Climate-neutral 2050

Danish Agriculture & Food Council

Sources, etc.
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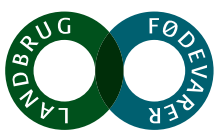
Climate-neutral 2050

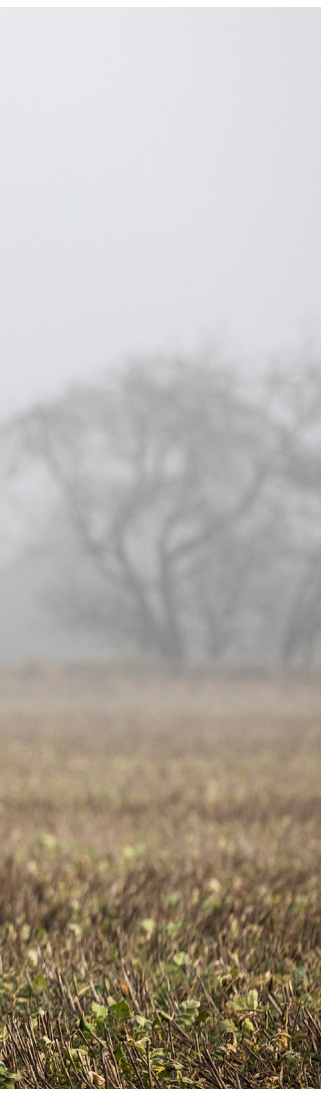


Climate-neutral 2050

By 2050, we will be 10 billion human beings on Earth. 10 billion mouths to feed. The demand for food will increase sharply. The Danish food industry is part of the solution. We will provide Danish solutions to global challenges.

Population growth, food demand and climate change are major challenges. Food production impacts the climate and, as a result, new and innovative solutions are needed if we are to satisfy everyone's appetite while considering the climate challenges the world is facing.

The Danish food industry is ready to take up this challenge. We want to set an example. And we want to create solutions that can not only be the answer to Danish gas emissions, but can also inspire and lead the way for our colleagues around the world.



That is why we want the Danish food industry to be climate-neutral by 2050.

It is an ambitious vision. And today, we cannot say exactly how it can be achieved. But it is essential that we think bigger than Denmark. Climate is a global challenge and there is therefore a need to act in line with the UN's global goals to limit world hunger, combat climate change and ensure a sustainable production through partnerships. Hasty solutions, such as limiting the Danish food production, may seem interesting according to national figures, but they do not solve global climate challenges, quite the contrary.

The solution is, however, to find ways to produce more with less. To develop new methods that ensure that food production leaves a smaller climate footprint. Fortunately, in Denmark, we have all the conditions required to take the initiative and lead the way towards climate-neutral food production. We already have one of the most climate-friendly food productions in the world. Good agricultural practices, innovative companies and efficient research have made Danish food production one of the most climate-friendly in the world today. There are many examples: manure that is transformed into energy, crop production residues that become proteins, cows that eat less but give more milk, etc. Thanks to these advances, we are on the right track. But yesterday's solutions will not solve global climate challenges. We are constantly striving to grow, set new goals and find new methods. We want to be an integral part of the solution to the challenges that our industry and society are facing. With our vision of climate, the food industry invites the whole Denmark to find the solutions of tomorrow, so that together we can achieve this vision of a climate- neutral food production in 2050.

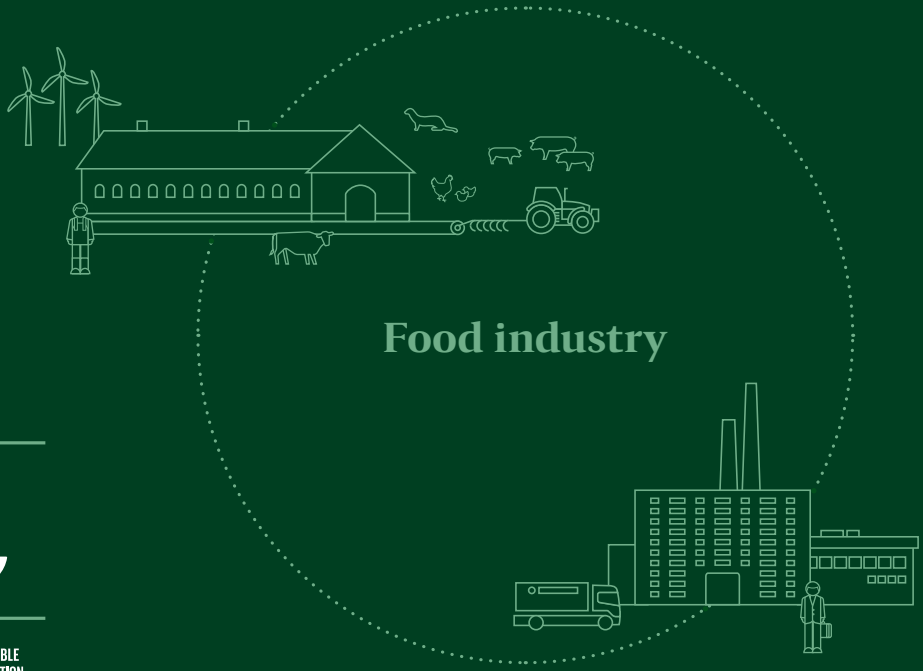
If we want to see this vision come true, we must work together. Universities with their knowledge. The State with its resources. Farmers with their adaptability and know-how. Companies with their ambition and willingness to develop, which, for example, will be able to optimise transport and packaging, ensure that all the raw materials are used and create the climatefriendly products that consumers demand. And all those who have the desire, the will and the knowledge to ensure the production of climate-friendly food. It won't be easy. It requires solutions that we cannot even imagine today. And it requires that consumers also take part in this process, for example by agreeing to pay a little more for the new climate-friendly products that we will develop. In return, we can make together a decisive contribution to one of the greatest challenges of our time and, at the same time, ensure that Danish products and solutions are promoted. Denmark is a small country, but we are a food nation with noble traditions and great visions. Together with the whole of Denmark, we will show the world that there is a way towards climate-neutral food production.

"The solution is to find ways to produce more with less. To develop new methods that ensure that food production leaves a smaller climate footprint. Fortunately, in Denmark, we have all the conditions required to take the initiative and lead the way towards climate-neutral food production."

Martin Merrild, president
Anne Lawaetz Arhnung, executive director
Danish Agriculture & Food Council

Our vision

The Danish food industry will become climate-neutral by 2050. This means that we will no longer emit more greenhouse gases than we absorb, and we will contribute to achieving this goal through green and sustainable energy. In close collaboration with the rest of Denmark and in line with the UN's global objectives, we will show the world that there is an economically sustainable path to climate-neutral food production.

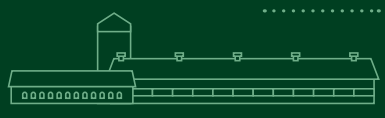


2 ZERO HUNGER

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS



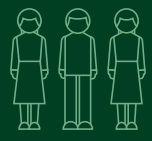
29,750 farmers

The Danish Agriculture and Food Council represents agricultural associations, family farms and farmers' groups for a total of about 29,750 farmers across Denmark

Climate-neutral 2050

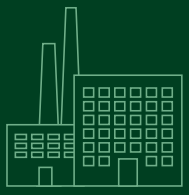
62%

Danish farmers own and cultivate about 62% of the Danish territory



189,000

The food sector employs about 189,000 people in Denmark



400 companies

The Danish Agriculture and Food Council represents about 300 food companies and about 100 agri-food companies

Our challenge

Climate emergency can be observed all over the world. Melting glaciers, rising sea levels and extreme weather conditions require action. At the same time, the global demand for food is increasing and, according to UN forecasts, the number of mouths to feed will rise to nearly 10 billion in 2050.

The climate is a real challenge for the whole world. Indeed, our planet will face major changes if we fail to reduce our greenhouse gas emissions.

We are already seeing some of these changes. The average global temperature is increasing. And even if a single hot summer or a single humid autumn cannot be attributed solely to climate change, we are seeing, in many places, more extreme weather conditions with greater fluctuations in one direction or the other than we have experienced in the past.That is why we must act. We must reduce the planet's greenhouse gas emissions. The global food industry faces an important task as, according to the IPCC, food production accounts for 24% of the world's CO_2 emissions. At the same time, the world population is increasing. It is projected to reach nearly 10 billion people in 2050. If we want these 10 billion people to have enough to eat, it is necessary to produce even more food: cereals, maize, vegetables and potatoes. In addition, meat demand alone is expected to reach about 455 million tonnes in 2050, partly due to the fact that more and more people will – fortunately – be lifted out of poverty, and will therefore supplement their diets with meat, such as chicken, beef or pork.

This is why the time has come for the most sustainable and innovative actors to take the lead and pave the way for tomorrow's food production. We must find Danish solutions to global challenges. We must show the way forward to produce more food while reducing our climate footprint. We must think innovatively, learn from our actions and show the Chinese farmer that it is possible to create a hood for his barn that will allow him to recover the methane emitted by his cows' eructation and reuse it as fuel for his tractor. We need to develop techniques that allow the Argentine veterinarian to vaccinate cows so that they do not emit methane. And we need to research green concrete, plant breeding and all kinds of other known and unknown scenarios that can really pave the way for a climate-neutral food production.

For some, the answer today is to reduce Denmark's production, but that would not solve the global challenge. Indeed, it will be necessary to continue to satisfy the exponential demand in food, and reducing the Danish production would only shift it to countries where milk, cereal or meat production has a higher climate footprint. More needs to be produced, and the Danish food industry has a duty to find climate-neutral solutions.

For the good of all of us. And for the good of the climate.

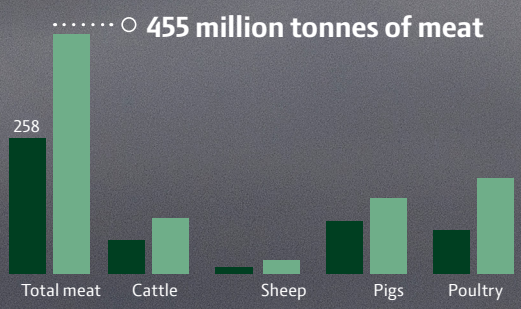
World population in 2050

Increase in the number of people on Earth between 2019 and 2050

Source: UN, 2018

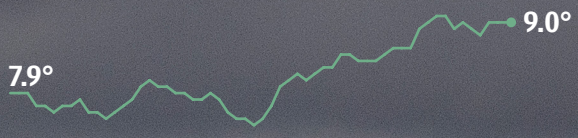
Forecasts of meat demand in 2050

2005 2050



Source: FAO, 2012

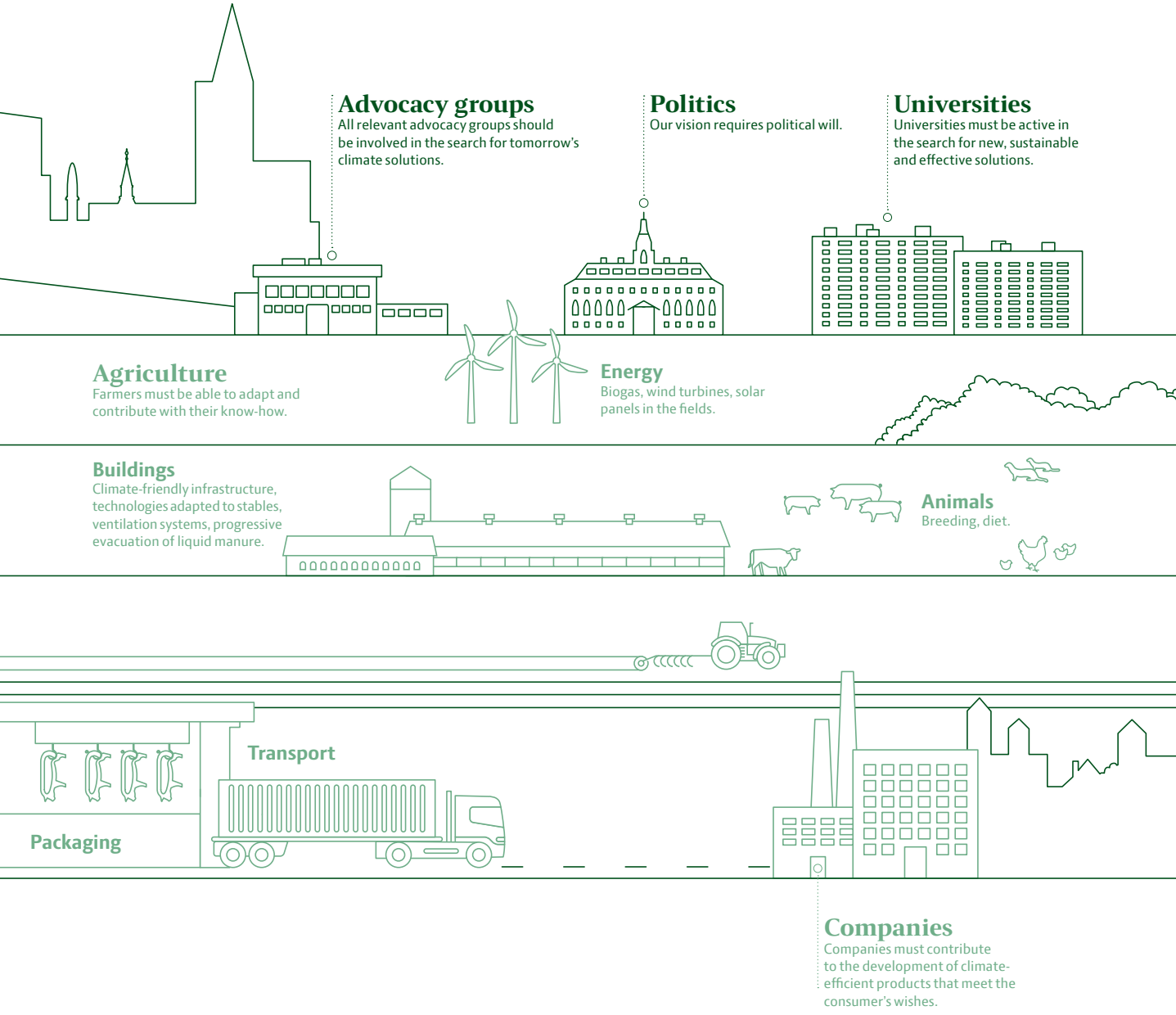
Average temperature (Celsius) in Denmark between 1960 and 2016



Source: Danish Institute of Meteorology (DMI)

Partnership

The path to climate neutrality in 2050 is not a path that the food industry must follow alone. That is why our vision is also an invitation to the whole of Denmark to undertake this journey with us. We invite policy makers, researchers, advocacy groups, our international colleagues, businesses and consumers to actively participate in finding solutions that will allow us to achieve the objectives that will make our vision come true.

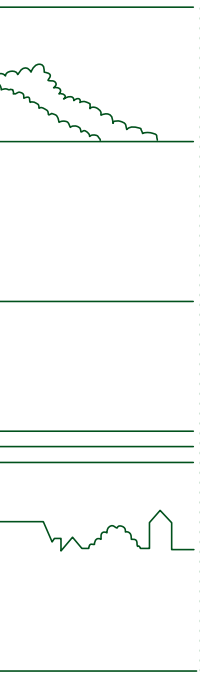


The future

With the help of the techniques we know today, even if we do not yet fully master them, we know that it is possible to make half of the way to climate neutrality. We will fully achieve our goal in the coming decades; not alone, but with the rest of society.

The solution

We need to invest massively in research and development. Politicians, organisations, consumers and the entire food industry must work together to find the solutions we need.



Climate-neutral 2050

The climate cow

In Denmark, we have shown that we are able to find and implement solutions in agriculture that can help reduce greenhouse gas emissions. This also applies to our work on a cow that would be more climatically efficient. The food industry and SEGES, the knowledge centre for agriculture, are constantly looking for new solutions, including how a cow could emit less methane.

By-products

In addition to meat, a cow can be used for various purposes: its skin is used to make leather, its blood is used in medicine, and offal is processed into mink food, while the contents of the animal's rumen are used to produce biogas.

250 kg of meat

Danish slaughterhouses are precursors when it comes to using and taking advantage of all parts of the animal. Everything is optimised, and nothing is wasted. A cow provides about 250 kg of meat once it no longer produces milk.

Source : Aarhus University for Kødbranchens Fællesråd and DAFC, 2015

1980

40 kg of leather

Greenhouse gas emissions from livestock and production are used to assess whether production is environmentally friendly, but it is also important to consider everything the cow is used for, in addition to meat. A cow provides 40 kg of skin that is used to make leather and gelatine.

60-80 kg of fodder

A dairy cow that produces 35-40 litres of milk per day feeds on 60-80 kg of fodder. This amount corresponds to about 22 kg of dry matter. Reducing the fodder consumption per kilo of meat would reduce the climate footprint per kilo of meat.

100% more efficient

Over the past 30 years, the average milk yield per cow has increased by almost 100%. In 1980, the average annual yield was 5,250 kg of milk per cow. Thanks to the improvement and development of fodder, this figure had risen to 10,260 kg in 2017.

"In Denmark, we have been working with the objectives of genetic improvement and the development of fodder based on highly effective ingredients. This means that cows now provide more milk for the same amount of fodder. We can therefore say that we have created a "climate cow", which impacts climate significantly less than the vast majority of cows in the rest of the world."

Ejnar Schultz, director of the knowledge centre for agriculture SEGES

2017

The starting point

To achieve climate neutrality, we need to know where we start. One of the sectors in which we know there are challenges is the agricultural production. That is why SEGES, the Danish knowledge centre for agriculture, has been studying the potential for reducing greenhouse gases from agriculture by 2050.

SEGES has succeeded in setting the starting point: the contribution of agriculture to Danish climate emissions is estimated at nearly 16 million tonnes of CO_2 equivalent. It is therefore our basis for influencing agricultural production.

This figure also takes into account the energy consumption of the agricultural sector, although agriculture is not included in the energy sector. Indeed, agriculture is not taken into account in the calculation of fossil fuel reduction nor in sustainable energy production. This also means that even if sustainable energy is produced by a wind turbine, a biogas plant or a photovoltaic installation owned by a farmer or located on agricultural land, this "credit" is currently attributed to the energy sector. This naturally creates some biased incentives that are not beneficial to the climate. That is why it is essential that agriculture be taken into account in green energy initiatives as long as fossil fuels are still being used in Denmark. The same is true for the CO_2 that can be absorbed by land or forests (the so-called LULUCF). Here too, the agricultural and food industry is not fully taken into account. However, this technique offers great potential for the future.

Known means of action

With the current knowledge we have about possible, but not yet fully developed, means of action, we estimate that we can already make half the way to climate neutrality by 2050. This forecast includes initiatives in crop production and major livestock production (pork and beef production). These means of action cannot be implemented overnight at no cost to the agricultural sector. The Danish state will have to contribute to the establishment of a large part of these means of action, by giving adequate political priority and allocating the necessary resources. The known means of action allow us to make a good part of the way, in particular by reassigning alluvial land, transforming manure into biogas, developing technologies adapted to stables and improved diets, as well as meeting current expectations regarding progress in livestock farming.

What the experts say

"Greenhouse gases from agricultural farming were mainly reduced during the 1990s. However, they can be further reduced, especially through nitrification inhibitors in nitrogen fertiliser and reassignment of peat soils."

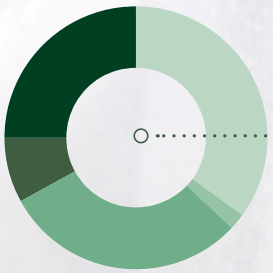
Jørgen E. Olesen, Professor at the Institute of Agroecology, Department of Water and Climate, Aarhus University

"We cannot totally eliminate methane emissions from cows, but we can significantly reduce them through changes in their diet and choice of breeders."

Peter Lund, Professor at the Institute of Animal Sciences, Department of Animal Nutrition and Physiology, Aarhus University

Contribution of agriculture in greenhouse gas emissions

CO_2 equivalent



15.6 mio. t.

- **35%** Methane
- **2%** Carbon dioxide (especially during liming)
- **30%** Nitrous oxide
- **8%** Energy use
- **25%** LULUCF

Source: SEGES

Reduction potential using existing means of action

Mio. t.

Source: SEGES

1

We work in the fields

Based on known means of action, it is in crop production that lies our greatest reduction potential.

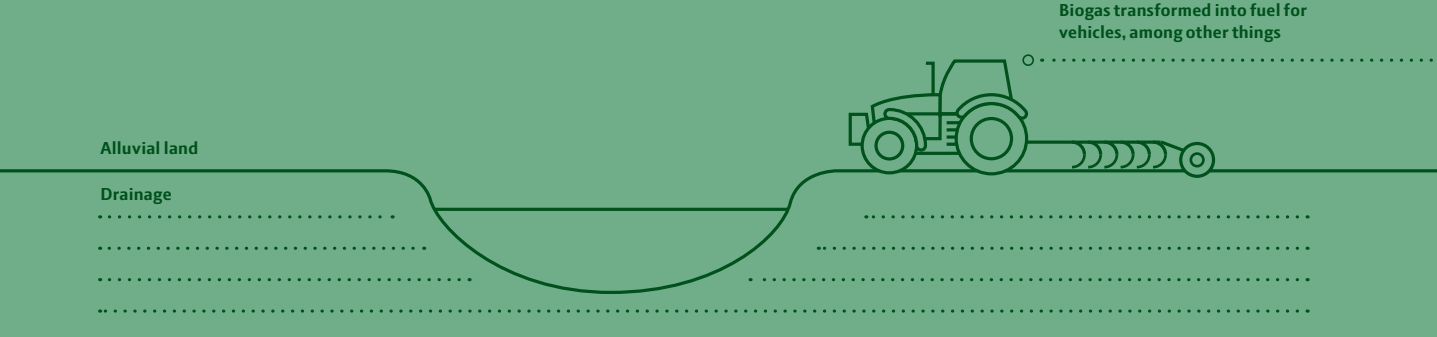
Different activities are the cause of greenhouse gas emissions from agricultural land. Nitrous oxide is released during field fertilisation, while organic matter in the field can decompose into CO_2 when the soil is cultivated. In particular, ploughing peat soils is one of the main sources of greenhouse gas emissions associated with field operations, as this type of soil contains a lot of carbon.

One way to reduce agricultural greenhouse gas emissions would be to reassign carbon-rich soils for purposes other than agricultural production. Today, about 108,000 hectares of carbon-rich land is being exploited. Re-assigning part of this land would not only limit CO_2 emissions, but would also have other positive effects, such as improving biodiversity and reducing nitrogen emissions into aquatic environments.

It is estimated that greenhouse gas emissions from carbon-rich alluvial soils account for about 39% of total emissions from field operations. This is the most important isolated factor. The challenge is economic: if this land is to be reassigned, it is essential that farmers receive financial compensation for the loss of productive land.

Other measures could also help to reduce greenhouse gas emissions from agriculture. The largest source of emissions from field operations is the release of nitrous oxide, which has a greenhouse effect 298 times greater than that of CO_2. The system of catch crops and the incorporation of harvest residue allow CO_2 to be stored in the soil. In addition, the use of nitrification inhibitors in livestock manure and chemical fertilisers significantly reduces greenhouse gas emissions, as their use limits the nitrification process, which is a source of nitrous oxide emissions.

According to current greenhouse gas emission calculation rules, it is estimated that 1% of the nitrogen supplied to the soil is converted into nitrous oxide. In Denmark, an emission factor of 0.6% would probably be more accurate. Therefore, a Danish measurement programme should be put in place in order to provide a more reliable Danish emission factor.



2

We work with the energy

Biogas plants convert livestock manure and organic waste into environmentally friendly energy and fertiliser, while limiting methane and nitrous oxide losses.

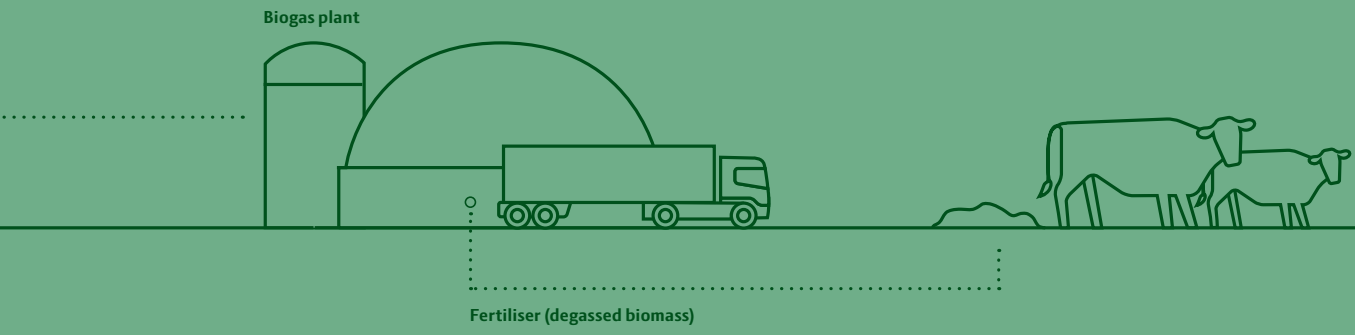
The total energy consumption, i.e. that of households, the transport sector, industry, the service sector and food production, contributes significantly to CO_2 emissions when based on fossil energy sources. It is therefore important, now and even more so in the future, to ensure an energy supply based on sustainable energy that is flexible, can be stored and meets all the energy needs of society: electricity, heating, transport, cooling, etc.

In this respect, biogas is an excellent complement to cheap photovoltaic and wind power. Biogas can also be used when there is no wind or sun, as it can be stored in the gas grid. In addition, biogas plays an important role as a fuel for trucks and as a driving energy in industry, where electricity alone is not enough.

In addition, biogas production reduces the climate footprint of animal feed production, as biogas plants collect methane that is formed naturally during manure storage. Therefore, replacing fossil fuels with biogas in households, industries or the transport sector has a doubly positive impact on the climate. By using biogas from livestock manure as fuel for cars, a total reduction of more than 170% in emissions can be achieved. The positive impact on the climate can be multiplied by cooling or evacuating manure from pig farms more quickly.

Finally, a biogas plant is a central element of the circular economy. It recirculates nutrients from food waste and other organic residues from households and industry, so that they can be reused as fertiliser in the fields.

With initiatives such as biomass, biogas, biofuels, wind energy, solar panels and energy savings in the primary sector, an emission reduction of 11.4 million tonnes of CO_2 could already be achieved by 2030. Then, the displacement effect will decrease as fossil fuels are phased out by 2050.



3

We work in the stables

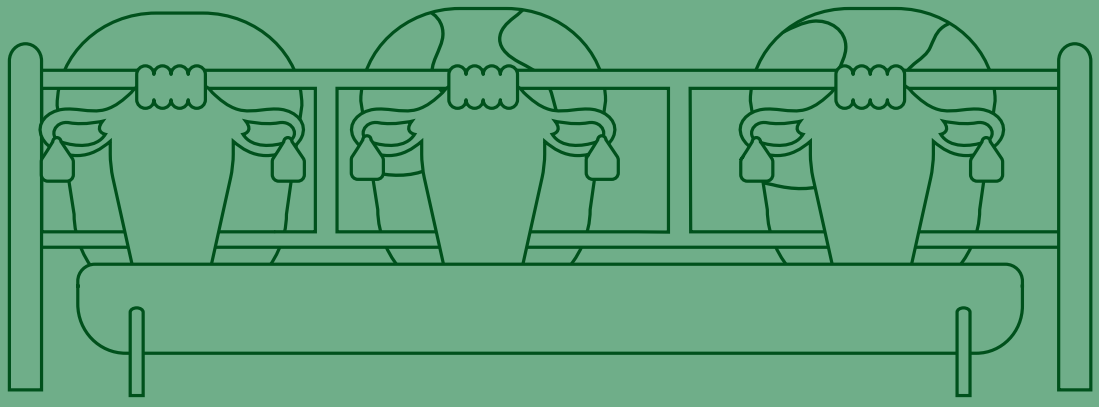
Adding fat to cow fodder reduces the amount of methane in the cow's stomach. In doing so, cows will emit less methane when they belch and flatulate inside and outside the stables.

The major challenge facing cattle farming is the emission of methane from cows: their eructation and flatulence are one of the main sources of greenhouse gas emissions related to agriculture. Methane is a gas whose greenhouse effect is about 23 times greater than that of CO_2.

When the cow ruminates, the feed it has ingested must be digested through its four stomachs. During digestion, methane is formed in the cow's complex digestive system. This methane then escapes into the atmosphere when the cow eructs or flatulates. With regular fodder, cattle farming emits approximately 3,195,000 tonnes of greenhouse gases. Cow eructation and flatulence represent the largest part of cattle breeding emissions, but cow digestion and methane excretion can be affected by their diet.

Studies show that it is possible to minimise the methane content of eructation and flatulence in cows by adding fat to their diets. Cows' stomachs bind methane better when fed with fat. It is estimated that such a change in cow feeding could reduce methane emissions by 140,000 tonnes of CO_2 equivalent.

In addition to ensuring adequate feeding for cows, this adjustment would reduce emissions from cattle production by producing more climate-friendly cows, as the amount of methane formed during digestion varies from cow to cow and is a hereditary characteristic. It should also be possible to improve the collection and use of climate gases and ammonia from stables.



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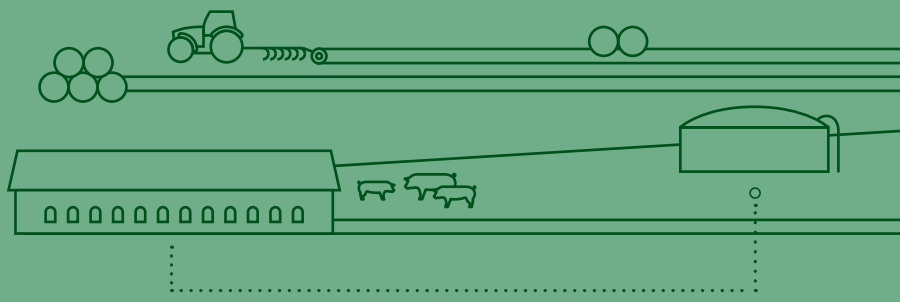


We work in the pigsties

Initiatives that modify livestock manure management can reduce emissions from pigsties. For example, emissions could be reduced by about 22% by removing manure more frequently from pigsties.

One way to reduce the impact of pigsties on the climate is to evacuate the manure produced in them more quickly into manure tanks. This method is called frequent evacuation.

In short, it implies transferring manure from the pigsty to a manure tank more quickly. Instead of evacuating the manure every five to six weeks, it is evacuated once a week. Since the temperature of the manure tank is lower than that of the pigsty, methane emissions are lower, significantly reducing greenhouse gas emissions. It is estimated that methane emissions from pork production could be reduced by about 22% by applying the frequent evacuation method in 90% of pigsties.

Of course, this system is not free of charge and it is estimated that it would cost the industry two million euros per year.

More can also be done to reduce greenhouse gas emissions from pork production. Measures could include building new environmentally friendly pigsties, developing a better diet for pigs and focusing on genetic improvement. It is estimated that genetic improvement could reduce the feed consumption per pig. Through genetic improvement, it is also predicted that by 2050, 200,000 fewer sows will be needed to produce the same number of piglets as in 2017, significantly reducing land use and emissions per kilo of pork produced.

The future

The Danish food industry can be characterised by its intensive work to innovate and develop new techniques. Leading by example and helping to find solutions for the future is part of our DNA. Of course, we do not yet have all the solutions, but following are initiatives that may make the food industry climate-neutral by 2050. Some can be implemented, while others may prove impossible, but their common feature is that they have the potential to contribute to our solution by 2050.

1

Methane capture

What if, in the future, we could capture the methane emitted by the cows via a "hood" and transform it into biogas? In fact, the methane that cows emit when eructing is a very light form of biogas. If this biogas could be concentrated and redirected to the natural gas grid, cows could contribute to energy production, turning an environmental problem into a resource. Projects are already underway to capture methane in stables. The objective is still far from being achieved, but this is an initiative that must be further explored in the future.

2

A vaccine against methane emissions

Thirty-one percent of agricultural greenhouse gas emissions come from the methane emitted by eructation and flatulence from cows. To address this problem, researchers in New Zealand are investigating the possibility of creating a vaccine that would remove from the stomachs of cows methanogenic microbes that turn into methane. The cow has a complex digestive system that relies on the presence of bacteria, fungi and protozoa to function properly. This makes it difficult to remove specific substances from the cow's digestive system while ensuring that digestion continues to be carried out properly. The possibility that, in the future, cows could be vaccinated against methane emissions would be most dramatic.

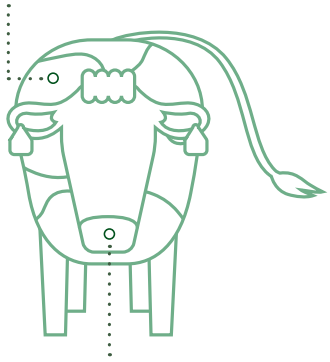
3

Enzymes and bacteria in the manure channels

This future scenario is still far from feasible, but it is nevertheless considered to have potential. Indeed, methane is partially emitted during manure handling. We are talking about 654,000 tonnes of CO_2 equivalent for cattle breeding, and about 1,132,000 tonnes of CO_2 equivalent for pig breeding. If, through intensive research, an enzyme or bacterium could be produced that could reduce or even eliminate methane emissions in manure channels, this would be a tremendous step towards reducing methane emissions from manure channels. This initiative remains a future scenario and is far from concrete, but it is a good example of an initiative that was thought to be light years away and may be closer than previously thought.

Vaccine against methane emissions

Researchers are currently working on methods to vaccinate cows against methane emissions



Methane capture

In the future, farmers may be able to capture the methane emitted by their cows and reuse it as fuel for their tractor

4

Livestock emitting less greenhouse gases

Work is already underway to find ways to reduce the methane that forms in the stomachs of cows. For example, this could involve supplementing the fodder with different oils, algae or derived substances. In the future, it is likely that chemicals capable of inhibiting methane production will be found. Today, nitrate and an inhibitor called 3-NOP are the focus of research. However, it is estimated that such products will be very expensive, if there is only one kind on the market.

5

Sustainable construction

In the food industry, a lot is being built. As new research is carried out, we are building stables that are more environmentally and climate-friendly. In the future, construction could also help to reduce greenhouse gas emissions.

The food industry will be able to do its part by selecting more environmentally friendly materials to build buildings that will emit less CO_2 than the concrete we currently use. Building materials such as Futurecem, produced by Aalborg Portland, are now leading the way towards a more climate-friendly construction method. And in the future, green concrete could help farmers and food companies move closer to climate neutrality. Research is also needed in the field of circular construction and the use of sustainable building materials, such as wood.

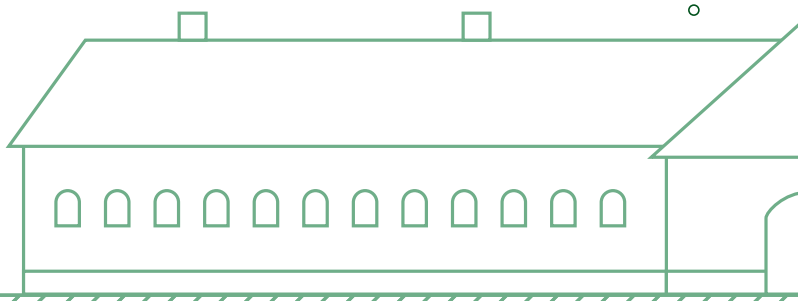
6

Energy crops on fallow land

A future method to reduce agricultural greenhouse gas emissions could be to plant energy crops, such as willow, on fallow land. Willow is an efficient crop that can absorb more CO_2 and release more organic matter than a fallow field.

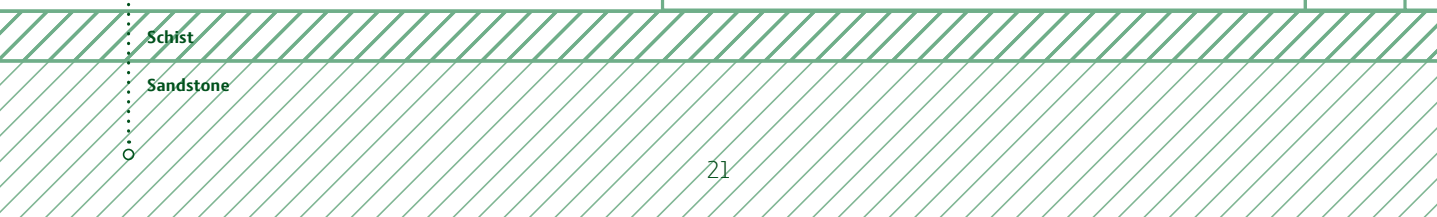
Sustainable construction

In the future, farmers could use "green concrete" to build their stables and other facilities



CO_2 storage in the subsoil

CO_2 storage in the subsoil has enormous potential



At the same time, fallow land converted to willow plantations may continue to have positive effects, such as retaining nitrogen. This approach must be studied closely, because it would allow us to develop a large part of the land that is currently set aside.

7

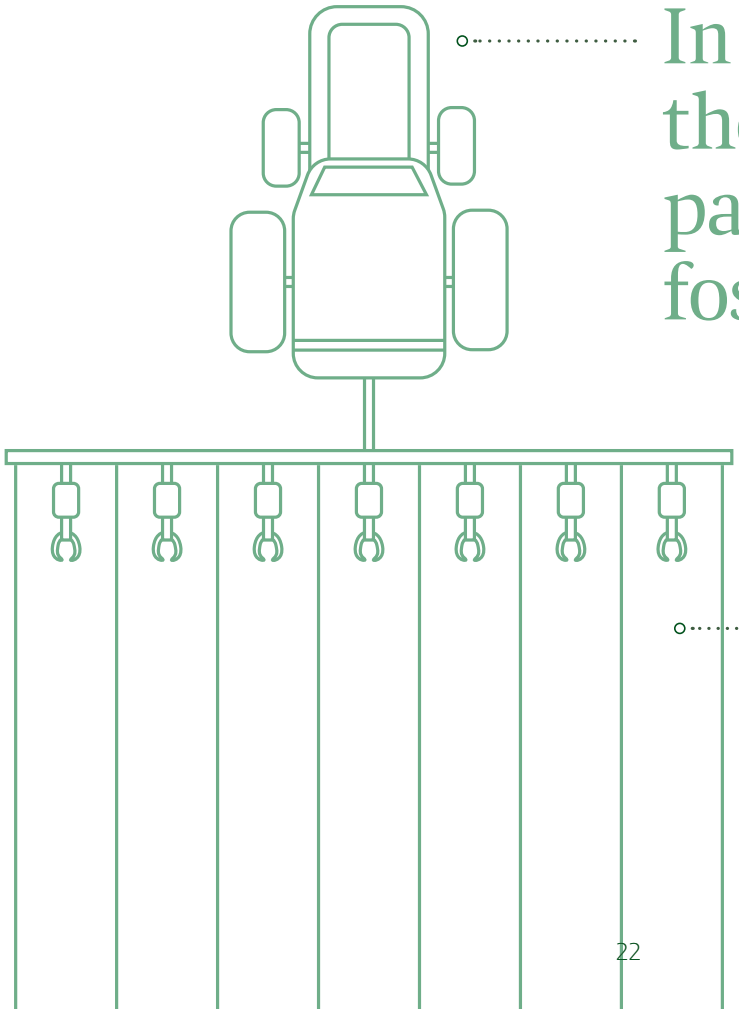
Plant breeding

One of the areas that offers, both today and in the future, great potential in terms of climate is plant breeding. For example, when clover is sown with grass (clover grass), the clover produces nitrogen for the crop, so the crop requires less nitrogen. Nowadays, the clover is often prey to what is called clover fatigue. Increasing the resistance of the clover and the robustness of the high-performance ryegrass allows maintaining a high yield of the clover grass without redevelopment or with less frequent redevelopment. As a result, its climatic efficiency increases, which will reduce establishment costs.

8

CO_2 storage in the subsoil

The storage of CO_2 in the subsoil is one of the initiatives that is already on the political radar. The Danish government has allocated more than 13 million euros to research on the storage of CO_2 in the Danish subsoil. According to GEUS, this technique could potentially collect a quantity of CO_2 equivalent to 500 years of Danish emissions by injecting CO_2



In the future, the machinery park could be fossil-free

All plants absorb CO_2 from the air

When mixed, clover and grass interact to obtain some of the nitrogen that is vital to them and that the clover absorbs into the air. The longer a field of clover grass remains in the same place for years, the more beneficial it is for the climate.

from the atmosphere into the sandstone layer. The sandstone is covered with a layer of schist that is impermeable to CO_2 and will prevent it from re-entering the atmosphere. This approach has great potential, and Danish farmers will play an important role in the implementation of this solution, as they own a considerable part of Danish land.

9

A fossil-free machinery park

It is also possible to reduce the climate footprint of agriculture by making the machinery park fossil-free. Within the agricultural sector, the effect is twofold when it comes to reducing CO_2 emissions from transport. In addition to converting its own machinery, the agricultural sector is also a major supplier and manufacturer of fuel from renewable energy sources. Biofuels account for 90% of energy consumption from renewable energy sources in road and rail transport. The electrification of the agricultural machinery park could also be part of the near future. Manufacturers are testing a tractor equipped with an electric motor, but the battery capacity will have to be increased before it can be used.

10

Methanisation

Methanisation is an important technology for the future renewable energy system. First, because it involves the interaction of the electricity and gas networks. With this technology, it becomes possible to store electricity from wind turbines and photovoltaic cells in the gas grid in the form of methane when electricity is produced in excess. In addition, methane can guarantee a security of supply in the electricity grid when there is no sun or wind. Methanisation also increases the energy quality of wind energy by converting it into methane. This technology can be a key element for optimising the use of renewable electricity produced from the sun and wind, so that this energy is not wasted.

11

Transforming the CO_2 in the air into biochar

Transforming the CO_2 in the air into biochar is a real project for the future. Biochar is formed when straw is burned without oxygen (pyrolysis). Biochar is mainly composed of carbon difficult to metabolise (400-1000 years) and has a positive effect on the soil. As an alternative to storing CO_2 in subsoil sandstone formations, CO_2 could be transformed into biochar and used to fertilise the soil. This would provide a stable structure of carbon in the soil that would not be released as CO_2 for several centuries or even millennia.

12

Reforestation of protected areas near extraction wells (BNBO)

Forests and reforestation can bind CO_2 biologically. This is why forests are effective in removing CO_2 from the atmosphere during their growth period. However, reforestation presents some challenges in Denmark, as planting trees would lead to the disappearance of agricultural land. But if we can consider reforestation in areas where crop restrictions are necessary, these areas will become so-called multifunctional areas, where drinking water will be protected, CO_2 removed from the atmosphere and nature and recreational areas favoured. This solution needs to be examined more closely.

The food companies

Our vision of a climate-neutral food industry must be supported by the entire value chain, from farm to fork. Food industry companies are already focusing on the challenges of climate change. Arla and Danish Crown have created a real climate vision, while several other companies in the sector are also working to reduce their climate footprint.

Arla

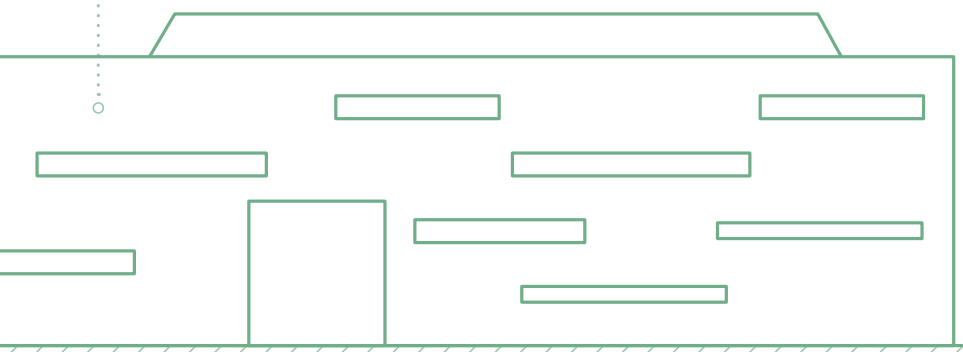
Arla wants to achieve climate neutrality by 2050

Arla has set its course towards climate neutrality by 2050 for the entire group in all countries. To do so, Arla decided to focus on three areas.

Because although Arla's climate footprint per kilo of milk produced is less than half of what the UN considers to be the average for a litre of milk produced in the rest of the world, Arla now wants to invest fully in order to achieve its objective.

First, Arla will support the cooperative's more than 10,000 members by implementing climate optimisations on their farms: a better diet that limits the development of greenhouse gases in the cows' stomachs, CO_2 storage in the soil and several other initiatives that will put the cooperative's members on the right track.

Secondly, Arla has been focusing on production and logistics. Third, Arla has been focusing on consumption and packaging, where new methods and technologies will help the group achieve its ambitious goals.

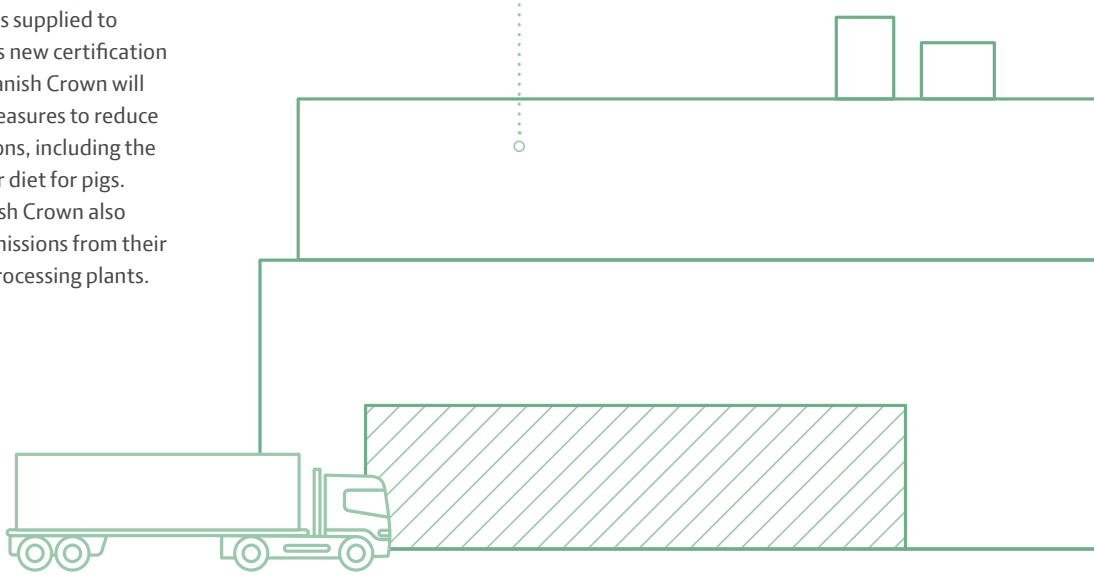


Danish Crown wants to be the world's leading sustainable meat producer

The climate footprint of pork production is to be halved by 2030, while the entire value chain is expected to be climate-neutral by 2050, with 2005 as the starting point.

One of the initiatives to achieve this objective will be the implementation of a new certification scheme for pork producers called "Klimavejen" or "Climate Path". This scheme includes a starting certification for farmers, which will allow them to access a common sustainable development programme for sustainable meat by 2030. Danish Crown expects that by 2019, 90% of the pigs supplied to them will be part of this new certification scheme. In addition, Danish Crown will introduce a series of measures to reduce greenhouse gas emissions, including the composition of a better diet for pigs. Within the group, Danish Crown also wants to reduce CO_2 emissions from their slaughterhouses and processing plants.

Danish Crown



The companies

Many food companies are working on concrete projects to reduce their greenhouse gas emissions.

This is, among others, the case for the two largest companies in the sector, DLG and Danish Agro, both of which focus on climate initiatives.

Danish Agro has established a strategic collaboration with the energy company Ørsted to ensure its climate efficiency. It has also built biofuel plants, replaced all its light bulbs with LEDs, and provided a course to more than 100 truck drivers to reduce diesel consumption by 300,000 litres per year.

DLG aims to act in favour of the climate too. Over the past five years, DLG has reduced its energy consumption by 2% per year, and intends to continue on the same path. In addition, the group is replacing its truck fleet to make it more fuel-efficient, and is building new efficient production facilities – recently, a fodder factory reduced its energy consumption by 80%.

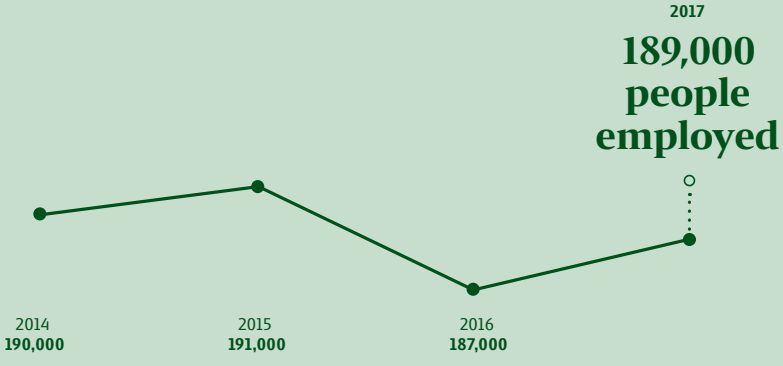
Facts

The Danish food sector contributes to the Danish society. Production and export create jobs and income at all levels of the Danish economy

Fact about employment

The food sector creates jobs

The food sector employed 189,000 people in 2017. Of these, 50,000 were employed in jobs in the agricultural sector, from the local electrician to the dairy agent and the transport operator.



Fact about income/export

5.5% of GDP

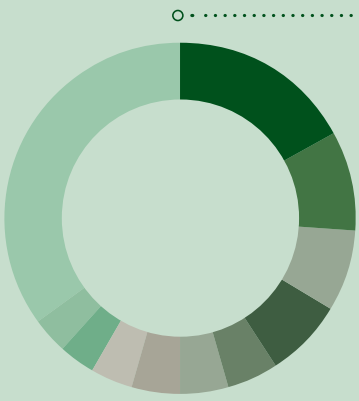
The food sector contributes 5.5% of GDP to Denmark's overall economy.

22.3 billion euros of exports

In 2017, the food sector exported 22.3 billion euros, a new record and an increase of 1.2 billion from the previous record of 2016.

75% sold abroad

About 75% of all Danish food production is sold abroad.



Export of food production

- **17%** Germany
- **9%** Sweden
- **8%** China (incl. Hong Kong)
- **7%** Great Britain
- **5%** Poland
- **5%** The Netherlands
- **4%** Norway
- **4%** Italy
- **3%** USA
- **3%** Japan
- **35%** Other countries

Source: Danish Agriculture & Food Council by courtesy of Danmarks Statistik

Facts about climate

A 16% decrease

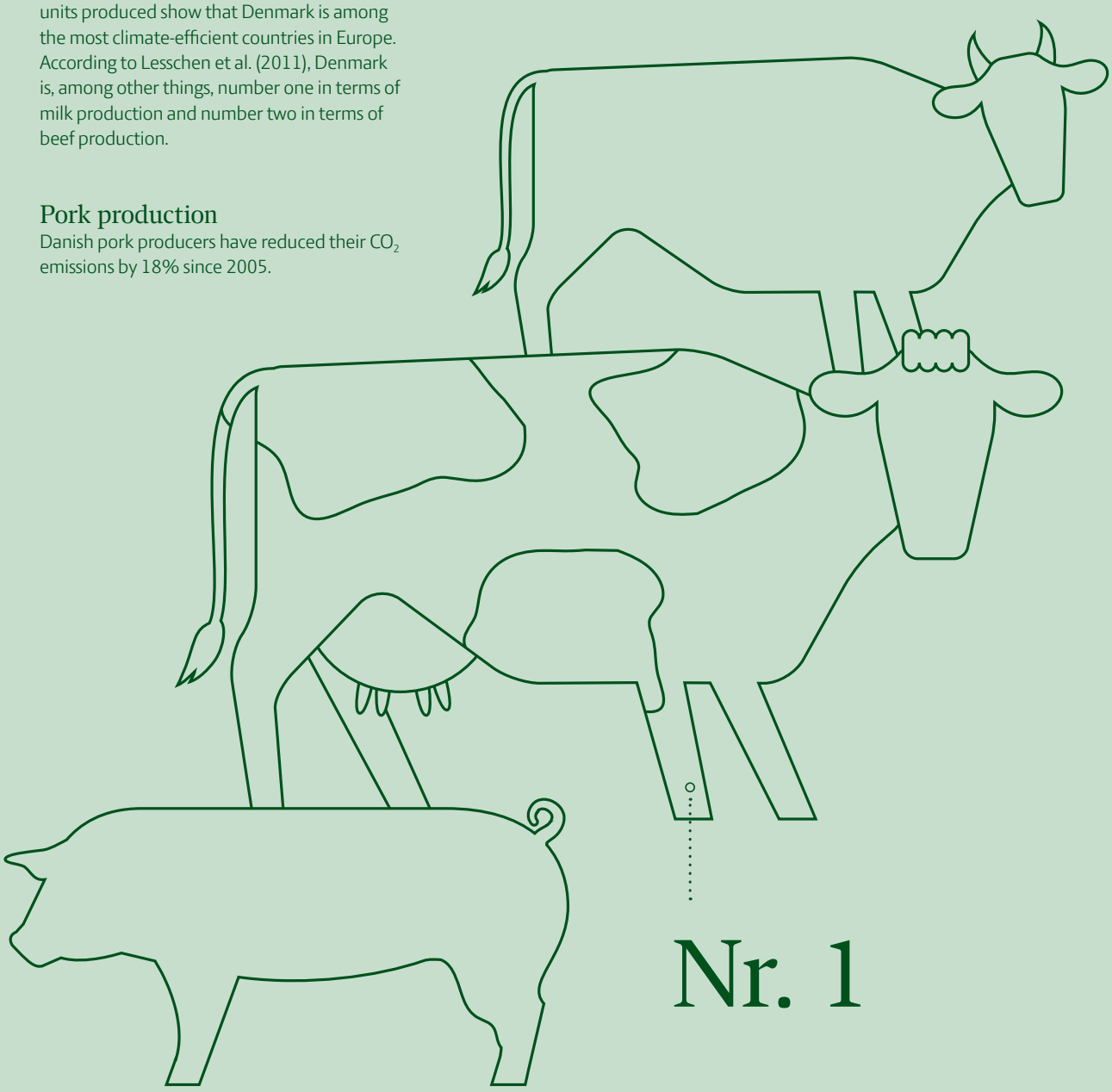
Between 1990 and 2016, production increased by 31%, while greenhouse gas emissions decreased by 16%.

Among the most climate-efficient

International studies based on the number of units produced show that Denmark is among the most climate-efficient countries in Europe. According to Lesschen et al. (2011), Denmark is, among other things, number one in terms of milk production and number two in terms of beef production.

Pork production

Danish pork producers have reduced their CO_2 emissions by 18% since 2005.



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