



Decarbonisation Roadmap 2023 | KMC Group

Decarbonisation Roadmap

A roadmap for targeted reduction of
KMC Group's CO₂ emissions

 **KMC**
Ingredients to grow your business

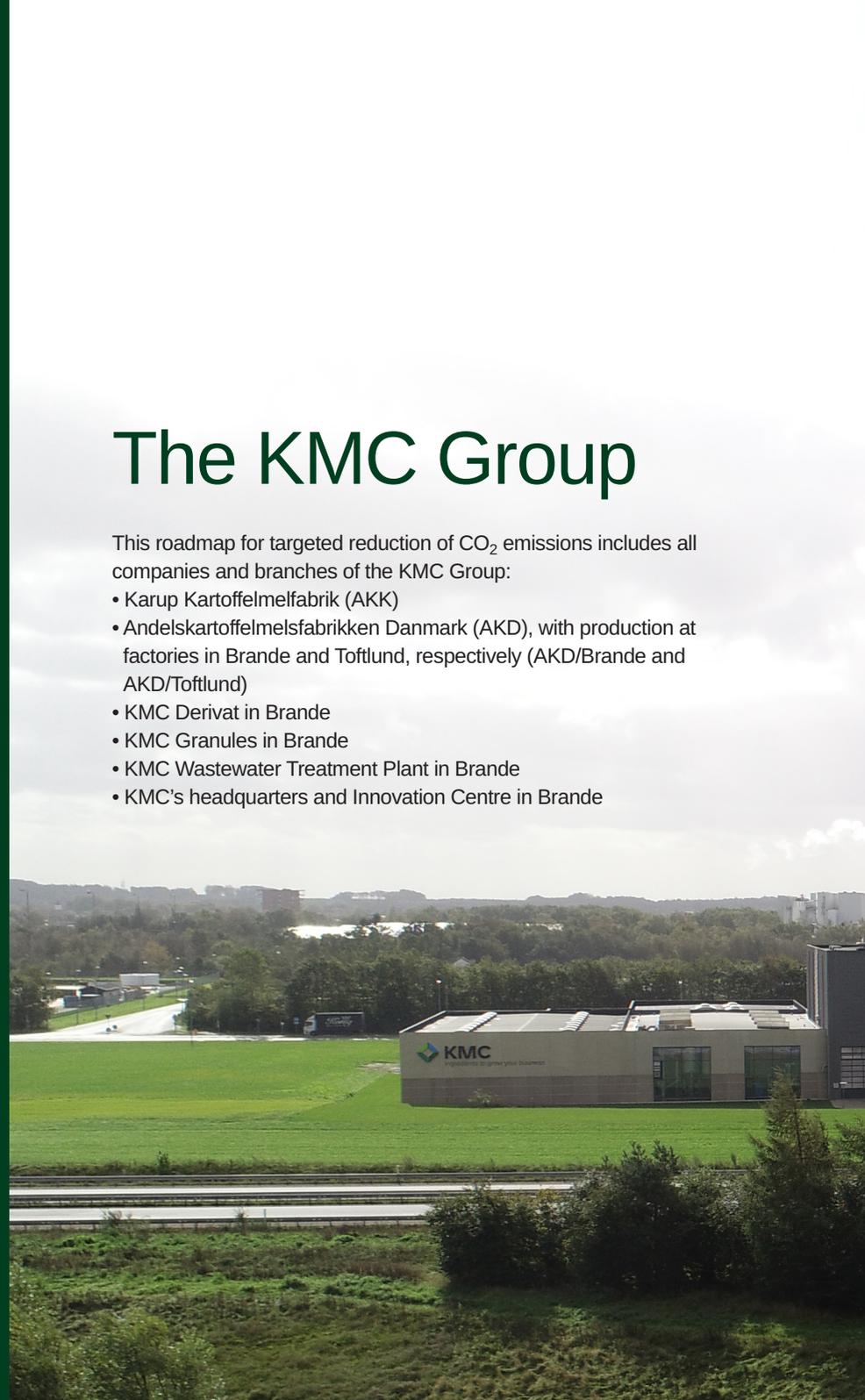
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The KMC Group

This roadmap for targeted reduction of CO₂ emissions includes all companies and branches of the KMC Group:

- Karup Kartoffelfabrik (AKK)
- Andelskartoffelmelsfabrikken Danmark (AKD), with production at factories in Brande and Toftlund, respectively (AKD/Brande and AKD/Toftlund)
- KMC Derivat in Brande
- KMC Granules in Brande
- KMC Wastewater Treatment Plant in Brande
- KMC's headquarters and Innovation Centre in Brande



Sustainability visions

*The KMC Group supports ambitions of the EU and Denmark to achieve climate neutrality by 2050, as described in the “EU Green Deal” and within the framework of the “Fit for 55” package. As one of Europe’s largest producers of potato starch, we have a vision of a more sustainable future. Therefore, we have developed this roadmap to show how we **can and will contribute to reducing our Greenhouse gases (GHG) emissions in line with our European and Danish ambitions.***

The value of years of documentation

KMC has worked with energy management since 2009. This means that over the past 14 years, we have been able to document our efforts to achieve the least possible consumption of energy per unit produced. We do so based on:

- overall environmental and climate consideration
- compliance with the requirements of the authorities and our customers for the quality of our products

- compliance with relevant laws and regulatory requirements in the field of energy
- consideration of the company’s continued competitiveness.

Targeted efforts needed

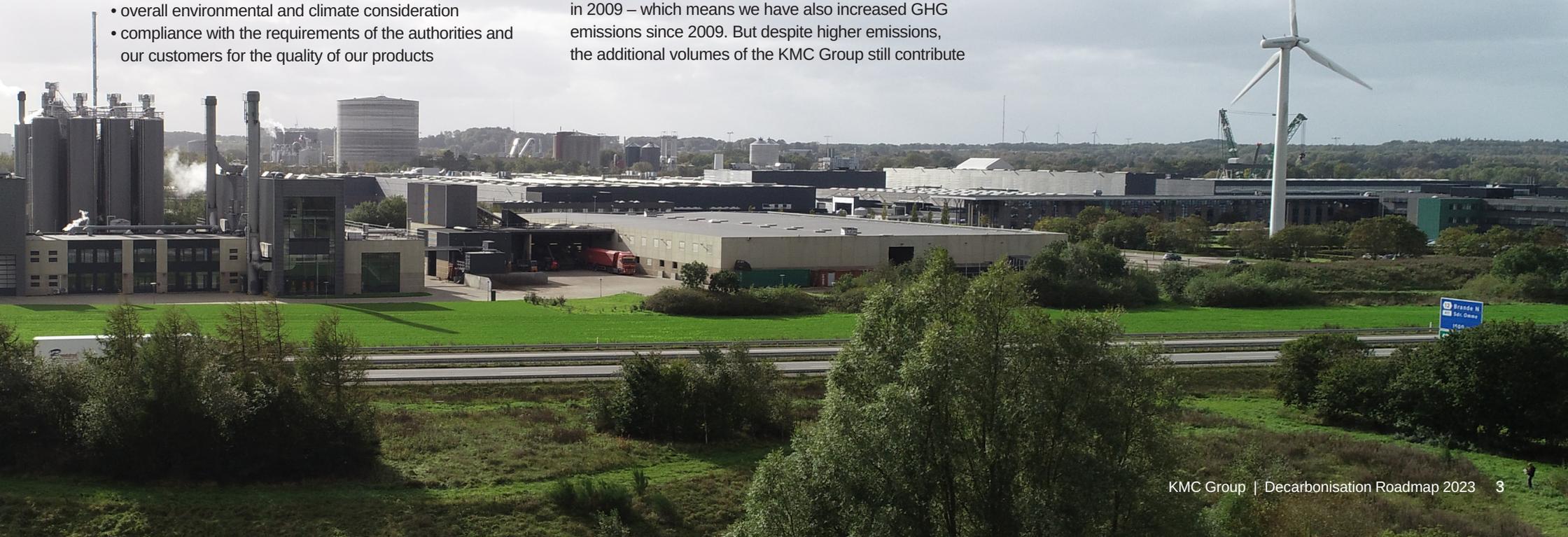
The highest emissions in the entire KMC Group come from the growers in the form of production of the potatoes that are our raw material. But the production of potato starch itself is also an energy and heat-intensive process, and it requires targeted efforts to reduce our emission of GHG. The KMC Group will continue to explore different technological options and practices that can help us achieve reductions, and thus our goals.

Increased production – with positive climate effects

The KMC Group is growing, and thus we have increased our production since we introduced energy management in 2009 – which means we have also increased GHG emissions since 2009. But despite higher emissions, the additional volumes of the KMC Group still contribute

significantly to the decarbonisation at the customers of the starch sector. The *higher emissions* at the KMC Group result in *lower emissions* from our customers’ production. It also strengthens the EU’s circular bioeconomy.

- This is true, for example, because potato-based ingredients help extend the shelf life of many different foods. That reduces food waste, which in turn reduces CO₂ emissions.
- Potato-based ingredients are an important plant-based alternative to animal ingredients in many foods, which in this way can be produced with lower climate impact.
- Potato starch helps food manufacturers reduce their energy consumption compared to starch made from other raw materials, such as corn.



Danish energy becomes greener year-by-year

For many years, Danish energy policy has focused on increasing the number of green energy sources. This has resulted in a significant reduction in the climate impact of the electricity and natural gas used in Denmark.

We have gathered facts about how energy production in Denmark is becoming increasingly greener with Green Power Denmark, the Danish Energy Agency and the Confederation of Danish Industry as sources.

Electricity in Denmark is becoming increasingly greener

The proportion of CO₂-neutral electricity in Denmark was 80% in 2022. 48% of our electricity came from wind turbines, 6% from photovoltaic (PV) panels, 16% from biomass, 8% from hydropower and 2% from nuclear power. The remaining 20% was produced from coal, natural gas and fossil waste (e.g. plastic, which is considered fossil energy).

The large proportion of renewable energy, especially from PV cells and wind turbines, is the primary reason why CO₂ emissions from electricity production have not increased. Wind turbines and PV panels have never before produced as much as they did in 2022, and no other country in the world has as large a part of its electricity consumption covered by wind and sun as Denmark does.

Prospects for climate-neutral electricity generation by 2030

The uncertain times in the electricity market in recent years have caused the declining trend in CO₂ emissions from electricity production to stagnate. But if we go back a little

further, there was a sharp drop in emissions. Since 2010, the CO₂ content in Danish electricity consumption has decreased by 71%, which means that emissions from an average kilowatt hour consumed in Denmark are down to 193 grams of CO₂ in 2022. For the KMC Group, which has a high annual electricity consumption, this decrease in itself is a large reduction in climate impact.

If 2023 turns out to be closer to normal in terms of energy, the decline in CO₂ emissions per kWh will undoubtedly continue. If the plans for the expansion of renewable energy are implemented, electricity production in Denmark will be almost completely CO₂ neutral even before 2030.

Gas in Denmark is also becoming increasingly greener

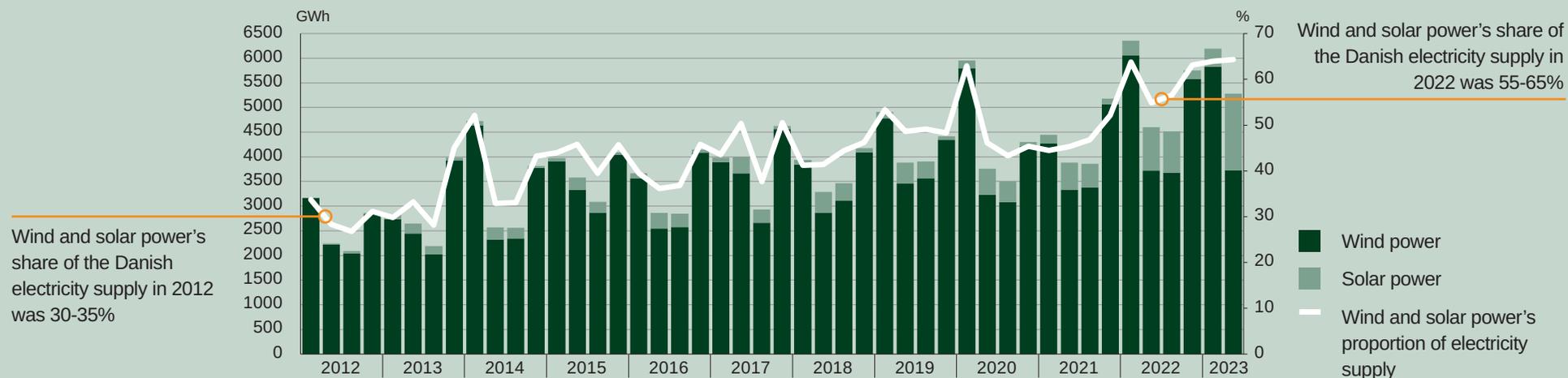
In 2022, the share of biogas in the Danish gas grid reached 33.9%. That's an increase of 16.9 percentage points compared to 2020, when biogas only accounted for 17.0%.

The high proportion of biogas has brought the intensity of CO₂ gas down to 134 g CO₂ per kWh*. That's a significant decrease in CO₂ intensity compared to previous years, when the corresponding figure from, e.g., 2020 was 168 g CO₂ per kWh.

The KMC Group supplies raw materials for Danish biogas production, thereby contributing to greener gas in the Danish gas grid – which in turn reduces CO₂ emissions from the gas we use in our own production facilities.

*) On the assumption that biogas emits 0 grams of CO₂ per kWh.

Trends in electricity production in Denmark from wind and solar in GWh



A value chain with optimal resource use

The KMC Group has a long tradition of prioritising a circular value chain with the highest possible degree of utilisation of our raw material – the potato. This applies to waste prevention, it applies to focus on achieving the lowest possible energy and water consumption and it applies to upgrading, utilising and recycling our valuable main and by-products. That's why we are constantly exploring new and more valuable ways to utilise the entire potato – e.g. for new starch products, fibre, protein, fertiliser and raw material for the production of green energy.

Potato granules and flakes are used in many potato-based products such as mash, snacks and gnocchi.

Our main product is different types of **potato starch**, which are attractive ingredients in countless foods all over the world.

Potato protein is in demand for both food and animal feed.

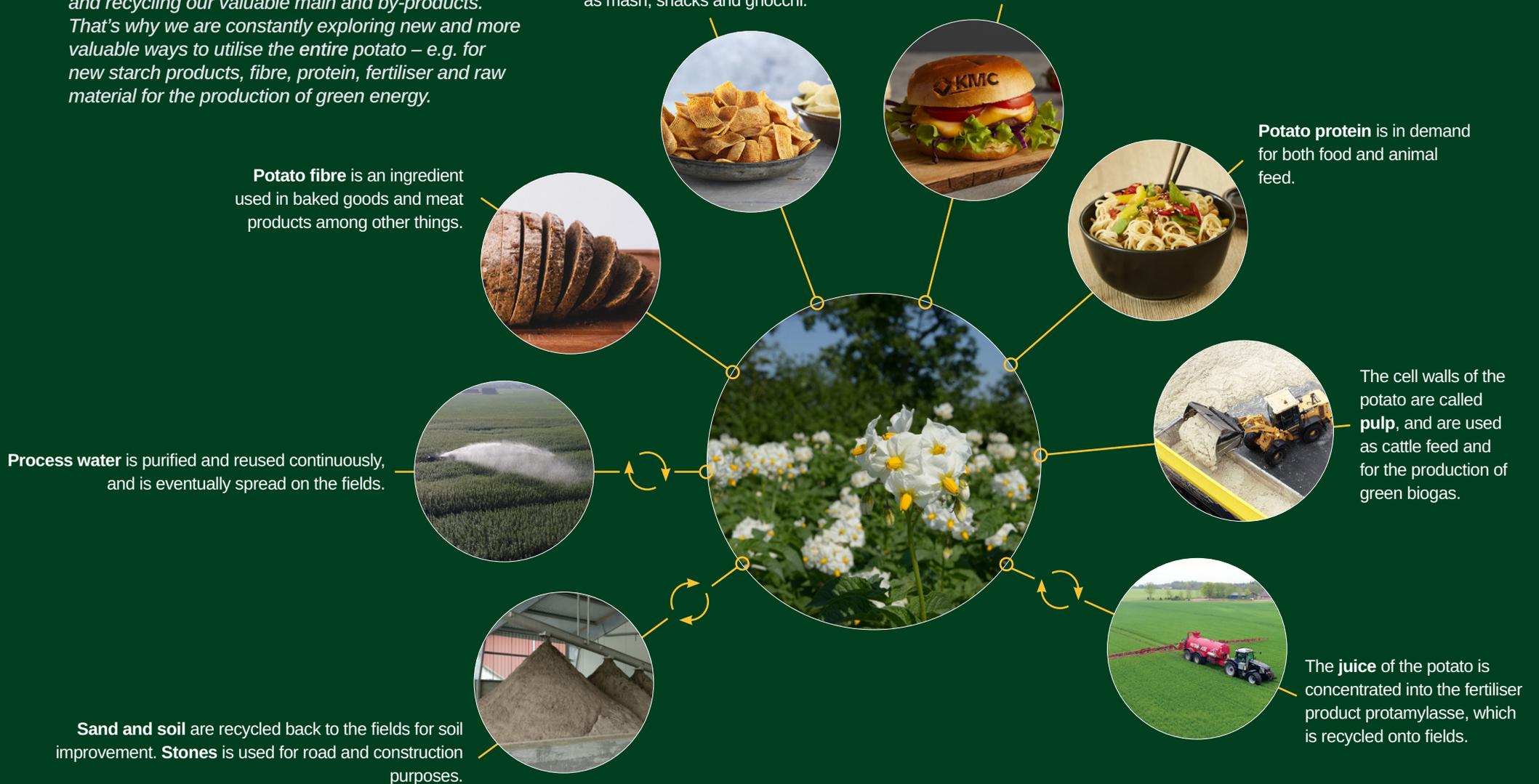
Potato fibre is an ingredient used in baked goods and meat products among other things.

Process water is purified and reused continuously, and is eventually spread on the fields.

The cell walls of the potato are called **pulp**, and are used as cattle feed and for the production of green biogas.

Sand and soil are recycled back to the fields for soil improvement. **Stones** is used for road and construction purposes.

The **juice** of the potato is concentrated into the fertiliser product protamylasse, which is recycled onto fields.



Solar panels on roofs and in the open country

The KMC Group has a goal of running the company with as high a share of renewable energy as is economically and practically possible. We consider solar energy to be an important alternative to coal, oil and gas for the production of electricity.

Rooftop solar panels

Roof-based solar panels are more expensive to install than land-based installations. Nevertheless, the KMC Group wants as much solar energy as economically and practically possible to be mounted on the company's roofs, in order – in principle – to affect the open countryside as little as possible.

So far, the KMC Group has launched the following initiatives with solar energy on rooftops:

- A solar panel system will be mounted on KMC's new Innovation Center, which will be ready in the summer of 2024. The installation will supply power to the Innovation Centre and KMC's headquarters.
- We are investigating the possibility of establishing a solar panel installation at KMC's new logistics centre, which will be completed in early 2025. The installation will supply power for operation of the logistics centre and KMC's production facilities, to the extent permitted by law.
- We are assessing whether it is possible to retrofit a solar panel installation on the roof of KMC Granules' potato warehouse. If it is possible, the installation will supply power for the operation of the refrigeration system at the warehouse, the production plant at KMC Granules and for other purposes.

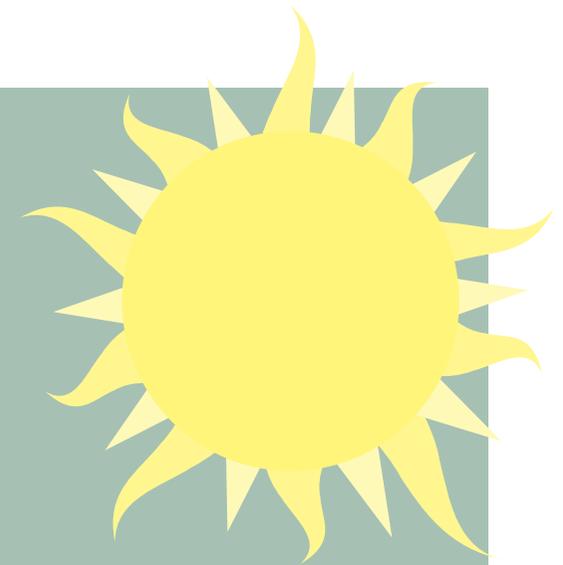
Solar panels on open ground

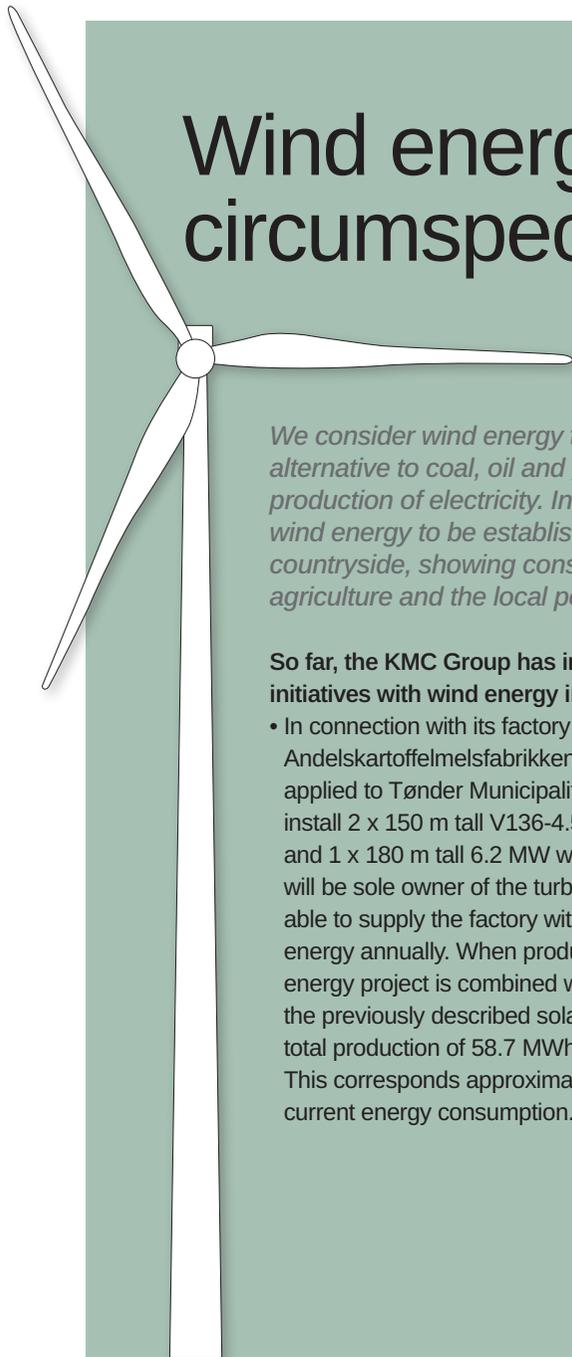
KMC Group wants solar panels on open ground to be established with the greatest level of coexistence with nature, landscape, agriculture, air traffic and local population.

We generally do not believe that solar panels should be placed on fertile agricultural land, unless other significant considerations have to be taken into account. We will strive to ensure that agricultural land used for energy production in the form of solar panels can also serve other purposes.

So far, the KMC Group has launched the following initiatives with solar panels in the open landscape:

- Karup Kartoffelmelsfabrik (AKK) has applied for permission to build a 274-hectare solar panel farm located in Uhre. AKK's share in the facility – which will be able to produce 212,500 MWh of solar energy annually – has not yet been finalised. AKK's location near Karup Air Base does not allow the installation of wind turbines, and therefore the choice fell on solar panels. The area planned to house the solar panel farm is suited for spreading the factory's washing water and for growing grass for biogas production.
- Karup Kartoffelmelsfabrik (AKK) has applied for permission to build a 130-hectare solar panel farm located in Uhre. AKK will have a significant stake in the farm, which can produce 100,000 MWh annually, and will supply the factory with solar energy. As is the case with AKK's aforementioned solar panel project, the proximity to the air base determines the choice of solar panels. The area planned to house the solar panel farm is suited for spreading the factory's washing water and for growing grass for biogas production.
- In connection with its factory in Toftlund, Andelskartoffelmelsfabrikken Danmark (AKD) has applied for permission to build a 10-hectare solar panel farm. AKD will own the entire solar panel farm, which will be able to supply the factory with 11.2 MWh of solar energy.





Wind energy with circumspection

We consider wind energy to be an important alternative to coal, oil and gas for the production of electricity. In principle, we want wind energy to be established in the open countryside, showing consideration for nature, agriculture and the local population.

So far, the KMC Group has initiated the following initiatives with wind energy in open country:

- In connection with its factory in Toftlund, Andelskartoffelmelsfabrikken Danmark (AKD) has applied to Tønder Municipality for permission to install 2 x 150 m tall V136-4.5 MW wind turbines, and 1 x 180 m tall 6.2 MW wind turbine. AKD will be sole owner of the turbines, which will be able to supply the factory with 47.5 MWh of wind energy annually. When production from the wind energy project is combined with production from the previously described solar energy project, a total production of 58.7 MWh is expected annually. This corresponds approximately to AKD/Toftlund's current energy consumption.



Electrification as a tool

The KMC Group wants to reduce its consumption of fossil natural gas in favour of more green energy sources. This wish is partly fulfilled by the fact that natural gas in Denmark itself has become much greener in recent years, as it consists of an increasing proportion of green biogas. In addition, one of our overall goals is to replace natural gas with electrification where economically and practically possible.

So far, the KMC Group has launched the following electrification initiatives:

- At AKD/Brande, we have reduced gas consumption by using heat pump technology for preheating two gas-fired starch dryers. This is expected to result in gas savings of 682,747 m³, which is currently under verification.
- Heating in the canteen building at AKD/Brande has been switched from gas to a heat pump. We have converted electric heating into a heat pump to reduce electricity consumption in our workshop.
- At AKD/Brande, the gas burner in the protein dryer has been supplemented with electric heating.
- At AKD/Toftlund, work is underway to replace gas boilers for heating with heat pumps. This will result in combined savings of about 39,000 m³ of gas.
- An electric heater has been installed in one of the starch dryers at AKD/Toftlund. The electric heater can be used when drying starch outside the main production period (the campaign), which runs from August to January. However, it cannot be used during the campaign itself, as it is not possible to draw the extra amount of electricity from the grid. This is expected to result in gas savings of 417,591 m³, which is currently under verification.

We have also initiated studies on the possibilities of electrification elsewhere in the KMC Group. However, the available technology for switching from gas to electricity is not yet so advanced that it is possible to make a switch in all the areas we want. But we are following developments continuously.

Optimisations can lower CO₂ emissions

The KMC Group is continuously working to reduce our CO₂ emissions in all contexts. This also applies in the form of the optimisation of our production facilities and offices.

So far, the KMC Group has launched the following initiatives to optimise energy efficiency:

- In 2023, we will convert KMC's entire head office from natural gas to district heating, just as KMC's newly built Innovation Centre will be connected directly to the district heating network. 61% of district heating in Denmark is now based on green energy, and the goal is for 100% of district heating to be green by 2030. Natural gas will eventually be phased out.
- KMC Derivative Factory is about to expand, and have therefore started a major project within energy-efficient design (energy review). Based on previous experience, the study will shed light on the possibilities of implementing energy-improving measures. The goal is to choose exactly which technology will ensure that the new production plants will be as energy efficient as possible. Solutions such as high-temperature heat pumps will be the subject of the study, and all existing surplus heat sources in the factory will be identified. Based on our knowledge of KMC Derivative's current and future processes, a number of concrete solutions will be developed based on known and well-documented technologies. This process will be able to optimise energy utilisation and reduce total energy demand, so that the factory's environmental impact will also be reduced.
- At KMC Wastewater Treatment Plant, we have launched a project with the implementation of anaerobic wastewater treatment, which will replace the current aerobic treatment. Anaerobic wastewater treatment is a biological treatment in which anaerobic microorganisms are used to break down and remove organic contaminants in wastewater. Production at KMC Derivative Factory is continuously expanded, meaning the need for greater capacity at KMC Wastewater Treatment Plant increases correspondingly. When the need for greater capacity is combined with the Danish government's new initiatives for green transition (e.g. introduction of new CO₂ taxes and subsidies for green solutions), anaerobic treatment of wastewater immediately becomes an attractive solution for KMC – and this applies both from a sustainability and an economic perspective. Currently, the sustainability of switching from aerobic to anaerobic treatment must be assessed, e.g. in the form of an estimate of the expected reduction in CO₂ emissions. The expectation is that the project can contribute with significantly lower electricity consumption at the treatment plant.

Plant-based ingredients as climate bonus

The potato has one of the lowest climate footprints among Danish agricultural crops. It delivers many calories per hectare with a nutritious and healthy profile. In other words, the potato has fantastic strengths that we are constantly working to develop.

Climate responsibility as an argument for plant-based diets

In recent years, the consumption of plant-based foods has increased significantly, gradually developing into a megatrend in the Western world. Some consumers have gone all in on veganism. Others have introduced a weekly meat-free day or have become flexitarians, pescatarians or vegetarians. Common to all these consumers is that they are turning towards new types of meals and principles, and for most people, climate responsibility is a key argument. KMC's ingredients support this focus. We develop and produce food ingredients that can fully or partially replace animal ingredients with potato-based ingredients – which are inherently plant-based.

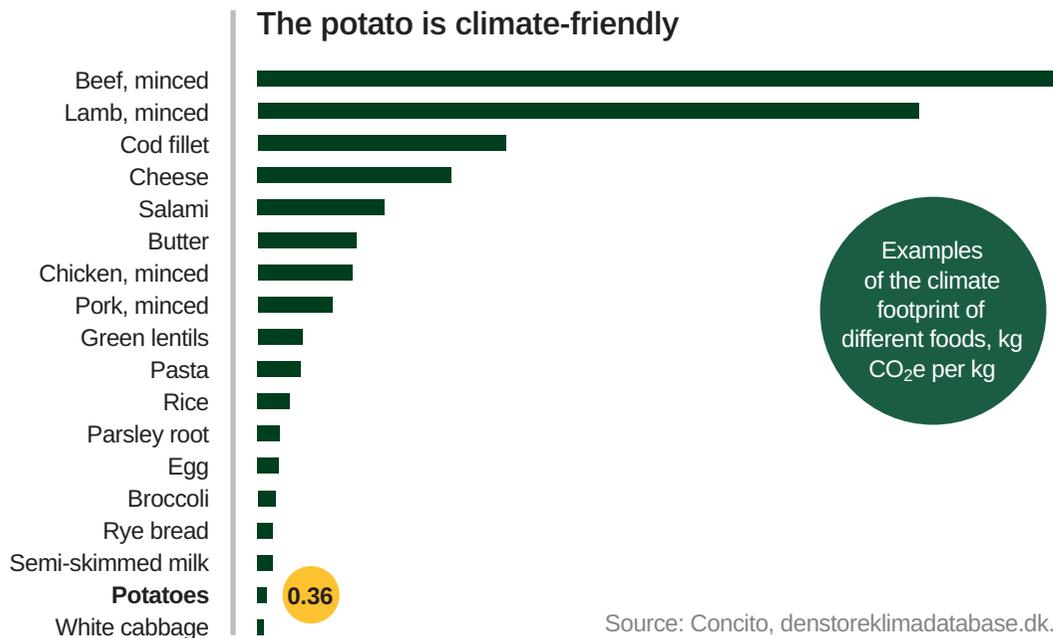
Evidence of the climate effect of potato-based ingredients on the way

The KMC Group is dedicated to offering solutions that reduce our customers' climate footprint by replacing traditional, animal ingredients with plant-based and more climate-friendly KMC ingredients.

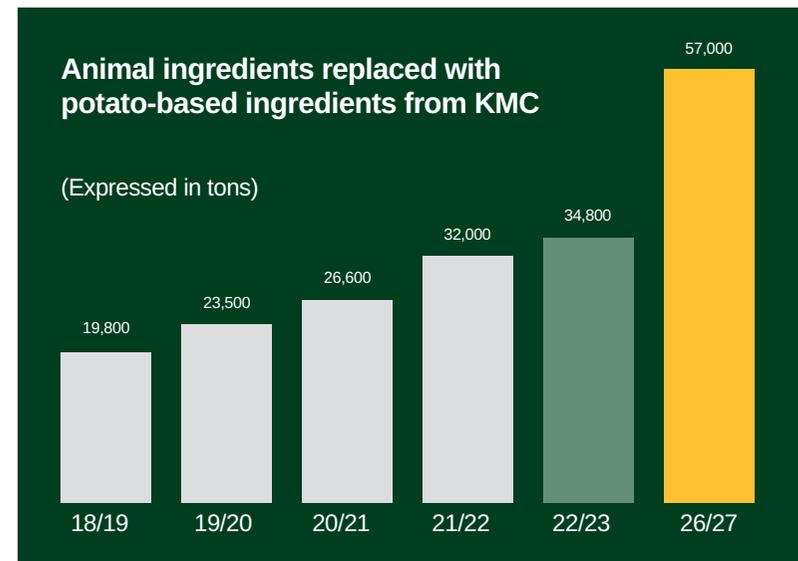
This effort will reduce our total climate footprint, but we do not yet have a precise calculation of how many CO₂ equivalents our solutions will displace. We are currently working with several external partners to define and validate the local and global climate impact of using KMC's plant-based ingredients. We expect the results to be ready during 2024.

The goal is to replace 57,000 tons of animal ingredients by 2026/2027

Until the new and comprehensive calculations are in place, we have continued to calculate how many tons of animal ingredients we replace year-by-year with our potato-based ingredients. We have monitored this since 2010, and the development in recent years is shown in the figure below. In the financial year 2022/2023, the KMC Group replaced 34,800 tons of animal ingredients with plant-based solutions at customers. This is an increase of 22% compared to the previous year, and over the past three years an increase of 68%. Our goal is for potato-based solutions from the KMC Group to replace at least 57,000 tons of animal ingredients worldwide by 2026/2027.



Source: Concito, denstoreklimadatabase.dk.





Circular fertiliser

The KMC Group continuously focuses on making optimal use of all resources and avoiding waste. For example, potato nutrients enter the natural cycle when we recycle them as field fertiliser for next year's potato crop.

Potatoes create an effective fertiliser for potatoes

The potato contains juice in exactly the same way as an orange. Potato juice is concentrated into a product we call protamylasse, which contains the basic plant nutrients N (nitrogen), P (phosphorus) and K (potash) – and has a low chlorine content.

It is precisely these properties that make protamylasse particularly suitable as a fertiliser for potatoes, and therefore the concentrated potato juice is sent back to the KMC Group's cooperative owners as part of a circular value chain.

Circular product reduces CO₂ emissions

When potato growers use the fertiliser that comes from the potato itself, they avoid having to use large amounts of artificial fertiliser. Since the production of artificial fertilisers requires high energy consumption, an energy-intensive fertiliser product is replaced with a natural type of fertiliser that comes directly from the potatoes – thus reducing the emission of CO₂ from the displaced production of artificial fertiliser. This is a concrete contribution to the green transition, and it is estimated that one ton of potato protamylasse replaces 10.5 kg nitrogen, 2.7 kg phosphorus, 39.5 kg potash, 2.3 kg magnesium and 3 kg sulphur.

These figures are still being validated, and therefore the climate effect of protamylasse is not part of our climate accounts at this time. But there is no doubt about the positive contribution to reducing total CO₂ emissions.

From potato to green gas

The KMC Group wants to contribute to the green transition in as many areas as are practical and economically possible. Examples include supplying our potato pulp for the production of biogas, which replaces natural gas.

Hidden energy in the potato

Potato pulp consists of the cell walls of potatoes, and is one of the valuable by-products of potato starch production. When pulp is sent through a biogas plant, green biogas is produced, which is distributed over the natural gas grid and thus displaces fossil natural gas. One of the KMC Group's by-products thus contributes to less demand for fossil fuels, and thus also to less greenhouse gas emissions.

There is more green energy in starch potatoes than we use on making starch

In 21/22, the KMC Group delivered a total of 206,000 tons of pulp to biogas producers. This resulted in the production of at least 9,270,000 m³ of pure methane, which gives approx. 15,450,000 m³ of biogas. This means that more biogas is produced from potato pulp than the amount of natural gas the KMC Group consumes in the total production of both native and modified potato starch. The climate effect of pulp as a source of biogas production is not yet included in our climate accounts.



The potato field's climate impact

The KMC Group wants to be able to calculate the climate footprint at field level of the potatoes produced by our owners/ growers – not least because the cultivation of potatoes constitutes the largest share of the KMC Group's total emissions.

Towards important knowledge about the potato field

Climate footprint at field level depends on a number of different specific conditions in the field. Some of these conditions are known and can be influenced (e.g. fertiliser), while other factors are natural and thus cannot be directly influenced (e.g. precipitation and temperature conditions during the growing season).

Our detailed knowledge of grower inputs and outputs in and from the field will in future make it possible to calculate the climate footprint of potato farming. It could be expressed in different ways, for example as emissions per hectare or as emissions per kg of starch.

Consultancy with direct climate benefits

The goal is that we can be able to calculate climate footprint and that we can be able to use it actively in advising growers throughout the growing season. This can help align efforts on the ground to reduce the climate footprint and increase yields.

The process is already underway, and we expect to be able to make the first calculations on selected areas in 2024, before the system is then rolled out to larger areas.



KMC Group's climate goals

The KMC Group has a goal of climate neutrality by 2050. In addition, we have decided which reduction targets we want to achieve in 2030, divided into three product groups.

The 2030 reduction targets for scope 1 and 2 are stated for native (untreated) potato starch, modified potato starch and potato flakes and granules respectively. We have set 2015/2016 as baseline year.

Reduction target for CO₂ emissions per ton of native potato starch by 2030: 55%

Reduction target for CO₂ emissions per ton of modified potato starch by 2030: 30%

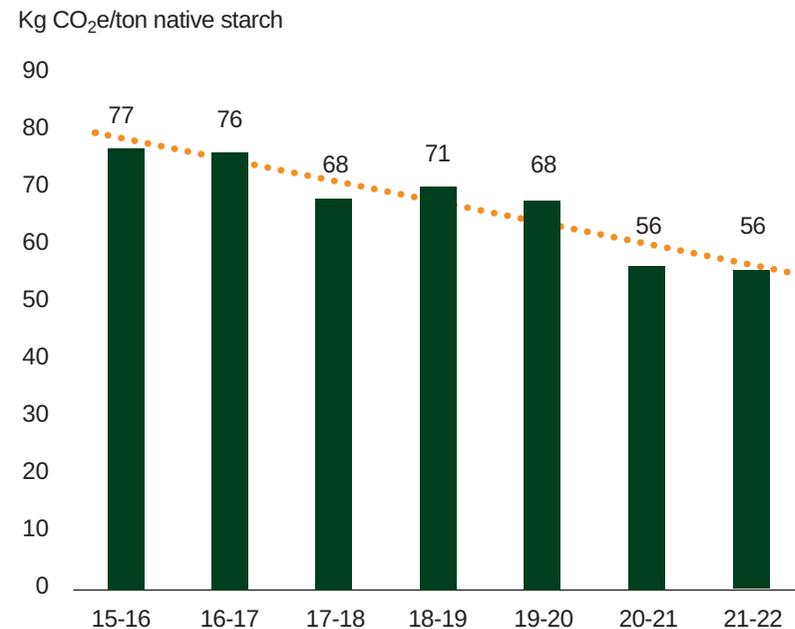
Reduction target for CO₂ emissions per ton of potato granules and flakes by 2030: 30%

To document the impact of our efforts, we have prepared climate accounts for the KMC Group for the most recently completed financial year (2021/2022). The accounts are validated externally. By comparing with our baseline year (2015/2016), we can see how far we have come in our efforts to reduce the KMC Group's climate footprint within each of the three product groups.

Native potato starch

Status of CO₂ reduction for native potato starch between 2015/2016 and 2021/2022:

Reduction per ton of native potato starch: 27.3%

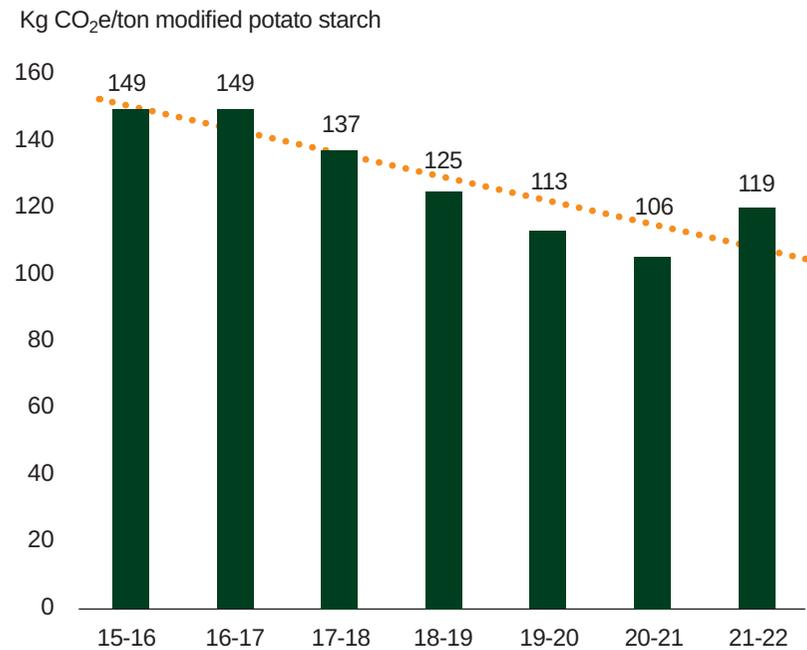


KMC Group's climate goals

Modified potato starch

Status of CO₂ reduction for modified potato starch between 2015/2016 and 2021/2022:

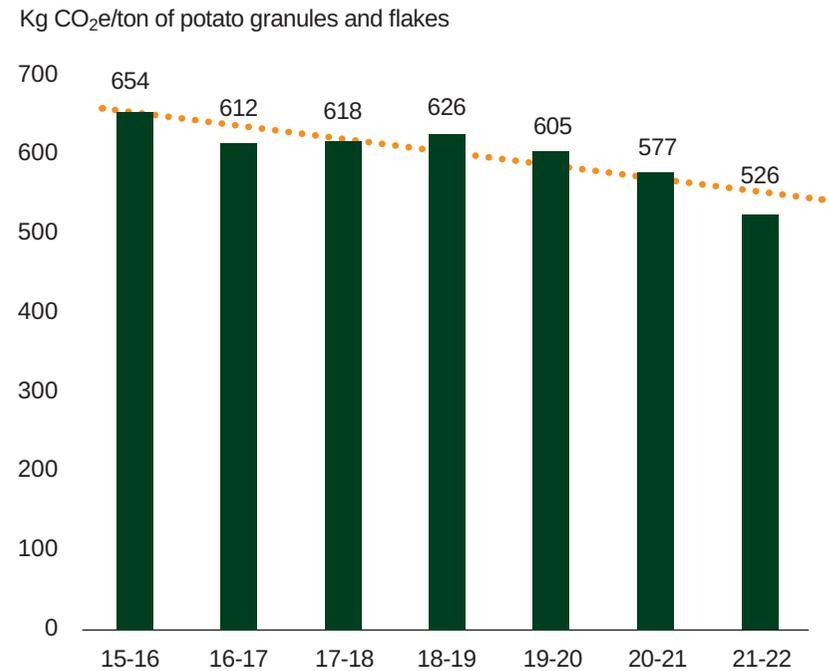
Reduction per ton of modified potato starch: 20.1%



Potato granules and flakes

Status of CO₂ reduction for potato granules and flakes between 2015/2016 and 2021/2022:

Reduction per ton of potato granules and flakes: 19.6%



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