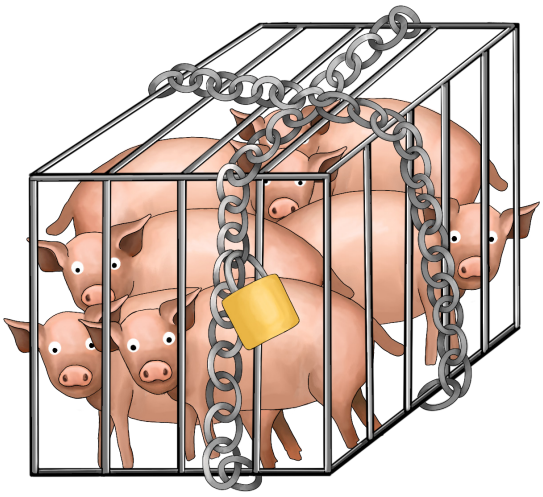

# Government and industry forecasts for biogas production rely on locking in pig and cow numbers

Our research, based on Danish biogas and animal production data, lays it bare: to hit the Danish **government's 2030 factory farm gas target, cattle and pig numbers must remain roughly stable (94% of current numbers)**. By 2050, **three-quarters of current production will be locked in. This is not a transition – it is a factory farm trap.**

# Total manure/ animals[d] that needs to be produced according to 2030, 2040, and 2050 government forecasts as a percentage of the total manure/ animals produced in 2024[18]:

| 2030 | 2040 | 2050 |
|---|---|---|
| 94% | 81% | 75% |

The industry has even higher aspirations than the Danish government. It wants to collect 25.4 million tonnes of manure in 2030[19], which is 9 million tonnes more than the volume forecast by the government. The industry assumes that this additional manure will come from collecting an even larger proportion of total manure volumes, as opposed to increasing animal numbers. However, this would require at least three quarters of all manure produced to be collected as biogas feedstock[e], which seems **extremely unrealistic**.



To get an idea of the consequences of industry manure volume targets, but with more realistic manure collection rates, we calculated the total amounts of manure that would be required to meet the industry targets, *applying the same collection rates as those implied in the government data*. In this case, **in 2030 total pig and cattle manure production would theoretically need to increase by 48%** from current production – a sign of how absurdly high the industry's aspirations are[20]. By 2040, assuming the government's collection rate for 2040 of nearly 60% of manure collected for biogas, **5% more manure would need to be produced compared to 2024[f] to meet industry aspirations.**

Of further concern is that manure volume forecasts by government and industry **do not appear to reflect the growing importance of organic farming in Denmark**, already a global leader in organic food consumption[21]. Around 1/3 of Danish milk and half of yoghurt sales are organic[22]. A total of DKK 3.6 billion (nearly half a billion Euro) has been allocated to the organic land grant scheme from 2023-30, aiming to help expand organic land to achieve the government's goal of doubling it by 2030.[23] Organic cows must have access to grass fields for at least 6 hours daily from 15 April to 1 November[24]. **However, the more time a cow spends outdoors, the less manure can be collected**. The **International Energy Agency** describes husbandry of animals on pastureland as *"a major barrier to a viable biogas industry"*[25].

d We assume that pigs and cow numbers change in line with manure volume changes. Ie. the volume of manure produced per animal remains constant.

e Industry states that in its most ambitious scenario 85% of total manure produced would be collected as biogas feedstock. However, in our calculations based on Danish government manure production forecasts (see Technical Annex part 4.2) the industry collection rate is 74% for 2030. Either way, given the intensification and geographical concentration of pig and cattle farming already observed between 2010 and 2024, we believe that these collection rates are unrealistic, and that aspiring to them will drive extreme intensification of pig and cattle farming, with dire consequences for the environment, animal welfare and issues such as anti-microbial resistance.

f Note that this smaller increase of 5% results partly from industry targets for manure being smaller in 2040 than in 2030, and partly from government data suggesting that by 2040 nearly 60% of total manure production will be collectable.

## Denmark's leadership on phasing out climate-damaging energy crops[g] and fossil fuels is undermined by the need to send 85% of its cereal production to animal feed[26], as well as the enormous volumes of imported soya, other animal feedstuffs and fertilisers.

In 2022, Denmark imported at least EUR 850 million of feedstuffs typically used in animal feed rations such as soybeans, sunflower and rapeseed protein cake[27]. Nearly EUR 300 million of soybeans were imported[h] from Brazil and Argentina[28], where – despite many certification efforts – it is virtually impossible to ensure soya is truly deforestation-free[29]. In addition, agricultural fertilisers worth more than EUR 420 million were imported[30], presumably in large part to support the growing of cereals fed to Denmark's farmed animals.

One key measure to cut reliance on feed imports is to produce more plant-based proteins domestically and directly for human consumption, as underlined in the Plant-Based Action Plan. This will also significantly reduce Denmark's exposure to volatility of international markets.

## The climate benefits of processing manure through biogas plants are dwarfed by the emissions caused by industrial-scale intensive animal production.

Animal agriculture causes an estimated 84% of the EU's agricultural emissions[31]. Also in Denmark, this amounts to approximately 80%[32]. The biogas industry claims that *"[d]igesting livestock manure in biogas plants can almost eliminate methane emissions from both cattle and pig production"*[33]. But this claim is dangerous and misleading. *At best*, biogas merely reduces emissions from manure, which accounts for only one-quarter of total emissions resulting from animal production[34]. *At worst,* biogas may be creating perverse incentives – locking in animal production, reducing waste costs for factory farms, and even turning manure into a revenue stream, while disregarding the vast majority of emissions from factory farming[35].

Crucially, cow and other ruminant animal burps (enteric fermentation) make up nearly 40% of total animal emissions[36]. Additionally, growing animal feed is responsible for 30% of emissions and often linked to biodiversity loss and deforestation, especially in Latin America.[i] However, the European Commission's methodology for estimating greenhouse gas emissions from manure biomass energy production (Renewable Energy Directive) ignores emissions from enteric fermentation and feed production[37], meaning that currently any estimates of the emissions of manure biogas lack credibility.

g Biogas from purpose-grown crops (both energy crops and sequential crops) generate significant greenhouse gas emissions from growing them (fertiliser, tractor, etc). Energy crops also drive land use change (such as deforestation). Moreover, the biogas (methane) produced from these crops is additional to the methane already present in the atmosphere meaning that even minimal methane leakage from biogas plants increases total atmospheric volumes of methane, which is an extremely powerful greenhouse gas. Denmark is phasing out energy crops fast and has no plans for using sequential crops.

h In addition to importing soya directly from Brazil, in 2022 Denmark imported nearly 250 million US$ of soya from Germany which in turn imports nearly half of its soya from Brazil.

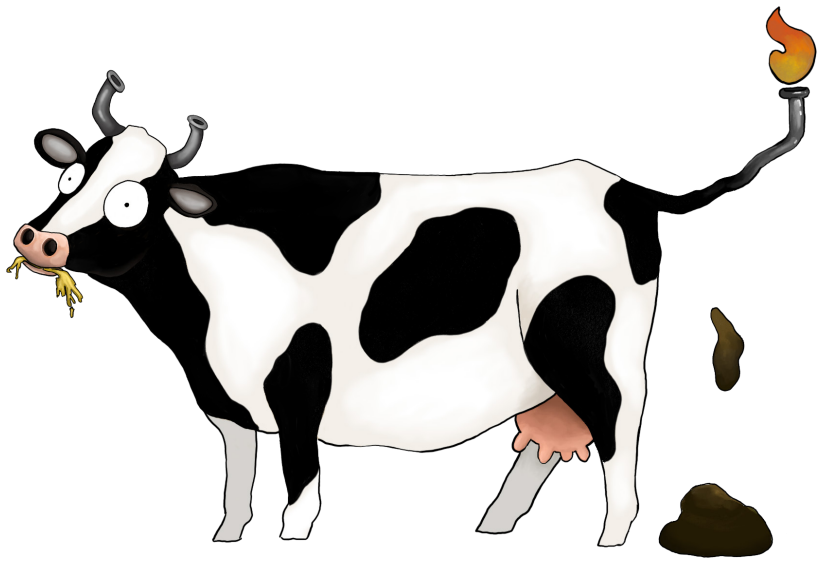
i Manure should be reclassified as a by-product rather than waste, particularly in the context of theRenewable Energy Directive (RED) emission accounting methodology. This reclassification would ensure that the environmental and social impacts from the entire life cycle of biomethane production from manure, including land use changes from feed cultivation and methane emissions from livestock, are accurately reflected. This would also encourage a shift towards non-avoidable feedstocks, discourage increases in herd sizes, and ensure that impacts in countries providing animal feed for manure production are accounted for, promoting a global justice perspective in emission accounting. For more information, see: Feedback EU. 2024. Biomethane from manure: a curse, not a cure. The biomethane rush driving intensification of livestock production in Europe. The Hague, the Netherlands: Feedback EU https://foodrise.eu/biomethane-from-manure-a-curse-not-a-cure/

# The devil is in the digestate part 1: methane emissions

Both the biogas and animal farming industry claim that turning manure into biogas tackles the high levels of methane that manure would emit if left untreated. However, digestate (left-over biomass after the biogas has been extracted) is the biggest methane emitter of the whole biogas production chain[38]. For example, a study of 30 manure-fed biogas plants in France found that **three-quarters of manure storage methane emissions avoided by the biogas process were cancelled out by the emissions from digestate storage**[39]. This is very serious given that methane is more than 80 times more effective at trapping heat in the atmosphere than $CO_2$ over a 20-year period[40].

> **"Methane abatement is the fastest and cheapest lever we have to slow heating in this decisive decade."**
>
> Sir David King, Chair, Climate Crisis Advisory Group[41]

Taking into account issues such as methane leakage and digestate storage and handling, global average biogas methane emission rates of 6% of biogas production are higher than those of natural gas at 2.2% of production[42]. Despite strict regulations[43] and third-party leak detection and repair requirements, Danish biogas emits 3.8% of its methane[j] into the atmosphere[44]. In addition, a recent investigation by the Changing Markets Foundation and Deutsche Umwelthilfe unveiled major methane leaks and malpractice at two Danish biogas plants[45]. This means that even without accounting for upstream emissions (e.g. animal feed production), ***"small leakage rates can significantly erode the climate advantage"*** of biogas – with leaks coming from both production sites[46] and pipelines[47]. Unfortunately, current European methods for methane accounting[k] do not consider leakage in a realistic manner[48] – and *"while the EU has regulations to reduce methane leaks from fossil fuel production, such as oil and gas plants, the provisions do not currently extend to biogas production"*[49].



j 3.8% reflects the median which is a better way of understanding methane emissions in the Danish biogas sector because a small number of super-emitters disproportionately increase the average, which is 6.1%. See Bakkaloglu (2025, endnote xl) for a detailed discussion on different methodologies and a comparison with the Danish government reported average of 2.8% (Danish govt methane loss). We have chosen to report the 3.8% figure as the most representative according to Bakkaloglu.

k The European Commission's methodology for estimating greenhouse gas emissions (Renewable Energy Directive) significantly underestimates total emissions resulting from biogas production because it ignores major emission sources such as leaks, mistakenly assumes 0% emissions from covered digestate storage and leaves small biogas plants off the hook.

# The devil is in the digestate part 2: nitrogen pollution

The Danish government has recently been found to be violating the EU Nitrates Directive designed to protect rivers, coasts and groundwater from nitrogen pollution – with the overapplication of manure onto fields as one of the key culprits[50]. Unfortunately, digestate from biogas production does not resolve the fundamental issue of excess nutrients in manure. This results in digestate becoming a bottleneck for biogas industry expansion because it **often exceeds the capacity of surrounding croplands to absorb it as fertiliser**[51]. To prevent increased nutrient pollution, it is essential that digestate from biogas production (including when processed) remains subject to the same nitrogen application limit of 170 kg N/ha as manure, as set by the Nitrates Directive – contrary to a recent controversial decision by the EU's Nitrates Committee that allows processed manure (RENURE) to exceed this limit by up to 80 kg/ha (totalling 250 kg/ha), provided it replaces mineral fertilisers. But driven by the Netherlands, Italy, and Denmark[52], the revision, *"while framed as a means to substitute synthetic or mineral fertiliser, in practice would allow continued unsustainable high numbers of livestock"*[53].

Furthermore, a French government study[54] of manure biogas plants found **that leaving cover crops and spreading raw manure on soils substituted more synthetic fertiliser and stored more carbon in the soil – with overall better net greenhouse gas savings – compared to spreading digestate**[l].

l While methane emissions from manure storage were strongly reduced by AD, three quarters of these reductions were offset by the emissions from digestate storage. Adding in emissions from feedstock and digestate transport, and soil carbon storage which is lower with digestate, it was concluded that currently AD in France emits slightly more GHG compared to the baseline scenario of composting and applying raw feedstocks to the field. This result must be interpreted in the French energy context, where electricity generated by AD was measured against a grid with lots of nuclear electricity, but for Denmark we also already have a more decarbonised energy mix due to the size of the wind energy sector. The French study used the standard GWP 100-year time horizon not reflecting the critical short-term impact of methane and only assumed a 1% methane leakage rate not reflecting realistic leakage rates in current AD production and supply chains, meaning that the overall climate impact may be higher than calculated. More info in section 4.1.4 in https://foodrise.eu/wp-content/uploads/sites/2/2023/11/Biomethane-Report-November-2023.pdf

# Policy recommendations

We acknowledge the role that biogas can play in a 'sustainable niche', for instance with the treatment of sewage sludge. **But tying biogas targets to industrial animal manure is a dangerous mistake. It rewards the very system driving pollution, climate impacts, and local community harm, while perpetuating animal welfare violations.** Biogas from manure should therefore play merely a **supportive role** to the main task of reducing the number of industrially produced animals and continuing the noteworthy journey Denmark has embarked on with its Plant-Based Action Plan. We therefore offer the following recommendations:

## 1. Stop the Biogas–Factory Farming Spiral: Break the link, and protect animals as well as communities

Denmark's biogas boom is fuelling a dangerous cycle: more manure collection means more concentrated animals, more pollution, and more harm to local communities. To reverse this trend:

### Cap and Reduce Animal Numbers (Including Near Biogas Plants)

- **Freeze permits for new or expanded factory farms.**
- **Set binding targets to cut animal density in zones with high concentrations of farm animals, matching the faster reductions already seen in municipalities with no biogas production.**

### Decouple Biogas from Industrial Animal Production

- **End subsidies that fund biogas production derived from manure sourced from factory farms, and use such resources for the plant-based transition and the upscale of new business models.**

## 2. Reduce Denmark's manure based biogas targets based on a thorough impact assessment where all upstream and downstream environmental impacts are accounted for

Government biogas forecasts are based on a "middle-ground scenario" of 40 PetaJoules of annual Danish gas consumption across all sectors by 2040[55]. However, the Green Gas Strategy also sets out a "Low Consumption scenario" of 24 PetaJoules, suggesting that **deeper electrification to further substitute future gas consumption** has already been given serious thought.

To set an appropriate new production target starting from the "Low Consumption scenario", **a full impact assessment must account for all upstream and downstream environmental impacts of factory farm gas.** This also means that **manure biomass emissions accounting must reflect the appropriate portion of the entire animal production cycle** (e.g. feed production and enteric fermentation) **as well as methane leakage during and after biogas production.** Lastly, impacts on the **well-being of local communities** should also be examined.

Also, when scrutinising biogas ambitions, alternative uses of unavoidable "waste" biomass should be considered. For instance, scientific evidence proves that using unavoidable food industry by-products as animal feed[56] results in more emissions reductions compared to using such biomass as biogas feedstock.

## 3. Do not make use of the new RENURE loophole to protect Denmark's water quality and climate ambition

To prevent increased nutrient pollution, it is essential that all manure-based fertilisers – including digestate and RENURE – remain subject to the Nitrates Directive's 170 kg N/ha limit. Denmark should therefore not make use of this loophole and maintain the current cap for all manure-derived fertilisers, even if processed via anaerobic digestion. It should accelerate the transition to plant-based protein production and business models for farmers as **envisioned and tackled by the Plant-Based Action Plan** – ensuring a strong farming sector, lower emissions, clean water, improved public health, and a future-proof food system.

> **"Reduction of excess meat consumption is amongst the most effective measures to mitigate greenhouse gas emissions, with a high potential for environment, health, food security, biodiversity and animal welfare co-benefits".**
>
> Chief Scientific Advisors to the European Commission[57]

For detailed information on the data and calculations behind our key findings in terms of animal numbers, manure volumes, animal number changes at municipal level, etc. please see the **technical annex**.

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1 All currency conversions in this report from original data in US Dollars and Danish Krone to EUR were done in October 2025.

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13 Please see the Technical Annex part 2 for full details of the data sources and calculations. https://foodrise.eu/wp-content/uploads/sites/2/2026/03/Technical-annex_Denmarks-dystopian-dash-for-biogas-2.pdf

14 See technical annex part 4.1 for details on the data and calculations of these collection rates. https://foodrise.eu/wp-content/uploads/sites/2/2026/03/Technical-annex_Denmarks-dystopian-dash-for-biogas-2.pdf

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