

# Global Climate Task Force



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**The Danish agro-food cluster has a high agricultural production and develops climate solutions benefitting the whole world.**

# Foreword

Denmark's agro-food companies sell food products that feed millions of people all over the world every day. The undertakings also supply food production technology and know-how for the benefit of even more.

This has been generating export revenue for years and not least provided thousands of jobs throughout Denmark. At the same time, Denmark's agro-food cluster contribute to the global production of safe, nutritious food products with a low climate and environmental impact.

The production of food is responsible for a significant percentage of the global climate impact. This challenge will only be intensified when the world population is expected to reach 10 billion by 2050 with an additional 3 billion middle-class consumers. At the same time, we are facing climate-related and biodiversity challenges that demand immediate action and that more space be created for wildlife and nature areas. Consequently, we must learn how to produce more food and reduce our climate and environmental impact at the same time and use less space in the process. Denmark's agro-food cluster can be a crucial player in this context.

The World Resources Institute (WRI) has pointed out that the most important climate-related effort is to produce more food per

hectare of cultivated farmland while reducing our climate and environmental impact at the same time. According to the WRI, the most efficient agricultural countries must increase their production, not reduce it, in response to the climate emergency. Danish technology and know-how can contribute to a far more climate-friendly production all over the world. Denmark is a small country, but we can make a big difference.

Danish companies currently export solutions that help make food production more efficient and reduce its environmental and climate impact. The solutions are developed through long-standing cooperation involving universities, advisory services, agriculture, the food industry and a wide range of innovative companies. To succeed in these efforts, it is crucial to continue to have a strong agro-food cluster with a large agricultural production in Denmark that can be used to develop scalable models for a more climate-efficient, eco-friendly production.

The Danish Agriculture and Food Council has set up a task force that has focused on tapping

into the vast potential of Danish companies to develop and supply climate-friendly and eco-friendly solutions for food and agricultural production worldwide. We have gathered facts and specific examples of how Danish undertakings can make a difference. We provide a wide range of specific proposals for how to further boost and strengthen these developments. This will benefit the climate. And it will mean the creation of more jobs throughout Denmark.

We hope that as many people as possible will take part in the discussion about the global opportunities and specifically help support these efforts.

We hope you will enjoy the reading!



**Kristian Hundebøll**

Chairman of the Global Climate Task Force and CEO, DLG



The Danish agro-food cluster represents 10 pct. of employment in the rural municipalities



# 75%

75 pct. of the workforce employed in the Danish agro-food cluster works with exported goods

# The global challenges facing us

## A SUSTAINABLE TRANSITION HAS THREE DIMENSIONS:

1. Economic sustainability
2. Environmental sustainability
3. Social sustainability

When working towards a sustainable transition, it is important to strike a balance between all three dimensions.

## SUSTAINABILITY COVERS MANY DIMENSIONS

Such as climate, resource efficiency, nature, land use, energy consumption, people, and economical stability and performance. There is a need for a holistic approach to sustainability, where all three dimensions should be considered when making the green transition.

The world is facing a number of major challenges. One of the biggest is the rising emission of greenhouse gases causing climate change, pressuring our natural resources due to the reduction of natural habitats as well as population growth and the derivative rising demand for food products.

By 2050, roughly 10 billion people will inhabit the earth and, according to the Food and Agriculture Organization (FAO), the demand for all types of foods will sharply rise worldwide. As more and more people leave poverty behind, and the global middle class grows, this higher prosperity will mean that particularly non-Western countries will see a rising demand for food products.

According to the World Resources Institute (WRI), the global population is expected to grow from 7 billion in 2020 to 9.8 billion by 2050. As earnings are increasing in developing

countries, the overall demand for food is in the process of rising by more than 50%. The demand for animal products is expected to rise by almost 70%, according to WRI.

At the same time, vast parts of the world's population are still undernourished. Increasing the production of food requires a more resource-efficient, sustainable production, as agriculture already uses half of the world's arable land. Agriculture and land use currently represent one-fourth of annual greenhouse gas emissions at global level.

The conversion of the food production process – which leaves behind a substantial climate impact – is difficult because it produces products under biological, natural conditions. A strikingly greater need for foods worldwide will increase the strain on natural and farmland resources unless we develop and improve the

food production process. Therefore, new innovative solutions are needed, if we are to feed all mouths, while ensuring, at the same time, that we are addressing the world's climate emergency, preserving biodiversity and protecting natural resources and the environment.

The climate emergency discussion cannot be isolated as solely a national issue. National climate-related initiatives must be jointly conceptualised with their global climate impacts. Denmark has every opportunity to seriously address all the challenges – through climate-friendly products, knowledge, know-how and technology.

# Vision for the Global Climate Task Force

Denmark's agro-food cluster has a strong platform from which to show the rest of the world, how it is possible to produce climate-friendly, sustainable food products.

In Denmark, we can take pride in the fact that the Danish agro-food cluster is already considered a worldwide leader in the areas of food, technology and know-how. Today, the food industry is a major exporter due to its international strengths in terms of quality and food safety as well as climate-friendly and sustainable production.

The agro-food industry wants to actively assist in meeting the climate targets set by Denmark and countries around the world in the Paris-agreement, and the industry itself is working to become climate neutral by 2050. Given the fact that climate change is world-

wide, however, our efforts to lower carbon emissions must be, too.

As we approach 2050, we are looking at a world population that will have grown to almost 10 billion. Having more mouths to feed and rising pressure on our natural resources due to the reduction of available arable land per capita create a pronounced need for a more sustainable global food production focusing on energy efficiency with reduced carbon footprint, biodiversity and animal welfare.

Denmark's agro-food cluster will lead the way to a more climate-efficient, sustainable global food production through our international strengths and unique solutions in the areas of sustainable production, know-how and technology. We want to develop and establish solutions with and for the rest of the world.

## MEMBERS

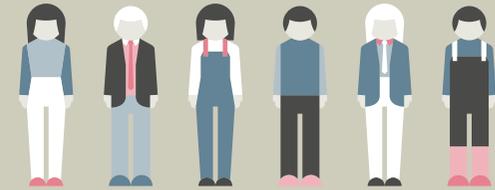
The Global Climate Task Force consists of 10 members. The members are all representatives from the Danish agro-food cluster with knowhow and knowledge within global climate solutions. The Danish Food and Drink Federation has contributed to the work as well. Furthermore, a long list of businesses in the agro-food cluster contributed with valuable inputs to the work.

# A global market

The Danish agro-food cluster will work with the Danish government to increase market access in order to create a global market for the climate solutions from Denmark



We will continually deliver healthy, safe and sustainable food products to Denmark and to the rest of the world

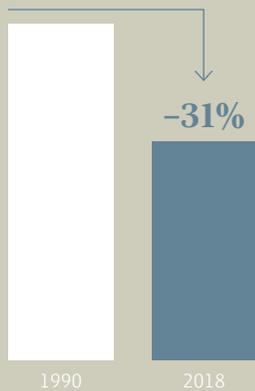


## Bilateral Climate Partnerships

The Danish agro-food cluster will through strengthened bilateral climate partnerships make sure that we always have the newest knowledge, learn from best-practices, and create the best framework for a more sustainable global food production

We will continue to be a strong, innovative and competitive sector, that contributes positively to the danish economy, job creation, export income and welfare in Denmark

## The Danish Agricultural CO<sub>2</sub>e-emissions pr. produced unit



(Index 1990=100)  
Source: DCE, Danmarks Statistik

## Unique know-how

We want to use our unique Danish know-how to export green solutions, technologies, genetic material and sorts, which can reduce the greenhouse gas emissions on a global level.



## Danish agroindustry takes the green lead

The Danish agro-food cluster will in partnership with the Society work towards strengthening the danish agro-food industries green lead internationally through research and innovation.

# 1,5°

The global temperature cannot rise more than 1,5 °C as a result of climate change. Countries around the world has committed themselves to limit the climate change in the Paris agreement



The Danish agro-food cluster will ensure the full use of our global climate potential by further developing the strong agro-food cluster with a high agricultural production in Denmark

# Fifteen recommendations of the Global Climate Task Force:

In the years ahead, the Danish agro-food cluster will contribute to the national target of reducing greenhouse gas emissions by 70% up to 2030 and becoming climate neutral in Denmark by 2050.

The agro-food cluster's contribution to reducing global greenhouse gas emissions is substantial by exporting solutions that streamline the food production process and minimise emissions. As has been the case up to now, solutions must be developed by closely collaborating with universities, advisory services, agriculture, the food industry and a wide range of innovative companies, and these solutions must be brought to world markets by actively cooperating with the Danish Trade Council, the Export Credit Agency (EKF), Danida, and others.

The success of these efforts will depend on the continued existence of a strong agro-food cluster with a large agricultural production in Denmark that can be used as a platform from which to develop even more climate-efficient, eco-friendly production processes and to continue the rewarding cooperation with Danish society.

To ensure this success for the benefit of the global climate and for growth and job creation in Denmark, the Global Climate Task Force proposes the following fifteen specific initiatives:

## 1 Memorandum of Understanding (MoU)

That three or four new cooperation agreements (Memorandums of Understanding, MoU) be established between Denmark and selected countries aimed at promoting sales of sustainable, climate-efficient Danish solutions for value chains in the agro-food cluster (e.g. in the form of new or enhanced MoUs, such as the one with California).

## 2 Build up local capacities

That two or three new collaboration projects be established with authorities (i.e. strategic sector cooperation (SSC) projects) in developing and middle-income countries focused on building local capacity within sustainable, climate-efficient food production (e.g., to follow up on projects in Columbia in the area of pig production).

## 3 Promotion via the Foreign Services

That the Foreign Service strengthens its promotion of the Danish agro-food cluster's expertise in relation to climate-efficient, sustainable food production. Specifically, by promoting Danish examples focused on 15 areas in which Denmark is leading the way (e.g. as white papers issued in cooperation with Food Nation and State of Green)

## 4 Export promotion

That, in cooperation with the Ministry of Foreign Affairs (the Trade Council), at least three or four marketing campaigns are carried out each year focusing on the selling of sustainable, climate-efficient Danish solutions to value chains in the agro-food cluster (e.g., linked to national plans for the implementation of the EU's economic recovery funds).

## 5 Market maturation projects

That the Danish Agriculture and Food Council and other relevant members of the agro-food cluster carry out at least two or three market maturation projects focused on Danish solutions for sustainable, climate-efficient food production in cooperation with EKF under the Green Accelerator scheme (e.g., for establishing a demonstration project for feed production or pig production).

## 6 Distribution of know-how and management

That at least one or two actions be implemented each year focused on the dissemination of Danish know-how and consultancy concerning sustainable, climate-efficient food production in developing countries in cooperation with Danida (e.g., affiliated with existing Danish Agriculture and Food Council projects in Nigeria, Uganda and Indonesia).

## 7 Secure equal competitive terms within the EU

That Denmark works to ensure that the EU Farm to Fork Strategy (as part of the European Green Deal) gives the food industry the right framework conditions and equal competitive terms across the EU member states to produce high-quality sustainable products and solutions for European and world markets alike.

## 8 Focus on competitiveness, growth and earnings

That focus be brought to competitiveness, growth and earnings, and that positive incentives are the prerequisites for the industry's investments in a more sustainable conversion of production processes. This means that frontrunner countries must be rewarded, rather than punished, that the single market must be protected, and that innovation, research and development are given top priority to ensure Denmark's capacity to deliver and remain a frontrunner.

## 9 Funding for developing sustainable products

That the Danish research, innovation and business promotion system continues to ensure greater coherence between the schemes and that greater financial incentives be secured to develop sustainable products and services targeting global commercial markets – particularly in the agro-food area.

## 10 Upgrade the Danish innovation centers

That the agro-food industry assists in upgrading the skill-sets of Danish innovation centres to manage and supervise knowledge-based cooperation in terms of beneficial climate and sustainability solutions (e.g., through information meetings, networks, materials, etc.)

## 11 Obtain research funds

That efforts be made to ensure Denmark's participation in European mission-driven partnerships of relevance to the entire food-product value chain. These efforts must focus on obtaining research funding from Horizon Europe, without deducting funds received from national research grants.

## 12 EU and UN should work for common standards

That the authorities, via the EU and UN, work to achieve common standards in terms of climate effect, specifications of carbon footprint, greenhouse gas accounting and specification methods internationally.

## 13 Support a common EU ETV

That Denmark actively supports a common European Environmental Technology Verification (ETV) system in the agricultural sector to accelerate the approval of sustainable technologies and development of testing protocols harmonised within the EU.

## 14 Fast track Novel Food approvals

That Denmark works to accelerate Novel Food approvals and that the impending amendment of the regulation on additives for use in animal nutrition makes it possible to increase the number and speed up the approval of additives that can contribute to sustainable production.

## 15 Accelerated approval processes

That authorities accelerate the case processing of veterinary certificates, on a par with the Netherlands.

# The Danish agro-food cluster is known for its high efficiency. Innovation. And close cooperation across the food chain and its sectors

The Danish agro-food cluster is characterised by close cooperation across supply chains and sectors, a high level of efficiency and, not least, innovation. The sector has a declared goal to lead the way in the green transformation, locally and globally alike. The solutions developed by the sector must be exportable all over the world to generate the green transformation required. And the process is already under way.

Danish agriculture often performs well in international comparisons of the energy efficiency of its production processes with a reduced carbon footprint. For example, a report published last year by the World Resources Institute showed that Denmark is one of the most climate-efficient countries in the world when

it comes to the production of both pork and dairy products. This is notably attributable to a high feed conversion ratio and the subsequent lower discharges from the feed production process – not to mention a cool climate that reduces slurry-related emissions. These efforts are important outside Denmark, too. They have been achieved through innovation, the development of new practices and technologies that can become important at global level.

Whenever we export Danish food technologies and solutions, this will often benefit the climate, as these solutions minimise production wastage and discharges and ensure that less farmland is cultivated simply, because the production process is more efficient. At present, there are no available estimates of

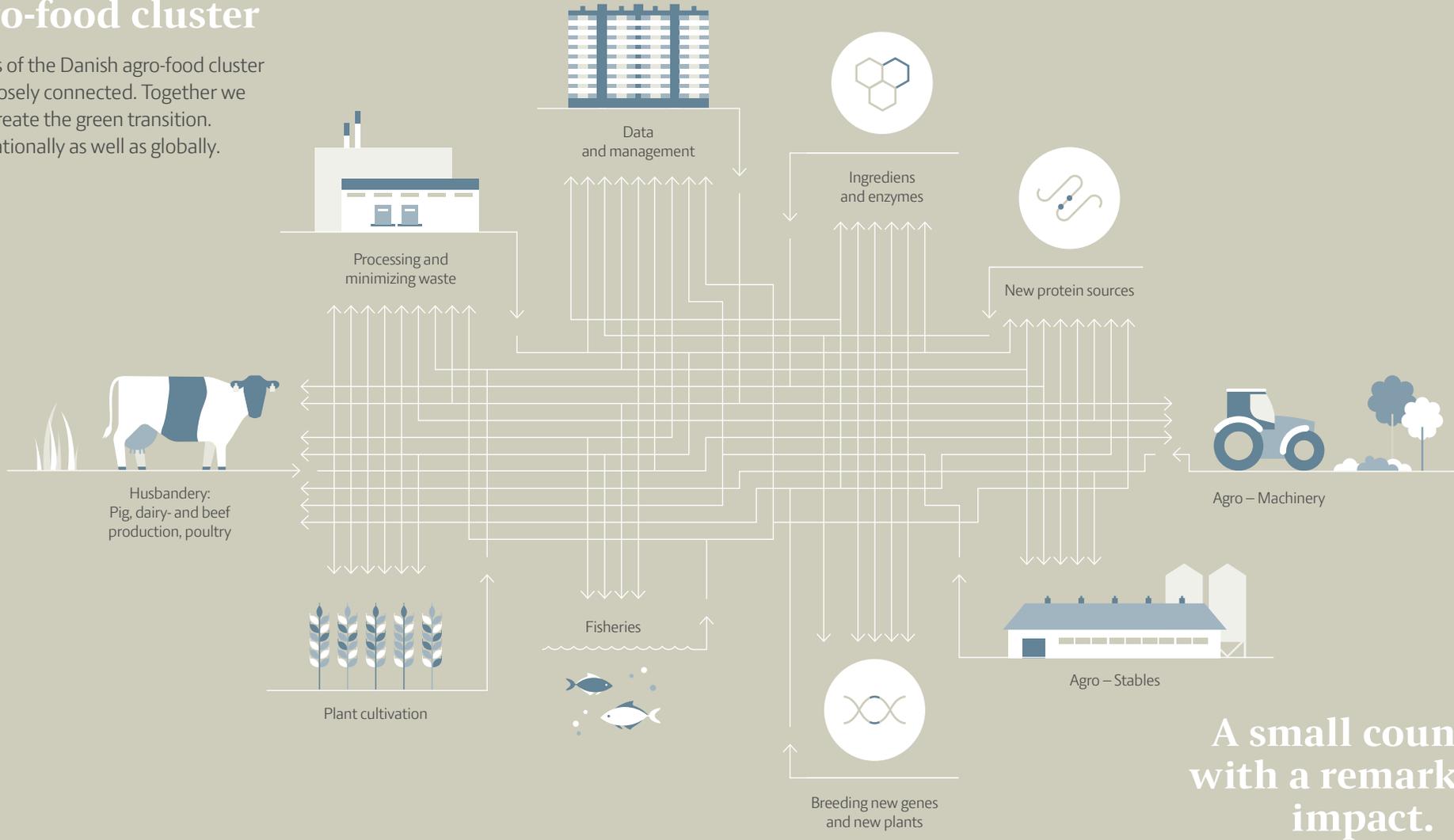
Denmark's food technologies' climate impact outside Denmark. This is notably because it is difficult to compare food production discharges transnationally, due to a lack of comparable data and due to a failure to agree on methodological approaches.

As part of its collaboration with the Danish Agriculture and Food Council's Global Climate Task Force, Axcelfuture has estimated the global climate impact of individual Danish technologies. It is worth noting that the results are rather uncertain and based on restrictive assumptions. The calculations were carried out using input from the companies themselves, independent experts and the Danish Agriculture and Food Council.

Every segment of the Danish agrofood industry's is developing new solutions for the green transformation. In the following, specific initiatives and companies within various sectors are singled out to exemplify and highlight the beneficial climate impact of the Danish agro-food industry's technologies and practices far beyond Denmark. They represent only a small selection of the many initiatives and companies contributed by the agro-food cluster and which in the aggregate make a big difference worldwide.

# The Danish agro-food cluster

All parts of the Danish agro-food cluster are closely connected. Together we create the green transition. Nationally as well as globally.



**A small country with a remarkable impact.**

A small country with a remarkable impact. The Danish agro-food cluster develops and produces climate solutions with a global impact.

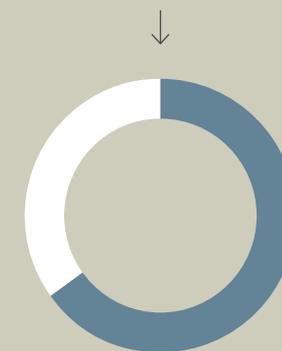
The Danish agro-food cluster produces and develops a **climate-efficient food production**, new technologies and know-how, which will make a substantial impact on agriculture and food production globally.

# Denmark's dairy and beef cattle sector leads the way worldwide in terms of sustainable, climate-efficient production processes.

Efforts to produce more climate-efficient cows were achieved through breeding, efficient housing systems, feed, management, data collection, and, not least, consultancy, training, development and research. All of which are elements for achieving a better climate-friendly production process.



65% of the livestock sector's global emissions (methane) come from cows



Several international studies show that the Danish dairy- and beef-sector is among the most climate efficient in the world.

(Source: World Resource Institute, Wageningen University)

## When cows digest feed, they produce the greenhouse gas methane. These methane emissions are one of agriculture's primary sources of greenhouse gas emissions.

Methane is a greenhouse gas with a 35-fold greater greenhouse impact than CO<sub>2</sub>. According to the Food and Agriculture Organisation (FAO), livestock production is responsible for 14.5% of all human-made greenhouse gas emissions at global level. FAO assesses that 65% of the livestock sector's global emissions come from cows. The dairy sector is responsible for 3% (excluding meat) and 4% (including meat) of combined greenhouse gas emissions, according to the FAO.

- Danish solutions can be used to reduce cows' methane emissions by improving cows' feed conversion. Feed made up of grass/clover/herb compounds refined for higher yields, enhanced digestibility and better nitrogen balance will reduce methane emissions. Additional breeding progress through genomic selection will ensure the continued improvement of cows' feed conversion.

- A wide range of feed additives, such as fat, the substance X, the 'No Methane' project, etc., currently exist and are being developed to minimise the methane formed during a cow's digestive process.
- Breeding and genetics are crucial for reducing methane emissions within the dairy and beef cattle sector. Key actions worth mentioning include sex-sorted semen, genomic selection and selective breeding to achieve more feed-efficient cows.
- The vast complexity of modern agricultural production systems means there are many factors to control and uphold to optimise and maintain optimal productivity. Efficient livestock housing systems and technologies – as well as better management and data relating to feed, water, temperature and animal well-being – are crucial for making the production process more energy efficient.

### **DLG** Feed that reduces the formation of methane

The development of feed solutions aimed at reducing methane emissions has been under way for a number of years. Recently, Aarhus University, the University of Copenhagen, Arla, Danish Crown, the SEGES Pig Research Centre, Lactobio, Vilofoss and DLG joined forces in the research project 'No-Methane' that aims to develop a specific product capable of reducing cow methane emissions by up to 50%. The 'No-Methane' project will work on three different feed solutions to reduce the amount of methane that is formed in the cow's rumen.

### **DLF** Feed crops that enhance feed conversion

The refinement of improved varieties of feed crops (for higher yields and digestibility, better nitrogen balance, resilience and disease resistance) through genomic selection will further improve cows' feed conversion.

### **VikingGenetics & Cowconnect** Using technology and data for management and innovation

VikingGenetics has developed a method for measuring each individual cow's feed intake using 3D cameras and artificial intelligence. The system is installed at commercial herds all over the world to make production processes more energy efficient. The comparative data from each individual cow's methane emissions make it possible to begin selecting cows with the lowest climate impact to reduce methane emissions.

Cowconnect works on cow feed management. Their solutions can be used to set up feed plans, daily management and reporting. This technology is in great demand from abroad to be able to reduce cows' methane emissions.

## **Arla Foods**

### **Climate Check ensures that milk has a low climate impact**

Arla Foods launched its first climate strategy in 2008. The strategy was widened in 2014 to include on-farm factors. This enabled Arla Foods to reduce its climate impact at farm level per kg of milk by 23% from 1990 to 2020. In terms of reducing emissions at farm level, Arla Foods developed and implemented a collaboration project across seven different countries involving advisory services in which the farmer receives a specific figure for his/her climate performance, a benchmark for emissions at similar farms, as well as options for reducing the climate impact per kg of milk. Based on data generated by Climate Check, Arla Foods identified five factors (such as feed efficiency, protein sources, etc.) with the biggest climate impact across all production systems. Arla's Climate Check tool is expected to be crucial for achieving the reduction planned for Science Based Targets up to 2030. This analytical work shows the strength of having access to vast data volumes across production systems.

In 2012, Arla Foods launched a giant Technology Transfer Centre in China to provide specific advice to Chinese farmers on how they can change management practices by focusing on feed safety, animal welfare, and energy efficiency with reduced carbon footprint. Arla Foods assists with partnerships and joint venture projects in Nigeria, Indonesia and other

locations to bring Danish know-how out into the world for the benefit of a sustainable dairy sector.

## **Danish Crown**

### **The same animals can be used for dairy and beef production**

Denmark's beef sector has a low climate impact. This is because in Denmark, milk, yoghurt, cheese and curd – and meat – come from the same cattle and their offspring, by contrast with North and South America and Australia, for instance, which raise beef cattle for meat alone.

The residual products from cattle slaughterhouses are used to produce biogas, etc., which generates far more energy than the slaughterhouses use themselves. It is the sum of many initiatives that generates these results. Danish Crown is working on a quality programme for calf production called 'Dansk Kalv' (Danish Calf), which focuses specifically on animal welfare. This programme has been further developed to control the climate impact of the individual farms now, too. Ongoing impartial inspections are made at farms, at the same time that the farmer sets specific targets and actively works to reduce the farm's climate impact. For example, the farmer works to optimise calf feeding, improve the spreading of slurry on the fields and exploiting the slurry for biogas, which helps heat many households.

## **FOSS**

### **Processing food without waste**

FOSS delivers analytical solutions for milk and dairy production. Over the course of its 65 years of innovation, FOSS has ensured that a growing percentage of the milk produced by each cow ends up as nutritious, healthy food for consumers. FOSS serves dairy customers all over the world representing 85% of the world's combined dairy production.

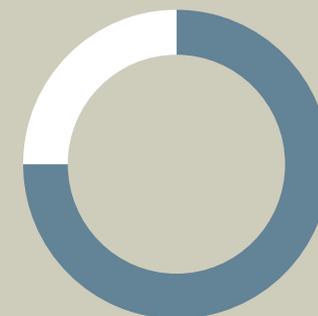
FOSS solutions streamline production processes and minimise waste at the dairies. Analytical solutions ensure that any bacterial problems are detected in the milk, before it reaches the production line, thus reducing waste and product recalls. The early detection of additives and contaminating substances makes it possible for dairies all over the world to address and restrict food fraud. By increasing production efficiency, minimising waste and counteracting food fraud, FOSS ensures that as much of the produced milk as possible is made into food for the consumer, thereby reducing the climate strain.

# Denmark's pig production system stands out as one of the most climate-efficient production systems in the world.

This was most recently concluded by the World Resources Institute. The sector's long-standing efforts involving breeding, genetics, energy-efficient housing systems and technology have stimulated a high worldwide demand for pork, solutions and know-how from the sector.



Danish genetic material can reduce one-fourth of the emissions from the pig production in China, if the genetic material is fully utilised



## -25%

In the period from 2005 to 2016 the emissions of greenhouse gasses from pig- and pork meat production was reduced by 25 pct.

(Source: Aarhus University)

## **Danish Crown** Pork from a sustainable production process

Danish Crown wants to build up its position as the world's leading producer of sustainable meat. They aim to achieve this by halving the climate impact of one kg of pork (compared to 2005) before 2030. The vision of Danish Crown is for its pork production to be climate neutral by 2050. The 2050 climate neutrality vision covers the entire value chain and all the group's activities.

Already now, 100% of the pigs delivered to Danish Crown's Danish slaughterhouses come from farms with a sustainability certificate specifying sustainability improvement targets. In addition, individual farm-specific LCA (life cycle analysis) calculations are currently being implemented. In January 2019, the University of Aarhus completed an LCA of how the environmental footprint of pig production had developed in Denmark from 2005 to 2016. The analysis showed that greenhouse gas emissions attributable to pork decreased by 25% during the period.

## **DanBred** Danish pigs' genes can reduce the climate impact of meat

DanBred delivers genetic breeding material to the whole world, which helps reduce the climate and environmental impact of the pig production system. Denmark's genetic breeding material can make a crucial difference worldwide. For instance, DanBred can help reduce China's pig stock emissions by 25%, if the genetic breeding material is fully utilised.

## **SKOV A/S** Eco-friendly, climate-friendly live- stock housing and technology

SKOV A/S is a world-leading company in the area of climate and farm management for livestock production and currently exports roughly 90% of its solutions. The livestock housing environment is important for livestock well-being, growth and thus the climate impact of the production process. SKOV A/S has developed products and systems aimed at ensuring ideal terms and conditions, which include ventilation systems for all climate situations. Similarly, SKOV A/S exports solutions capable of optimising housing productivity by monitoring and streamlining feed quantities. The company's solutions enable the farmer to sharply reduce feed units in the production process, reducing greenhouse gas emissions in the process.

## **IQinABox** Overview enhances production efficiency

Together with Danish Crown, the company IQinABox generates continuous documentation of farms' production efficiency week by week. Monitoring animals' daily gain, feed consumption, management, etc., makes it possible to assess specific initiatives and document the greenhouse gas reduction at the farms. The enhanced week-by-week overview of member farmers' feed efficiency optimises the potential of the individual farm and in companies throughout the value chain, too.

## **BioRefine Denmark** Grass is one of the feed solutions of the future

Grass protein is one of the solutions that can make pig feed greener in more than one sense of the word. By refining grass protein to be digestible by monogastric (having only one stomach) animals, grass protein can in future help replace some of the current soybean imports. BioRefine Denmark A/S was formed by the three agro-companies DLG, Danish Agro and DLF. The company was formed to launch a full-scale production of green proteins to be used in feed, etc.

# Danish poultry production is amongst the most feed efficient in the world

Poultry is amongst the most important and climate efficient sources of animal protein in the world.



In 2020 Denmark exported poultry meat for 3 billion DKK



**77.000.000**  
**kg eggs**

In 2020, 77.000.000 kg eggs were weighed in by the Danish egg packers



Danish poultry production has the best stable systems, when it comes to climate efficient production. This is especially important, when it comes to ventilation, farm management and efficiency

Population growth and higher living standards increase the demand for meat. Worldwide, poultry production is one of the most important and efficient sources of animal protein. The markets for chickens and eggs are some of the fastest growing worldwide, as these sources of nutrition are healthy and climate-efficient.

Greenhouse gases are produced in the poultry production system by the animals' digestion of feed and the storage of their manure. In addition, some farmland is used to cultivate feed, which also involves greenhouse gas emissions. This is one of the strengths of Denmark's poultry production: When benchmarked with neighbouring countries, the process is one of the most feed-efficient and the sector has some of the best housing systems in terms of energy-efficient poultry production

### **SKOV A/S** **Eco-friendly, climate-friendly livestock housing and technology**

All over the world, the company SKOV A/S contributes to an efficient, sustainable production of healthy foods worldwide that respects animal welfare.

SKOV A/S is a world leader in ventilation, farm management and digital services, and more than 95% of the company's poultry systems are exported. The company helps poultry farmers optimise their utilisation of their often limited resources, such as clean water, feed

and qualified workers. SKOV's ventilation systems are energy efficient and ensure healthy conditions for poultry and employees alike. Its farm management systems provide overview and make it possible to streamline production processes.

### **HKScan** **Supplying chickens to Scandinavia and the Baltics**

The slaughterhouse HKScan is one of the biggest agro-food companies in the Baltic Region, supplying chickens to Scandinavia and the Baltics. In early 2021, HKScan stated that it aims to make its own manufacturing processes carbon-neutral by the end of 2025 and achieve carbon neutrality throughout its value chain from farm to fork by no later than the end of 2040. In 2019, the company's carbon emissions totalled 2.4 megatonnes of CO<sub>2</sub>e. HKScan's climate impact is calculated pursuant to the GHG Protocol (scope 1–3). Data accuracy and completeness have been validated by KPMG. Carbon emissions from the manufacturing processes will be reduced by more than 70% by implementing green electricity from renewable energy sources, systematically improving its energy efficiency, and other measures.

The primary production is focused on reducing carbon emissions related to feed production and farming which has a big climate impact in the value chain. The key element of these initi-

atives is to improve resource efficiency and the fixation of CO<sub>2</sub> relating to farmland cultivation.

### **DAVA Foods Group** **Optimising the entire food chain ensures eggs with a lower climate impact**

The DAVA Foods Group is a manufacturing, distribution and packing conglomerate that processes, packs and distributes fresh shell eggs and a number of pasteurised products made from boiled eggs. The group processes approximately two billion eggs a year. DAVA Foods is one of the biggest suppliers of eggs in the Nordic region and a market leader in Denmark with a market share of 45–50%. DAVA Foods has a market share of 40% in Finland and 25% in Sweden. In addition, DAVA Foods exports to Greenland, Germany, the Czech Republic and the Netherlands.

By the end of 2023, DAVA Foods will have reduced its carbon emissions from vehicles by 30% per kg of produced eggs. The company will replace its fleet of vehicles so that egg transports are based solely on non-fossil-fuel vehicles by 2027. In addition, the entire manufacturing system's equipment will be continuously renewed to run on alternative energy sources. Furthermore, DAVA Foods will reduce its food waste, use recyclable packaging only and reduce its consumption of water and energy by 30% and 50%, respectively, per unit produced by 2024.

### **Rokkedahl Energi** **Heat exchangers that generate energy and reduce ammonia**

Rokkedahl Energi supplies sustainable energy solutions to agriculture and industry. The company is a leader in the area of heat exchangers for agriculture with more than 400 systems in operation, primarily in the broiler sector, where the company is responsible for 85% of the systems in Denmark. In terms of egg production, Rokkedahl Energi is well under way, too, and in this area the company expects its future market share to be just as big as for broiler production. Rokkedahl Energi also supplies products to our Nordic neighbours' poultry production systems, where its technology is a market leader. Heat exchangers enable poultry producers to reduce energy consumption by up to 80% in poultry housing units.

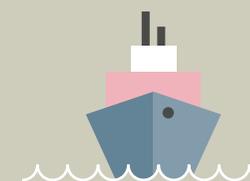
They also reduce ammonia emissions in housing units by 30–40% and reduce feed consumption. Energy savings and a lower feed consumption are direct, beneficial climate-related effects for the poultry production system, which is already one of the most climate-efficient food production systems worldwide.

# Danish fishery supplies food and efficient fishing vessels and has a beneficial environmental and climate impact

Danish fishery currently supplies Danish and foreign consumers with fresh fish every day. The fishery sector exports a high percentage of its products and helps underpin Denmark's national economy. The industry leads the way to a fishery sector with a lower climate impact by, among other things, keenly focusing on energy efficiency and delivering healthy foods for human consumption.



Danish fisheries show the way to a fish sector with a lower climate impact by developing mussels to catch carbon and nutrients from the aqua environment



**-9.400**  
tons CO<sub>2</sub> / year

By optimizing the fishery vessels, the Danish fisheries have made energy reductions of 9.400 tons CO<sub>2</sub> pr. year

- Fish and aquaculture are important for human consumption, as animal feed, and as a marine mitigation tool. For instance, increasing the production of mussels can help reduce the climate impact of the combined aquaculture sector and provide a number of ecosystem services at the same time. Mussel farming captures CO<sub>2</sub>, and mussel products can be directly used for human consumption or as ingredients in other production processes, such as mussel meal in the feed industry. Mussels also remove nutrients from the aquatic environment.
- Fishing vessels can use shore power so they can connect to the electricity grid during loading and unloading and when docked in a harbour. A combined shore-power overview shows that the current fishing fleet can uphold the Danish fishing industry's catch levels and reduce the current carbon emissions by 4.5–5%.
- Danish fishery is continuously optimising its vessels, demonstrated by an energy efficiency reduction of carbon emissions equating to 9,400 tonnes a year since 2019, and by developing an innovative concept for inshore fishery to cut fuel consumption by up to 61% for a standard vessel.

### **Danish Energy Consulting** **Making fishing vessels more energy efficient**

An example of constant, systematic reduction of fishing vessels' carbon footprint is seen in the efforts made by the company Danish Energy Consulting for a great many Danish fishing vessels. During the period 2018–2020, the company made 32 energy inspections that helped reduce fuel consumption by 25%, equivalent to a total reduction of CO<sub>2</sub>e emissions by 9,400 tonnes per year. These highly specific efforts have helped make the fishery sector significantly more energy efficient in recent years.

### **AB Ocean** **Shore power makes fishing vessels more energy efficient**

AB Ocean, with its fishing vessel HG 265, is a good example of a fishing company that is prepared to use shore power. The company can save fuel during loading and unloading and while the vessel is docked and waiting for new fishing opportunities. In 2020, the vessel carried out 28 unloading operations which required 4 tonnes of fuel per operation, and the vessel spent roughly 100 days in port where the vessel used 0.6 tonnes of fuel every 24 hours.

By using shore power rather than power generated by the vessel's own generators, HG 265

can save about 172 tonnes of fuel, equating to 545 tonnes of carbon emissions, provided that the shore power comes from green energy sources.

### **Danish Fishery** **Fishing vessels with markedly lower fuel consumption**

Danish fishery has developed an innovative concept for an energy-efficient, maintenance-optimised fishing vessel for coastal and inshore fishing which is predicted to reduce fuel consumption by 61% compared to a standard vessel. The project is based on broad cooperation among fishermen, shipyards, marine engineers, researchers and ports and works as a catalogue of the guidelines and climate benefits of various streamlining measures.

#### MUSSELS ARE USED FOR HUMAN CONSUMPTION AND AS A MARINE MITIGATION TOOL

Increasing the production of mussels can help mitigate the climate impact from the combined aquaculture sector and provide a number of beneficial effects for the ecosystem at the same time.

Increasing mussel production output by 105,000 tonnes a year would directly reduce carbon emissions by 17,000 tonnes a year. The production also has a number of derivative climate gains, as mussel meal can replace other ingredients that have a greater climate impact. In addition, mussel breeding reduces water's chlorophyll content and extends depth visibility at basin scale. The latter can be expected to increase the proliferation of eelgrass, which efficiently fixates CO<sub>2</sub> and has several positive eco-system effects.

Mussels remove nutrients from the aquatic environment. This is why various models should be set up to remunerate breeders for the socioeconomic gains that are achieved by reducing the content of nutrients in aquatic environments. For instance, producing 105,000 tonnes of mussels can remove approx. 1,450 tonnes of nitrogen and 95 tonnes of phosphorus.

# Danish plant cultivation reduces the climate impact worldwide

Danish plant cultivation delivers climate solutions to the whole world in every link of the food production chain – from seeds, machinery and spraying equipment to advisory services that ensure reliable, energy-efficient production.



Danish plant cultivation develops efficient new technology – such as using drones to optimise farming and efficient field sprayers that reduce the climate impact and water consumption



The Danish plant cultivation delivers grass- and clover seeds to over 80 countries around the world

## Effective plant cultivation is farming that delivers energy-efficient products based on knowledge, advisory services, innovation and new technology.

The segment develops and refines seeds to be more effective and resilient, and exports grass and clover seeds to more than 80 countries. As the plant cultivation segment also produces feed, it is an important component in reducing the climate impact of the animal production segment. Danish plant cultivation develops efficient new technology – such as using drones to optimise farming and efficient field sprayers that reduce the climate impact and water consumption.

### **DLG & Danish Agro** Overview and feed consumption data

DLG is involved in global standardisations and was one of the first in Europe to declare the climate impact on the label of its finished feeds. At the same time, DLG works on development and innovation in multiple areas, including breeding and developing green manure and green ammonia. DLG also works on developing grass protein, which reduces the need for imported soybeans, and on extracting green protein from peas.

Danish Agro is deeply involved with locally produced proteins and with optimising feeds and feed additives. The company uses climate-adapted products and develops digital solutions. For instance, Danish Agro uses climate seeds to adapt plants to local climates through plant breeding to optimise cultivation and thus increase yields, reduce water consumption and save on auxiliaries. Danish Agro exports seeds and tests them in various countries to reduce their climate impact. The company also uses Cropline, which uses satellite photos to improve SMART farming.

### **DLF** Climate-efficient seeds

DLF's plant breeding efforts target, among other things, a climate agenda objective: To develop more resource-efficient and climate-resilient seeds. DLF has focused on developing seeds that grow into more highly digestible crops for livestock, thereby improving feed conversion and reducing methane emissions. DLF is responsible for 25% of global exports of these grass and clover seeds – all over the world. Grass is a perennial crop that helps reduce emissions from soil cultivation, increases nitrogen fixation in the soil, has lower nitrous oxide emissions than other crops, reduces the leaching of soil nutrients, reduces the leaching of soil nutrients and the need for pesticides in perennial grass fields and increases farmland fertility.

### **Danfoil** Reduced need for water in field sprayers

Danfoil is one of Denmark's leading manufacturers of field sprayers. A combination of advanced technology, high capacity and quality has made Danfoil a preferred partner all over the world. It is continuously improving its patented air-based nozzle technology which guarantees their ability to meet their customers' spraying technology needs. A Danfoil field sprayer is powered by air pressure, rather than liquid. This ensures effective penetration and deposits of water and chemicals throughout dense crops (not only on the surface) and economises spraying to only 30-50 litres/ha, which reduces chemical use by 25% on average.

Danfoil's field sprayers use substantially less water than conventional sprayers. This makes agricultural vehicles lighter and enables them to run further per litre, reducing carbon emissions by up to 50%. In addition, they can usually be mounted on lighter vehicles, which reduces soil compaction. They use injection/individual dose spraying, which reduces the volume of pesticides.

# Data and advisory services are the key to a green transformation

The first step towards creating a more climate-efficient food production system is having a complete overview. Denmark's agro-food cluster is uniquely positioned to collect and exploit data in the food production process. This makes it possible to reduce waste and increase production yields throughout the production chain.



The Danish agro-food cluster has an extraordinary advisory service, which is developed through a historical setup with one of the oldest agricultural universities in the world, agricultural schools, innovation and advisory services within the whole food chain



The value chain from the agricultural research to implementation in the stables and the fields is short in Denmark. This ensures optimization of the production, increased production yield and a high quality of products for processing

## Agriculture is facing major changes and must make new giant leaps to achieve climate-neutral production processes.

The changes must be implemented faster than ever and require the involvement of far more players – outside agriculture, too. Denmark's efforts in terms of global developments also require international outlook and international partners so we can achieve the climate and sustainability targets and account for the benefit of the surrounding world and for agriculture's commercial viability.

You can't change what you don't understand, which is why the green transformation must initially be based on a general view of the production process. Denmark's agro-food cluster has deep insight into data from every link of the production chain, and the cooperation between the various links has created unique overview and enabled multidisciplinary optimisation and innovation. Concurrently, Denmark has a unique consultancy model. It builds on a historically strong set-up involving one of the world's oldest agricultural universities, agricultural schools, and innovation and advisory services throughout the chain. This shortens the value chain from agricultural research to changes in stables and on fields. Over the past 150 years, the chain has optimised production processes, increased yields and increased the quality of supplies to processing links.

- Data: For decades, the Danish agro-food industry has been collecting data to minimise on-farm wastage – as well as for development and innovation. This has resulted in vast, unique databases within the various farming sectors.
- Data ownership and cooperation across the production chain: Denmark's farmers own comprehensive databases of agro-cultural statistics based on agriculture's own innovation centre, SEGES. Also, the farmers themselves are member owners of the biggest undertakings in Denmark's food production systems. This provides a unique opportunity to share data across the chain for the benefit of research and innovation.
- Advisory services: The distance from research to practice is short in Denmark. Agriculture's research and advisory services are linked together by an innovation centre that gathers all innovation projects involving more than 1,000 plant experiments, production management applications, undertakings and all specialists under one roof.

### FOSS Data and analyses ensure a more climate-friendly food production process

FOSS is a world leader in the field of advanced measuring equipment for agriculture and food production, including dairies, grain and feed production, wine production and meat production. FOSS's analytical solutions convert measurements into information that enables undertakings to operate intelligent, data-driven production processes that reduce waste and increase yields – thereby minimising their climate impact. By enhancing production efficiency, minimising waste and combating food fraud, a company can produce more food products from limited raw materials. This is done by measuring and calculating the most efficient harvest date or managing the milk production process to maximise yields. Data analysis makes it possible to minimise production wastage. At the same time, early-warning systems make it possible to contain any food-safety problems, which reduces the need to destroy large consignments of food.

### SEGES Danish Pig Research Centre Production digitisation

Data will be a powerful driver in the transformation to achieve the Climate Neutrality 2050 vision. Digitisation lays the groundwork for knowledge, speed and higher quality. The SEGES Pig Research Centre uses data-driven software in its breeding tasks and, for example, its field database to pursue climate-improving initiatives both in Denmark and abroad. Accordingly, SEGES has developed digital tools such as CropManager and Mark Online (Field Online) that generate data for farmers to give them an overview of their fields and plant cultivation. This is similar to the dairy and beef cattle sector, where DMS (Dairy Management System) and SmartKoen (SmartCow) were developed to give farmers an overview of their cattle production and make it possible to input data directly from the livestock housing unit.

These data-driven products are in great demand all over the world. Accordingly, SEGES has entered into a joint venture with the State of California from 2021 concerning 'Climate smart solutions in the dairy sector' that aims to ensure shared data-driven research and idea creation. The parties are collaborating with Silicon Valley

companies on the latest research into feeding systems for implementing new knowledge and smart, data-driven solutions.

### **DLG and Danish Agro** **Establishing an overview of feed's climate impact**

Denmark's two major grain and feed producers – DLG and Danish Agro – are continuously working to improve the yield of the feed they supply. They do this by means of a large-scale development effort in which they use data to get an overview of a feed's strengths and weaknesses and optimise these factors at all times. This applies from the development of resilient, effective seeds to climate declaration labels on feed to digital solutions in the field.

DLG is involved in global standardisations and was one of the first in Europe to declare the climate impact on the label of its finished feeds. Climate declarations enable farmers to document their climate impact and give them an overview of the levers they can pull to drive their production process in a more sustainable, productive direction.

Danish Agro is deeply involved with locally produced proteins and with optimising feeds and feed additives. Danish Agro uses climate-adapted products and develops digital solutions such as climate seeds, which use plant breeding to adapt plants to local climates to optimise cultivation, increase yields and reduce the need for water and auxiliary products. Danish Agro

exports seeds and tests them in various countries to reduce their climate impact. The company also uses Cropline, which uses satellite photos to improve SMART farming.

### **Arla** **On-farm Climate Checks**

For decades, Arla's member owners have been working to establish a more sustainable milk production through green on-farm alternatives, such as circular milk production, renewable energy, biodiversity and now Climate Check, too. Climate Check generates a data-driven overview for farmers, comprising the number of animals, feed composition, crop production, fertiliser application, animal manure management and consumption of electricity, fuel and energy. When milk leaves an Arla farm, it will on average have required the emission of 1.15 kg of CO<sub>2</sub>e per kg milk. This includes emissions from cultivated, carbon-rich, peatland soil in accordance with international guidelines. Without peatlands, the average carbon emission is 1.06 kg of CO<sub>2</sub>e per kg milk. Climate Check is based on ISO 14044 for life cycle analysis (LCA) and adheres to the guidelines of the International Dairy Federation (IDF) for specifying carbon footprints, whereas emissions from animals, animal manure and soils are based on the rules of the Intergovernmental Panel on Climate Change (IPCC).

### **Danish Crown** **Sustainability certification of pigs**

All Danish Crown pigs come from Danish climate-controlled farmers who have acceded to Danish Crown's sustainability programme 'Climate Track'. Farmers who follow the 'Climate Track' commit to reducing their climate impact by 50% by 2030. This is the first milestone on the journey towards realising the vision of climate-neutral meat production by 2050.

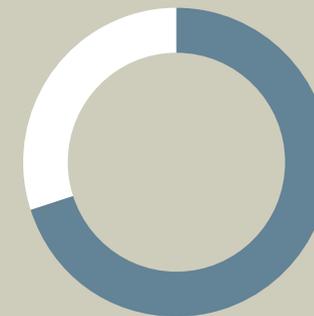
The programme requires farmers to set three-year targets for how their farm will reduce its climate impact and improve in several other areas such as the environment, animal well-being and social responsibility. Accordingly, each farmer sets a baseline for carbon emissions per bred pig to enable them to assess their performance in relation to their individual targets. The farmers are audited at least every three years to evaluate how they are progressing towards their 2030 goal.

# Using Danish genetics to reduce CO<sub>2</sub>e emissions from livestock production

Denmark's agro-food cluster has developed unique climate solutions for livestock production in the areas of genetics and genetic breeding material. Danish solutions are recognised for their high quality and are marketed to producers both in Denmark and abroad for the benefit of a more energy-efficient, sustainable production process.



Genetic breeding is the most important factor in reducing the methane emissions from the beef- and dairy sector



# 70%

Projections show that the demand for meat will rise with 70 pct. from 2005 to 2050

## According to FAO, the demand for meat will rise to 455 mio. tons of meat in 2050. This is an increase in demand of 70 pct. in 2050 compared to 2005

This is particularly attributable to the fact that more and more people are leaving poverty, while the world population is rising to almost 10 billion in 2050 at the same time. This prompts the need to establish a livestock production process with a lower climate and environmental impact worldwide.

- Genomic selection is well suited for reducing environmental and climate emissions in pig herds, specifically by charting how closely related two breeding animals are at DNA level. A high level of genetics and genetic breeding material ensures, among other things, an increase in the number of viable piglets per litter, a high daily gain and optimum feed conversion, i.e. factors that ensure high productivity and climate-efficient operations throughout the value chain.
- Breeding and genetics are crucial for reducing methane emissions within the dairy and beef cattle sector. Key actions worth mentioning include sex-sorted semen, genomic selection and breeding to achieve more feed-efficient cows.

### **Danbred** Genes from Danish pigs reduce the climate impact

DanBred delivers genetic breeding material to the whole world, which helps reduce the climate and environmental impact of the pig production system. If DanBred is capable of improving the genetic potential by 0.1 kg of feed per kg daily gain, it can save 7.5 kg of feed per produced finisher, thus reducing the carbon impact by 4 kg per finisher.

Genomic selection in pig production is well suited for improving environmental and climate sustainability. This is specifically because the goal of modern breeding programmes is to produce pigs using fewer resources. Genomic selection based on factors such as feed conversion, daily gain and survival rate are included in farmers' breeding targets and translate into reduced waste, which reduces nutrients such as nitrogen and phosphorous and emissions of greenhouse gases such as methane and CO<sub>2</sub>e.

Denmark's genetic breeding material can make a crucial difference worldwide. For in-

stance, it is possible to reduce emissions from China's pig population by 25% by exploiting genetic breeding material to the fullest.

### **VikingGenetics** Danish genes create a more climate-efficient beef cattle sector

R&D in the areas of breeding, genetics and feed efficiency for the benefit of dairy and meat producers is a cornerstone of VikingGenetics' activities. VikingGenetics pioneers in the field of breeding healthy dairy cows with high milk yields. The potential global benefits of using VikingGenetics' genetic systems in cattle herds are enormous. If VikingGenetics' systems were deployed in India, for instance, the country could reduce its methane emissions from Indian dairy cows by 33% per litre milk. The company has joined forces with Aarhus University to document the genetic impact in India, focusing on yields, health and methane emissions.

# The Danish agro-food industry creates the climate-efficient plants of the future

Tomorrow's plant cultivation process will need more efficient, resilient crops with a reduced climate and environmental impact that can increase carbon fixation at the same time. This requires a continuous creation of new and better varieties through plant breeding to continuously produce more efficient plants.



Danish plant seed breeders continuously work to create plant sorts with better yields, more resistance and higher quality. Those qualities are requested by customers domestically and globally



**New breeding methods can contribute to securing a more sustainable food production**

## +1%

Danish seed- and cereal plant sorts are continuously becoming more efficient. In average the yield is 1 pct. higher every year

## The world is experiencing a climate and biodiversity crisis, and climate change is causing weather patterns to change and undermining crop cultivation conditions in the form of droughts, flooding and increased outbreaks of disease and pest attacks.

Danish seed and grain varieties are made a bit more efficient every year. In fact, yields are increasing by 1% a year on average. Today, Denmark's plant breeders are fast and efficient, because they base their breeding on multiple parameters to achieve greater advances more quickly. Whereas it used to take 8 to 10 years to develop a new variety, this can now be done more than twice as quickly. This is due to close cooperation with universities, the use of the latest breeding tools such as genomic selection and other factors. This makes it possible to achieve faster effects and optimise and produce more resilient crops at the same time.

- Breeding new seed varieties demands precision, time and knowledge. This is because a crop is not just a crop: it must be adapted to the climate and the environment in which it must flourish. This is particularly important considering the currently occurring climate changes. The results of Danish breeding include exports of climate-efficient grass, clover and beet seeds to the whole world, as well as seeds for feed and grain crops for large parts of Europe.
- Denmark has a very high degree of grain certification, 95% – compared to only 50% in the rest of Europe. The certification degree of grass and clover seed is 100%.
- Danish seed breeders are continuously working to produce varieties with higher yields, resistance properties, quality, etc., properties that are in demand by customers in Denmark and abroad and which are a competitive parameter among breeders.

### Sejet Plant Breeding and Nordic Seed Resource-efficient plant breeding

Sejet Plant Breeding and Nordic Seed A/S are two examples of Danish plant breeding companies. Sejet Plant Breeding works to develop the latest technologies every day to create climate-efficient genetics for field crops in Denmark and abroad. The company's own breeding programme comprises varieties of spring barley, winter barley, winter wheat and winter triticale, all of which are developed and adapted to much of the European climate. The company exports its products to a number of countries and collaborates closely with breeding companies in countries such as France, Germany, the UK and Sweden.

Nordic Seed A/S breeds a wide range of crop varieties, including barley, wheat, peas, rye, oats, broad beans and lupins. The company takes a targeted approach to breeding healthy, high-yield crops and supplies the Danish market, the Baltics, Finland, Sweden, Ukraine

and Hungary. The company works to breed improved new grain varieties that are adapted to current and future requirements for the benefit of agriculture, plant breeders and the climate. They do this by breeding more efficient, high-yield seed grain varieties.

## **DLF** **Making grass varieties that are more adaptable to climate change**

Climate change is causing weather patterns to change, and farmers all over the world must increasingly expect more difficult cultivation conditions for crops in the form of droughts, flooding and increased outbreaks of disease. For years, DLF has targeted its breeding efforts on developing new seed varieties that address the problems caused by climate change.

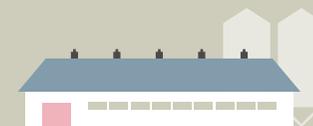
DLF's grass and clover breeding efforts target agriculture, as well as lawn grasses for private gardens, parks and sports grounds. DLF focuses on developing new varieties that maximise dry-matter yields for farmers, while minimising resources in the form of pesticides, fertiliser and watering to cultivate crops. Grassy areas are capable of fixating carbon in the soil and efficiently filtering out nutrients in the soil, which minimises leaching as a result. DLF is the definitive leader in the breeding of Festulolium (a hybrid of lolium (ryegrass) and tall fescue) and has a unique portfolio of products that combine high feed quality with high yields, extensive roots, resilience and stress tolerance. In the area of lawn grasses, DLF develops varieties that require less fertiliser and are more resistant to plant diseases.

Feed yields are optimised by selecting a healthy, resistant grass compound. Selecting grass varieties with high digestibility will increase

milk production by 0.25 litre a day per cow for each percentage point of higher fibre digestibility found in the feed grass. In addition, methane emissions are affected by digestibility, quality and feed composition. In other words, choosing the right feed solutions reduces emissions of climate gases per produced unit of milk or meat. DLF has developed a number of varieties that are distinguished by being highly resistant to plant diseases. This means that fungal attacks on their leaves are rare. This enables the grass to retain high yields, high quality and digestibility throughout the growing season which benefits the climate.

# Agro-industry developments generate sustainable solutions

The foods of the future must be produced with a lower climate impact than previously. This requires innovation, optimisation and new ways of thinking. In addition, new technologies are expected to achieve a large share of the greenhouse gas reductions.



Through innovation, optimization and new solutions, the Danish agroindustry has helped the farmers for more than 100 years. The Danish agro-food industry exports technology and solutions to the whole world

**14.000.000.000  
DKK**

In 2019 the sector exported for 13.8 billion DKK. This was a record for the sector. In 2021 the export is expected to rise to 14 billion DKK

## Denmark's agro-industry is one of the best in the world at developing and marketing solutions for the food production systems of the future.

Thus, Denmark's agro-industry will help feed the world's rising population and ensure that farmers in Denmark and abroad can achieve their climate targets.

- Denmark's greenhouse gas emissions amounted to only 0.1% of world emissions. This means that efforts made in Denmark to achieve the 70% target do not add up to very much overall unless they are subsequently spread to the rest of the world. Denmark's agro-industry has notably been focused on this since the financial crisis.
- Exports have steadily risen since then and set a record of DKK 13.8 billion in 2019. The agro-industry expects exports to exceed DKK 14 billion in 2021.
- The agro-industry exports products and disseminates solutions to the whole world but a sound, strong domestic market is required for this to continue.

### **VikingGenetics** Breeding and genetics have crucial climate impacts

A cow's genes, feed intake and methane emissions are interrelated. This is why VikingGenetics has developed a method for measuring the feed intake of each individual cow called Cattle Feed Intake (CFIT), based on 3D cameras and artificial intelligence. The co-operative society's patented system is installed at multiple commercial dairy herds from where new feed data is received every minute. The steadily growing volume of data continuously assists in developing, improving and validating the company's models. At present, VikingGenetics has the biggest volume of feed intake data in the world. As a result, VikingGenetics is now able to breed more feed-efficient cows. In practice, this means that milk yields are optimised in relation to the resource expended. The lower the individual cow's feed intake, the lower its methane emissions. Based on CFIT data, VikingGenetics can now select the bulls that will breed the most climate-friendly cows. The product was launched last year and is marketed around the world.

### **Assentoft Silo** Storage is important

Assentoft Silo is a Danish manufacturer of gas-tight silos and other grain handling equipment. Gas-tight silos replace conventional storage and drying of feed grain, and this changeover can reduce the feed's climate impact. Storing grain in gas-tight silos can reduce the total climate impact by 4.3–5.7%, compared to conventional drying. This is because gas-tight storage reduces the amount of energy used to store the grain, enhances grain digestibility and reduces respiration loss from the grain during storage. For example, a gas-tight silo with a 1,000 tonne capacity that replaces a conventional system for drying and storing feed grain will reduce CO<sub>2</sub>e emissions by at least 12,500 tonnes.

## **Agrofarm** The stables of the future are less polluting

Eco-friendly, climate-friendly livestock housing is one of the keys for creating a more climate-efficient livestock production system. AgroFarm is an award-winning Danish company specialised in improving, developing and installing high-quality livestock housing solutions. The company focuses on delivering advanced housing solutions that reduce ammonia emissions from pig and cattle housing systems, at the same time that it prioritises efficiency engineering and minimising costs.

The greenhouse gas levels are reduced by automatic slurry removal and air purification. Agro AirClean technology for air purification reduces ammonia evaporation by up to 91%, at the same time as it reduces noxious odours by up to 83%. Frequent slurry removal has a big climate impact as well. Measurements show that slurry removed from the housing unit contains up to 80% more methane. In other words, methane that would otherwise have evaporated into the atmosphere. Combining these two technologies achieves substantial climate benefits as a result. The Climate Partnership for the Food and Agriculture Sector estimates that frequent slurry removal from finisher housing units alone can reduce CO<sub>2</sub>e emissions from Danish livestock housing by 173,000 tonnes.

## **Danfoil** Less water in the sprayer

Danfoil makes innovative field sprayers for efficient plant protection. The sprayers' patented air-based nozzle technology makes it possible to spray as few as 30–50 litres of liquid per hectare. By comparison, conventional spraying equipment uses up to 200 litres of liquid per hectare. The sprayer's air-based nozzles ensure that the pesticide not only hits the crop surface but penetrates down to the entire plant. In addition, the technology reduces spray drift by up to 90%.

This makes it possible to achieve the same level of plant protection using substantially less water. The reduced water volume makes it possible to spray more hectares using the same sprayer size or the same number of hectares using a smaller sprayer. The last-mentioned option is particularly interesting as calculations show that changing from a sprayer with a 4,000-litre capacity to one with 12,000-litre capacity increases carbon emissions, and thus the climate impact, by 18%/per ha. This is largely, because bigger sprayers need to be mounted on bigger tractors, which use more diesel fuel.

# Putting new proteins on the plates of both people and livestock

The dietary needs of both humans and animals must be met by producing with lower climate impact. This requires alternative new proteins produced to maximise the use of resources that are currently unexploited, e.g., using potatoes to replace animal products, developing grass protein or converting methane into feed protein. The Danish agro-food industry can assist in these processes.



New plant-based protein sources can solve the need for producing more climate efficient food products and with less soil

## +28%

In 2020 the plant-based food industry grew by 28 pct. in Europe.

This indicates a large potential for plant-based goods and alternative protein sources in the future

## New sources of protein can help meet the need to produce foods – for humans and livestock alike – that are more climate-efficient and use less land in the future.

- There is a rapidly growing market for plant-based foods and alternative proteins for human consumption. THE ROADMAP FOR SUSTAINABLE TRANSFORMATION OF THE DANISH AGRI-FOOD SYSTEM assesses that it is possible to replace 325,000–515,000 tonnes of meat with protein-rich plants by 2050. In addition to the reduction of the climate impact, this will make it possible to use less land for food production and allow more space for wildlife and biodiversity. According to the World Resources Institute, a reduction of these dimensions could reduce the global need for land used to produce animal feed by up to 4.7 million hectares, which would reduce global CO<sub>2</sub>e emissions by up to 12.6 million tonnes.
- Alternative sources of protein are not only for human consumption, but are also an important area of feed production that could benefit the climate. This requires the development of new methods that use side-streams and effects, previously seen as waste, and turn them into resources instead.

Examples include refining grass to enable grass protein to be absorbed by monogastric livestock such as pigs, thereby replacing soy-bean imports; using starfish and seaweed as cattle feed; or developing a technology that can convert methane into protein to be used in animal feed.

### **Enorm BioFactory A/S** **Larvae as a source of protein**

ENORM BioFactory processes larvae into protein and fat for feed sources. The brilliant feature of larvae is that they can feed on residual products from the food industry, because they can live on virtually any organic substrate. The epitome of efficient utilisation. In addition to what the larva's natural properties have to offer, larvae can be bred vertically, enabling a highly efficient use of space. In addition, ENORM BioFactory is keenly focused on producing its products using energy-efficient solutions.

### **KMC** **New proteins for human consumption**

KMC exploits the entire potato. This includes the starch and flour for food products and the protein for feed and foods, i.e. a side-stream whose yield per hectare is almost equivalent to peas. KMC uses potato fibres for foods and the juice for biogas and fertiliser and exports 95% of its products.

Its climate history is a refined business focused on replacing animal proteins in the areas of cheese, confectionery, dressings, etc. In this business segment, the company replaced 23,500 tonnes of animal protein at world level over the past financial year. Translated into Danish consumption, this equates to converting 22% of the animal proteins consumed by Danes aged 4 to 75 into plant-based ingredients. By 2024–2025, the company expects to have replaced 39,000 tonnes of protein at world level, equating to 36% of the animal protein consumed by Danes aged 4 to 75.

### **BioRefine Denmark A/S** **Alternative sources of protein for feed**

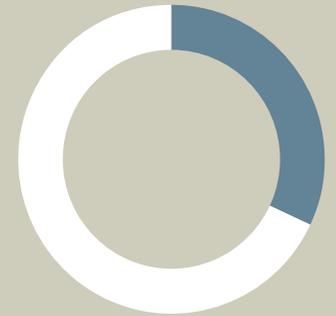
BioRefine Denmark A/S is a company formed by the three agro-businesses DLG, Danish Agro and DLF. The object of the company is to launch a full-scale production of green proteins. The first system started up in Nybro, near Varde, Denmark, in May 2021. This system will eventually produce protein based on 3,000 hectares of grass, clover and lucerne, which will produce 7,000 tonnes of organic protein with a raw protein content of more than 50%. Laying out 30,000 hectares of grass and lucerne would make it possible to meet the combined consumption of organic soy protein which amounts to 70,000 tonnes. This can be done by establishing three to five facilities in Denmark. The potential over the next three years is to produce protein for foods approved on the basis of grass and lucerne. Achieving a production of 50,000-75,000 hectares of grass protein is realistic in Denmark by 2030.

# Danish ingredients and enzymes reduce food waste and develop new foods

Denmark's agro-food cluster's ingredient sector plays a key role in the development of a sustainable, resource-efficient food production. The ingredient sector develops, among other things, enzymes, proteins and types of starch that reduce the climate impact of the food production system and reduce food waste from farm to consumer waste bins.



32 pct. of the global food production ends in food loss or food waste



**+5,6**  
billion. tonnes  
CO<sub>2</sub>e/year

The loss of wasted food leads to a global greenhouse gas emission between 3.3 to 5.6 billion tons CO<sub>2</sub>e on a global level

## Danish ingredient companies are characterised as keenly innovative and knowledge-intensive as they invest up to 10% of turnover into further research and development.

Danish ingredient companies are highly specialised and manufacture products such as proteins, starches, enzymes, microbial cultures, flavourings, additives, vitamins and minerals. These are added to enhance foods and livestock feed with unique characteristics such as extended shelf life, improved nutritional value, higher feed efficiency or reduced food waste, or to better exploit side-streams that would otherwise go to waste.

Many Danish ingredient companies are global market leaders in their field, and closely affiliated with the development of a more sustainable global food production. This enables the Danish agro-food and bio cluster, with its ingredients solutions, to help ensure a more energy-efficient and resource-efficient production by means of the following:

- Minimising food waste: Denmark's ingredient sector works to reduce food waste which is a major global challenge. This is done by developing enzymes, additives and microbial cultures. The UN Food and Ag-

riculture Organisation (FAO) has estimated that roughly 32% of global food production goes to waste. According to the US think tank World Resources Institute, the volume of food that goes to waste accounts for 3.3–5.6 billion tonnes of carbon emissions.

- Exploitation of all side-streams: A shining example of how the Danish agro-food cluster exploits all the side-streams are the efforts targeting potato starch. Most potato starch ends up in our food products. Starch is a versatile ingredient that can change the texture and transparency of foods or affect their brittleness and water content. This is why it is used in many products, such as pastries, noodles, liver paste, sausages, snacks, canned fish, dressings, winegums, cheese and tablets. At the same time, potato protein is extracted for use in both feed and food.
- The development of new proteins for human consumption and livestock feed: Up to 2050, the demand for all types of food – animal and

vegetable alike – will increase. This requires new proteins to make this production more climate-efficient, regardless of whether it is to be used for human consumption or in livestock feed. The Danish agro-food cluster delivers new proteins through products such as grass protein and the conversion of methane into feed protein.

## **Chr. Hansen A/S** **Longer shelf life reduces food waste**

On multiple occasions, Chr. Hansen A/S has been lauded as one of the most sustainable companies in the world, and a specification shows that up to 82% of the company's turnover goes to meeting the UN Sustainable Development Goals. Chr. Hansen A/S has developed products such as microbial cultures that increase yoghurt's shelf life and thus reduce food waste. EU statistics show that up to 17% of the EU's annual yoghurt production goes to waste or remains unused, with shelf life as one of the most frequent causes. In Denmark, it is estimated that 700,000 tonnes of food go to waste each year. By prolonging the shelf life using microbial cultures, the company helps reduce food waste by households and generate striking climate impacts in the process.

## **KMC** **Exploits all parts of the potato**

KMC is one of the world's leading manufacturers of potato-based ingredients for foods and other consumer products. The cooperatively owned company develops and manufactures potato starch, modified starch, dehydrated powdered products, potato fibres and potato protein. KMC exploits the entire potato. Including the starch, flour for food products, protein for feed and now protein for food, too. This side-stream can provide a yield per hectare that is almost equivalent to peas. KMC uses fibres for foods and the juice for biogas and fertiliser.

Their refined business focuses on replacing animal proteins in the areas of cheese, confectionery, dressings, etc. In this business segment, the company replaced 23,500 tonnes of animal protein at world level during the past financial year. Translated into Danish consumption, this equates to converting 22% of the animal protein consumed by Danes aged 4 to 75 into plant-based ingredients. By 2024-2025, the company expects to have reached 39,000 tonnes of protein replaced at world level, equating to 36% of the animal protein consumed by Danes aged 4 to 75.

## **Unibio A/S** **Converting methane from a problem into a resource**

Methane can be used as an ingredient for manufacturing protein. The biotech company Unibio has developed a fermentation technology that makes it possible to industrially manufacture the feed proteins of the future from methane. The bacterial protein can replace other sources of protein (such as soybean meal and fish meal) in feed for pigs, fish and poultry. The nutritional properties of the product are similar to fish meal.

Unibio uses bacteria, whose typical natural habitat is freshwater lakes where they live on methane gas, to make protein through a specially developed fermentation process. Unibio runs both a pilot plant and a semi-industrial demonstration facility in Kalundborg. The entire process is demonstrated here, from how the greenhouse gas methane is converted into protein in a special reactor to how the biomass is refined into a powdered protein that can be used in animal feed. Unibio's technology has the capacity to benefit the climate, reduce over-fishing of the oceans and reduce imports of soybean meal for animal feed.

