

Animal Nutrition & Health (ANH)



Safe harbor statement

- This factbook may contain forward-looking statements with respect to DSM's future (financial) performance and position. Such statements are based on current expectations, estimates and projections of DSM and information currently available to the company. DSM cautions readers that such statements involve certain risks and uncertainties that are difficult to predict and therefore it should be understood that many factors can cause actual performance and position to differ materially from these statements. DSM has no obligation to update the statements contained in this factbook, unless required by law
- A more comprehensive discussion of the risk factors affecting DSM's business can be found in the company's latest Annual Report, which can be found on the company's corporate website, www.dsm.com

Animal Nutrition & Health (AN&H) | **healthy animals, people & planet**

*Creating science-based **Nutritional Solutions** that contribute to high-quality food, while looking after the welfare of the animals that produce it and the planet*

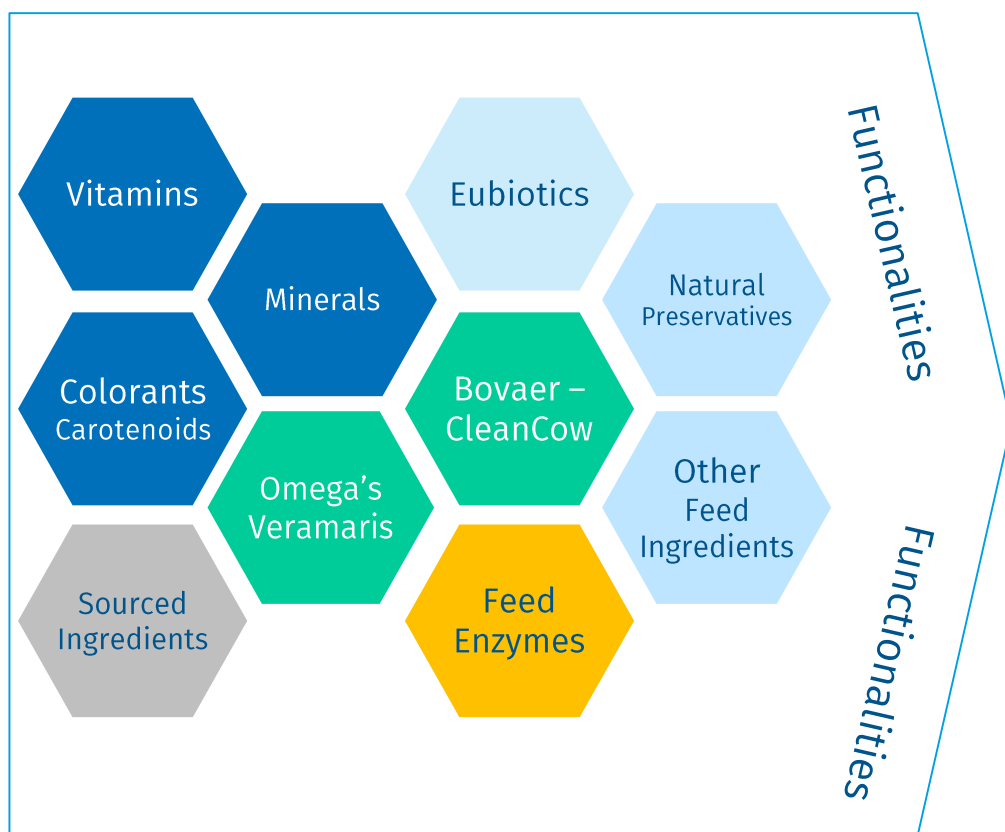
- DSM offers the most comprehensive science-based **nutrition solutions**, based on its very broad portfolio of **nutritional ingredients** including: vitamins from A to Z, enzymes, eubiotics, carotenoids, lipids, minerals and other specialties:
 - Nutritional Ingredients **increase the animal protein production yield**, which helps satisfying growing global demand for healthy protein brought upon by population growth and rising standards of living
 - Nutritional Ingredients also **improve animal health & wellness** and **reduce the environmental impact of farming** as less resources are needed to produce the same amount of animal protein
- DSM is differentiating its nutritional ingredients in **forms**, with various different physical properties depending on application, such as: state of matter, shape, purity, color, solubility, heat resistance
- Through an unique global network of **local premix facilities**, DSM works together with its customers to develop innovative solutions that satisfy specific needs, including the sustainability and commercial challenges we face in how we nurture the world
- DSM is **unique with this business model of “Global Products and Local Solutions”**. We have the most complete portfolio of ingredients, have a global network and are integrated along the value chain in premixes and solutions
- Our solutions are focused on **domesticated livestock** including poultry, pigs, ruminants and farmed fish, as well as companion animals, with solutions formulated specifically for these species



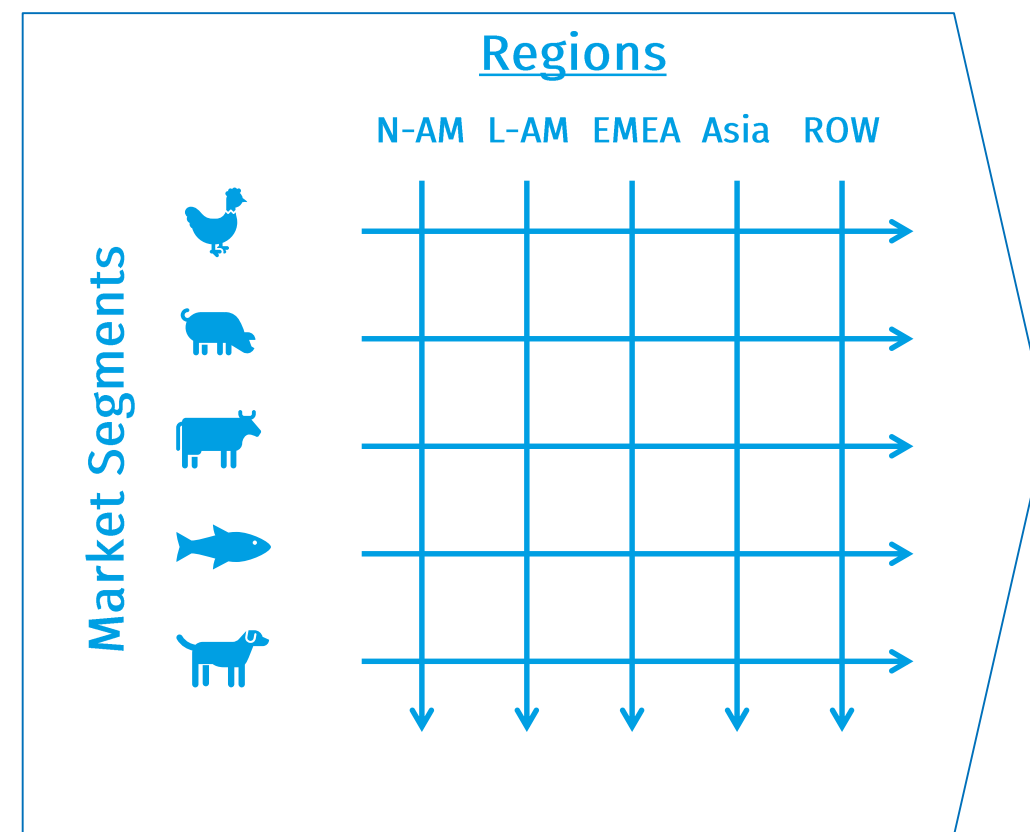
Animal Nutrition & Health (ANH) - a unique business model

Complete portfolio of **Nutritional Ingredients** in combination with **global network of local premix facilities**

Global Products



Local Solutions



ANH - complete portfolio of **Nutritional Ingredients**

*Broadest portfolio of **Nutritional Ingredients** for animal feed*

Vitamins

Vitamins are essential for well-being and good health. They play many crucial roles in farm animals in areas including: bone formation, disease resistance, feed efficiency, growth, fertility, and egg production

Carotenoids

Carotenoids are essential ingredients that are important in nutrition and reproduction. Providing sufficient carotenoids increases animal performance across species. Carotenoids also ensure consistent pigmentation of eggs and fish such as salmon. Key carotenoids are beta carotene, lutein, canthaxanthin, astaxanthin and zeaxanthin

Enzymes & Eubiotics

Enzymes improve feed conversion leading reduced costs of feed while at the same time improved ecological footprint of animal protein production. Gut health goes beyond issues with digestion, but also relates to many aspects of overall health. The role of the gut health products, including eubiotics, is of great importance in animal feed, in order to enable farmers displacing the use of antibiotics

Minerals

Minerals are needed in very small amounts in feed. Animals need certain minerals for instance to build strong bones and turn the feed into energy. As with vitamins, a healthy balanced diet should provide all the minerals needed to work properly

ANH - Formulations & Premix Solutions

*Differentiation of ingredients in a broad range of **Formulations** and **Premix Solutions***

Formulations

- A broad range of technologies transform the **Nutritional ingredients** into a different state of presentation: **formulations**, for example a fat-soluble vitamin oil into a powder form
- This increases performance in terms of stability, shelf-life, heat resistance, bio-availability, physical properties

Examples of forms



Spray
dried



Multi-layer
micro
encapsulate



Flake

Premix Solutions

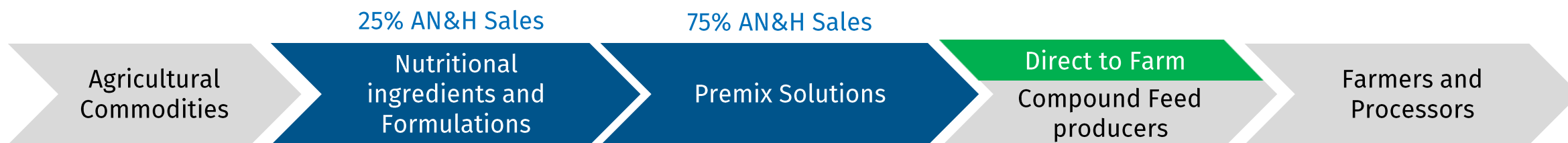
- DSM offers its clients regional and **segment-specific premix solutions**: a broad network of around 60 premix plants allows DSM to offer tailor-made, localized customer-driven solutions



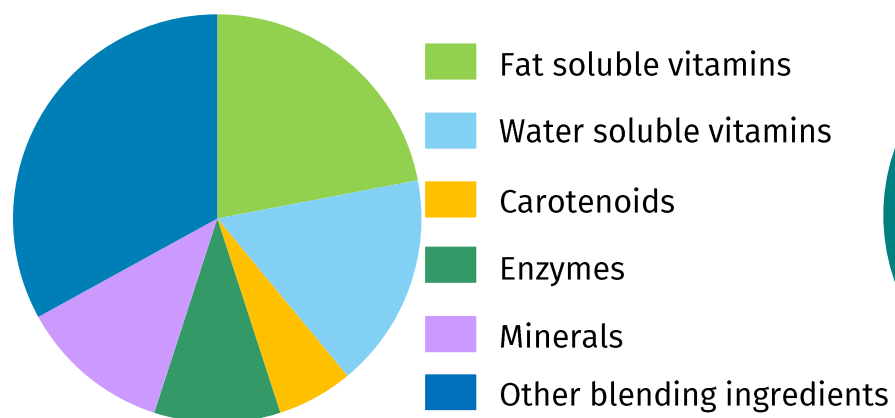
ANH - Active over the full value chain

€2.7bn* sales diversified across species, geographies, and channels

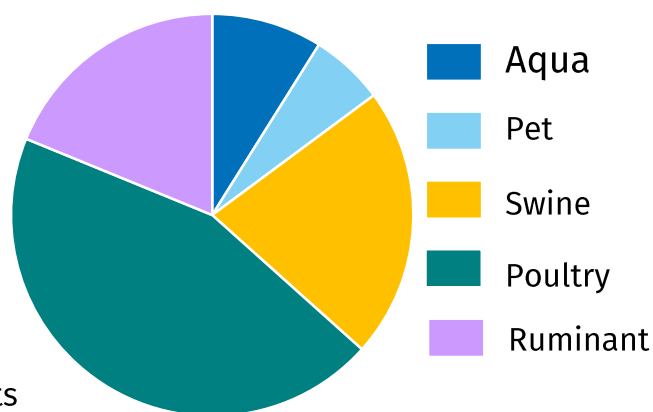
Feed value chain



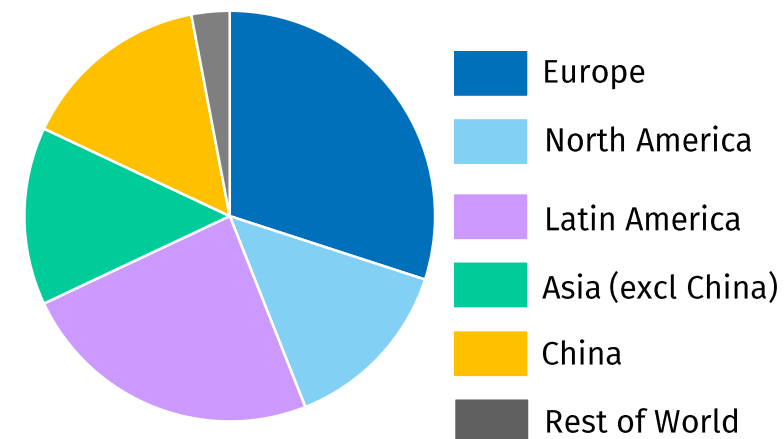
Sales related to ingredient (%)



Sales by species (%)



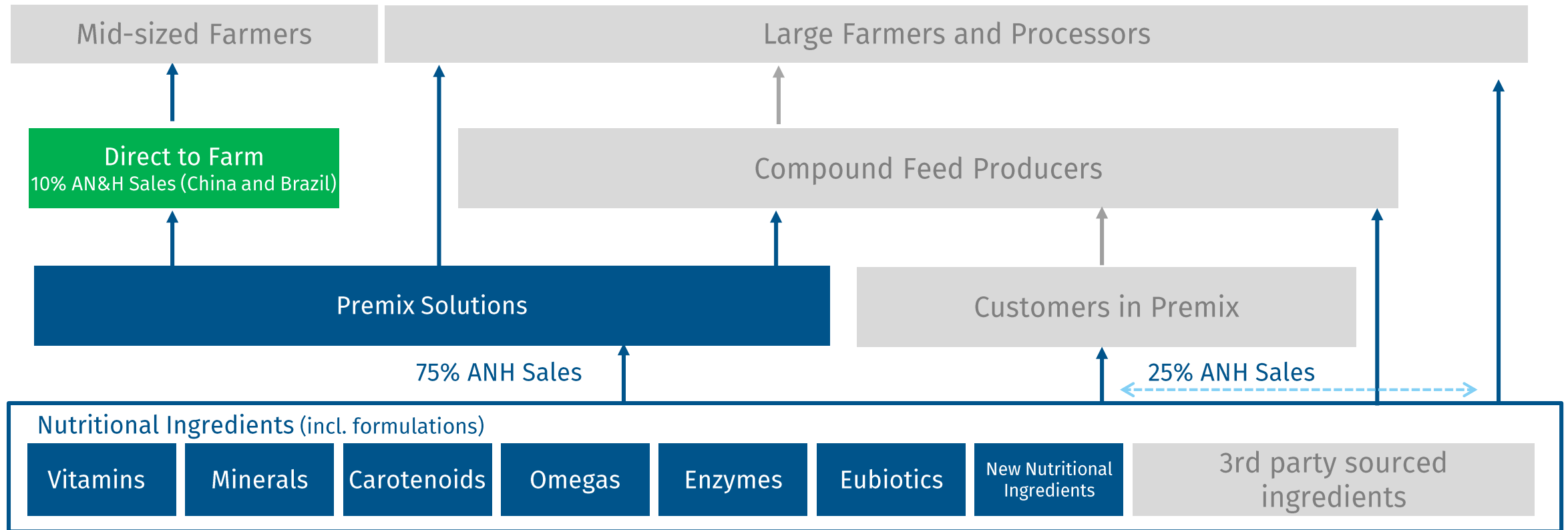
Sales by region (%)



*2018 sales of the underlying business corrected for DSM's best estimate of the 2018 temporary vitamin effect due to exceptional supply disruptions in the industry in the first nine months of 2018

ANH - active over the full value chain

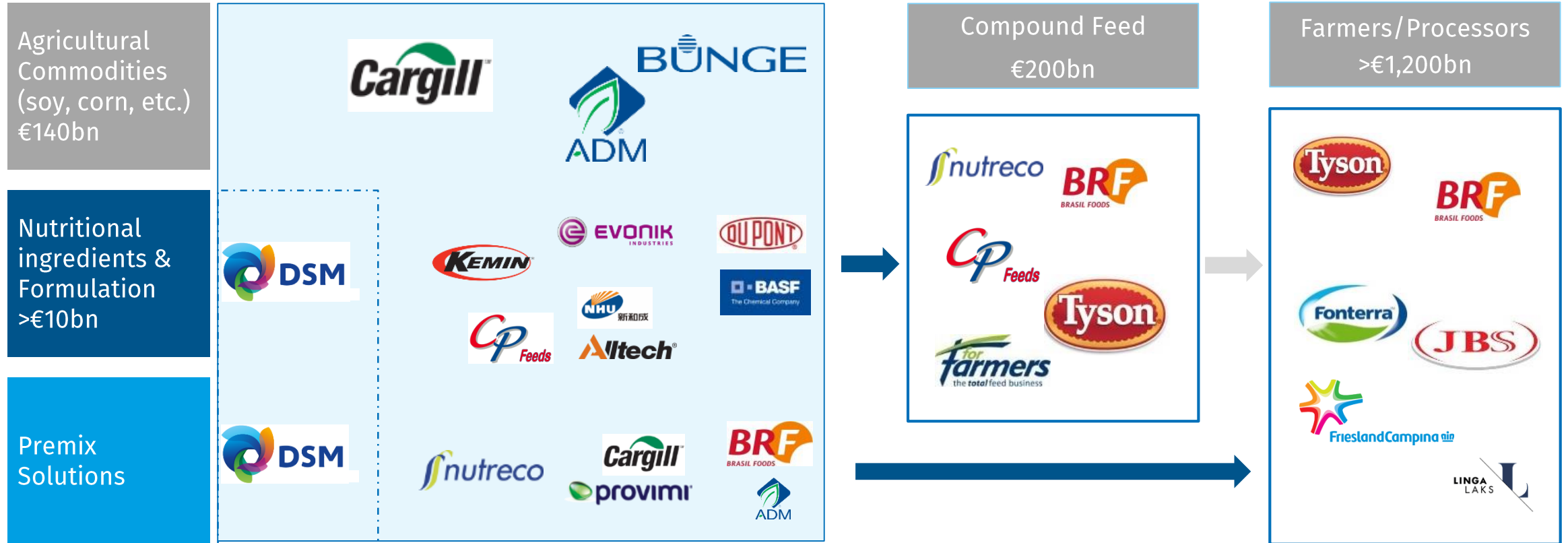
Ingredients – formulations – premix solutions – business to farm



- About 25% of ANH sales is supplied directly as **Ingredients** (formulations) to compound feed producers, large farmers, and other premixers.
- About 65% of ANH sales is sold as **Premix Solutions** to compound feed producers and large farms. Another 10% is supplied as premix solution, directly to mid-sized farms (Brazil and China)

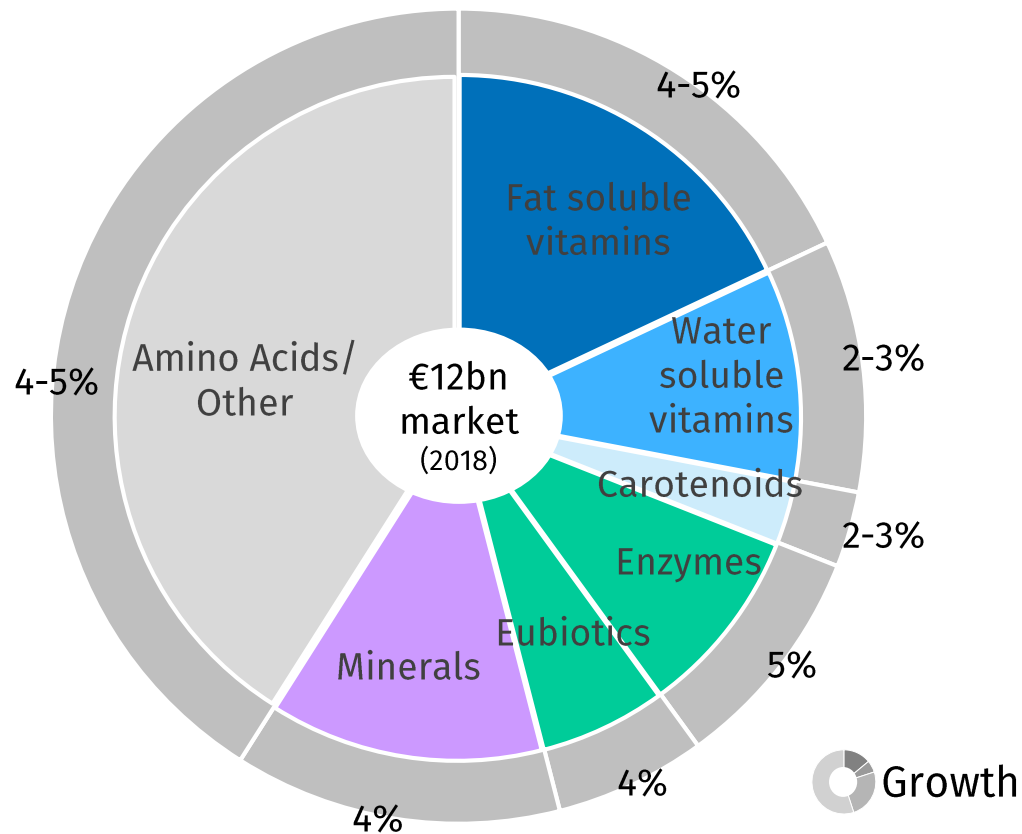
AN&H | Market & customers

DSM is a leader in the less volatile and higher margin business of **Premix Solutions**

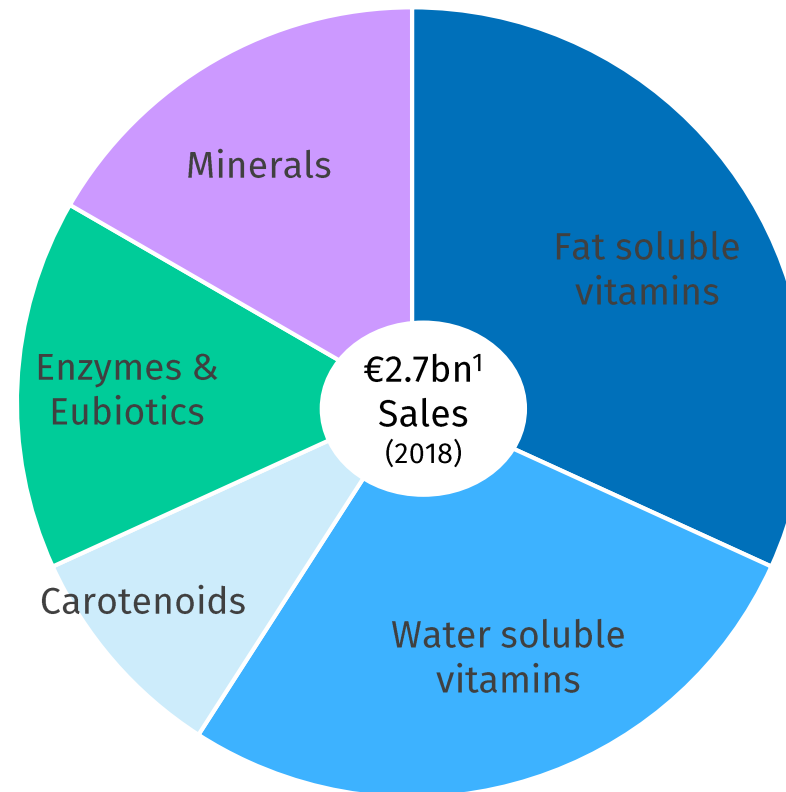


ANH - Global **Nutritional Ingredients** market

Total **Nutritional Ingredient** Market
Market Growth ~3-4%



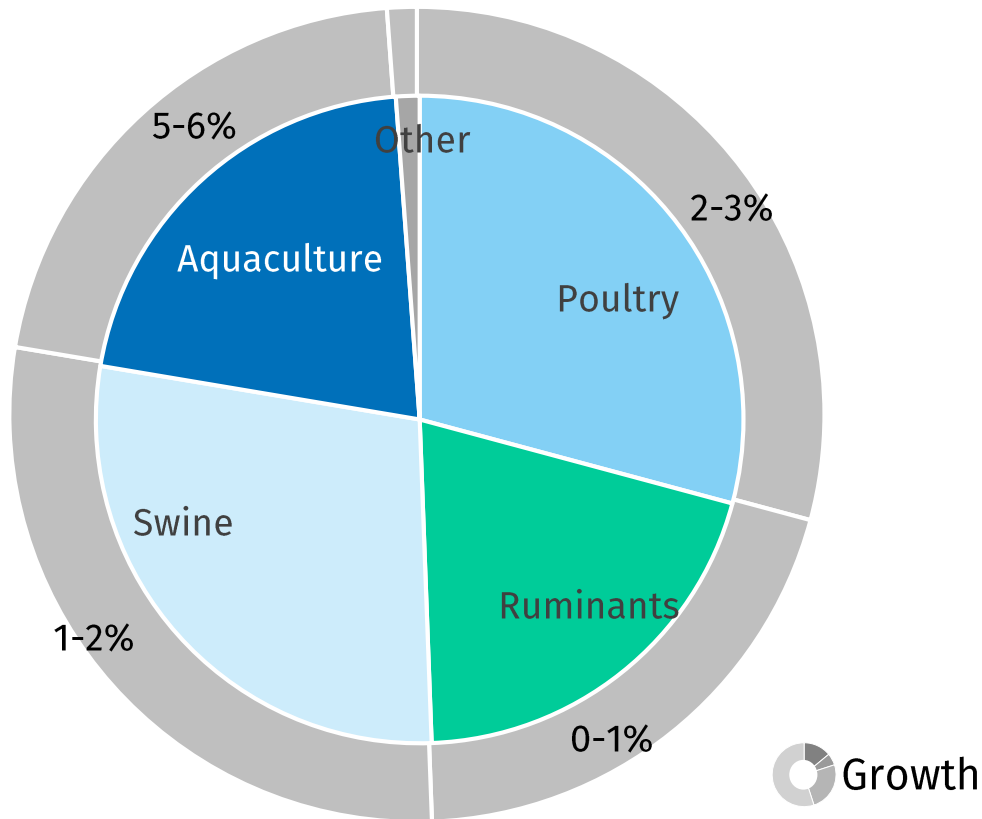
DSM ANH Sales (2018)
DSM target above market (~5%) organic CAGR



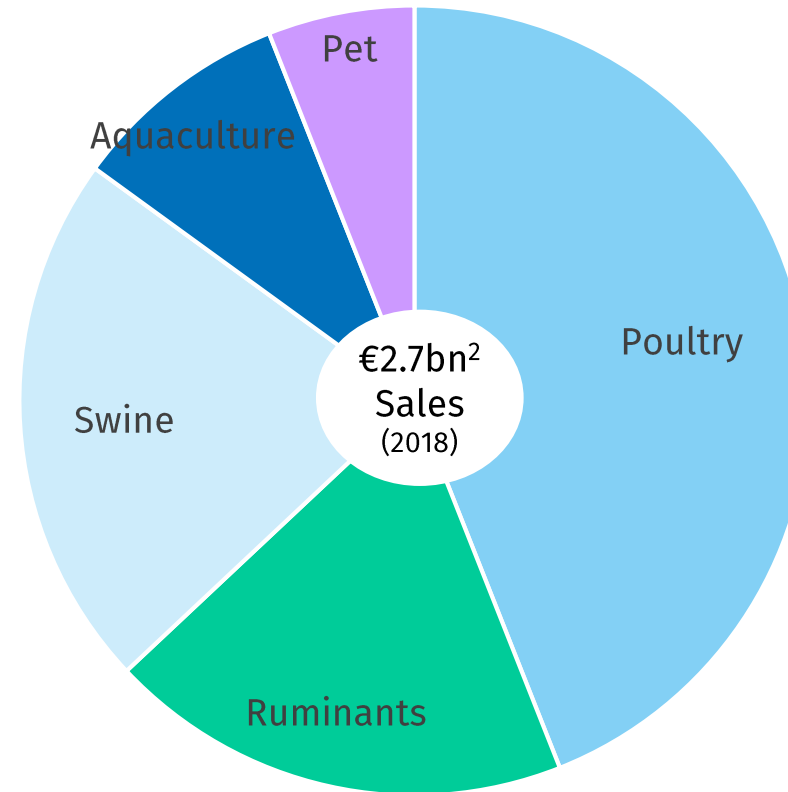
¹2018 sales of the underlying business corrected for DSM's best estimate of the 2018 temporary vitamin effect due to exceptional supply disruptions in the industry in the first nine months of 2018

ANH – Global Animal Protein Market (Meat & fish) by species

Total global **Animal Protein** production (volume)
Global Market growing 2-3% (avg 2016-2018)



DSM ANH Sales to species
DSM Growth ~5%



¹ source 2018 FAO: Meat/Aquaculture production

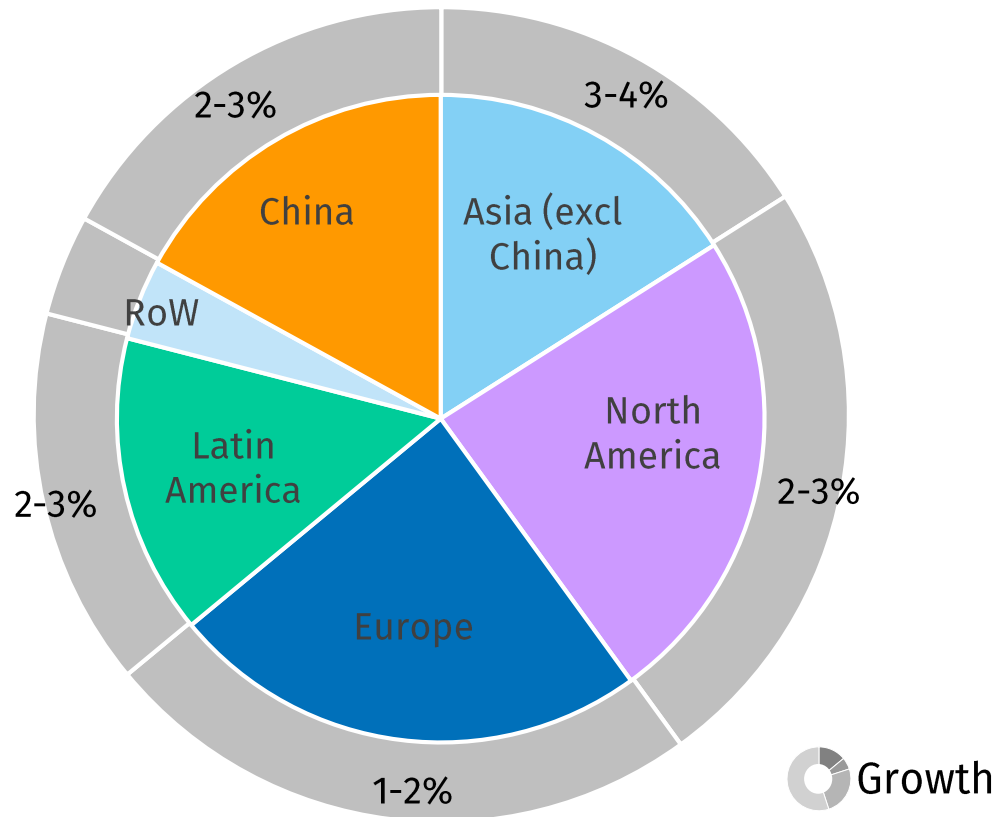
²2018 sales of the underlying business corrected for DSM's best estimate of the 2018 temporary vitamin effect due to exceptional supply disruptions in the industry in the first nine months of 2018

ANH - Market by region

Global diversification serves as a defense for regional market shocks

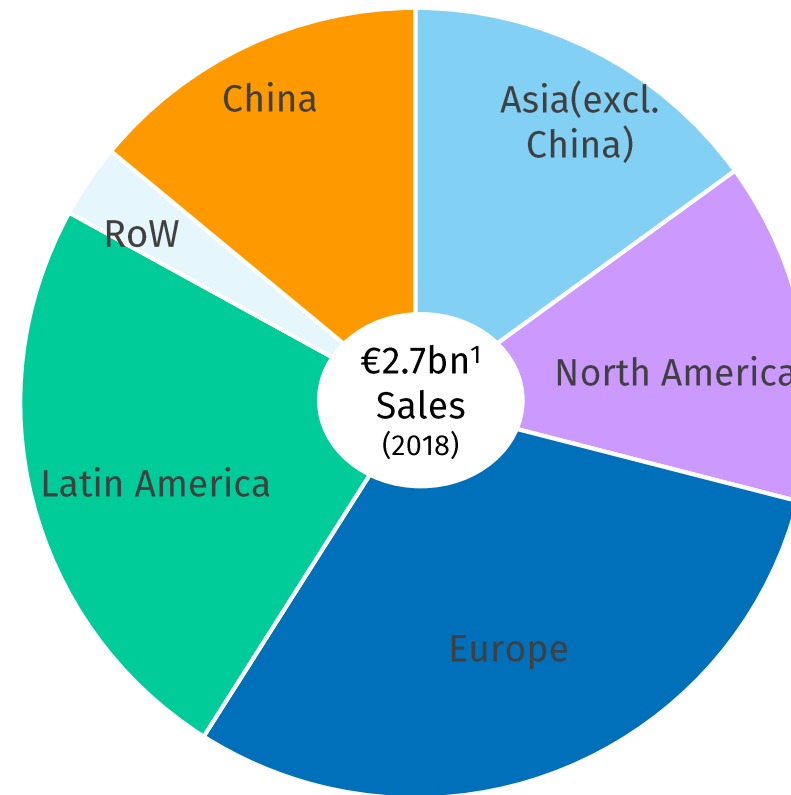
Global **Animal Protein** production by region

Global Market growing 2-3% (avg 2016-2018)



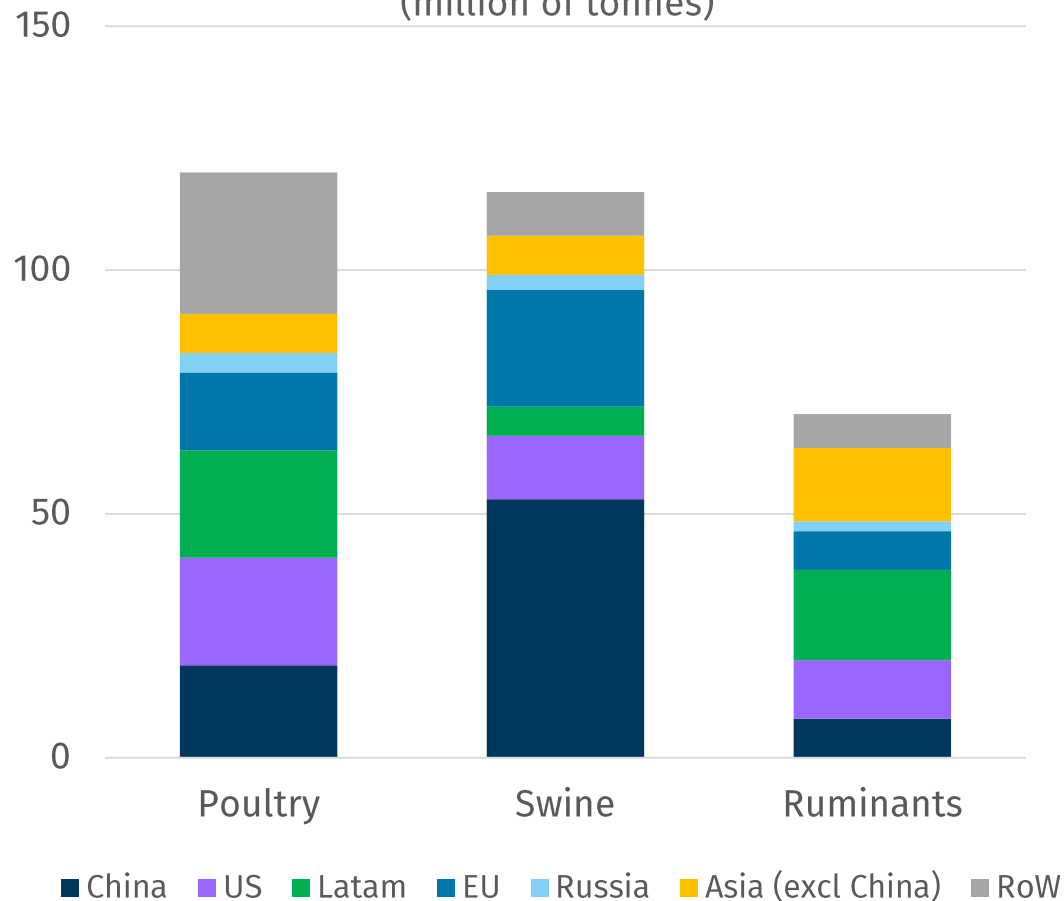
DSM ANH Sales by region

DSM Growth ~5%

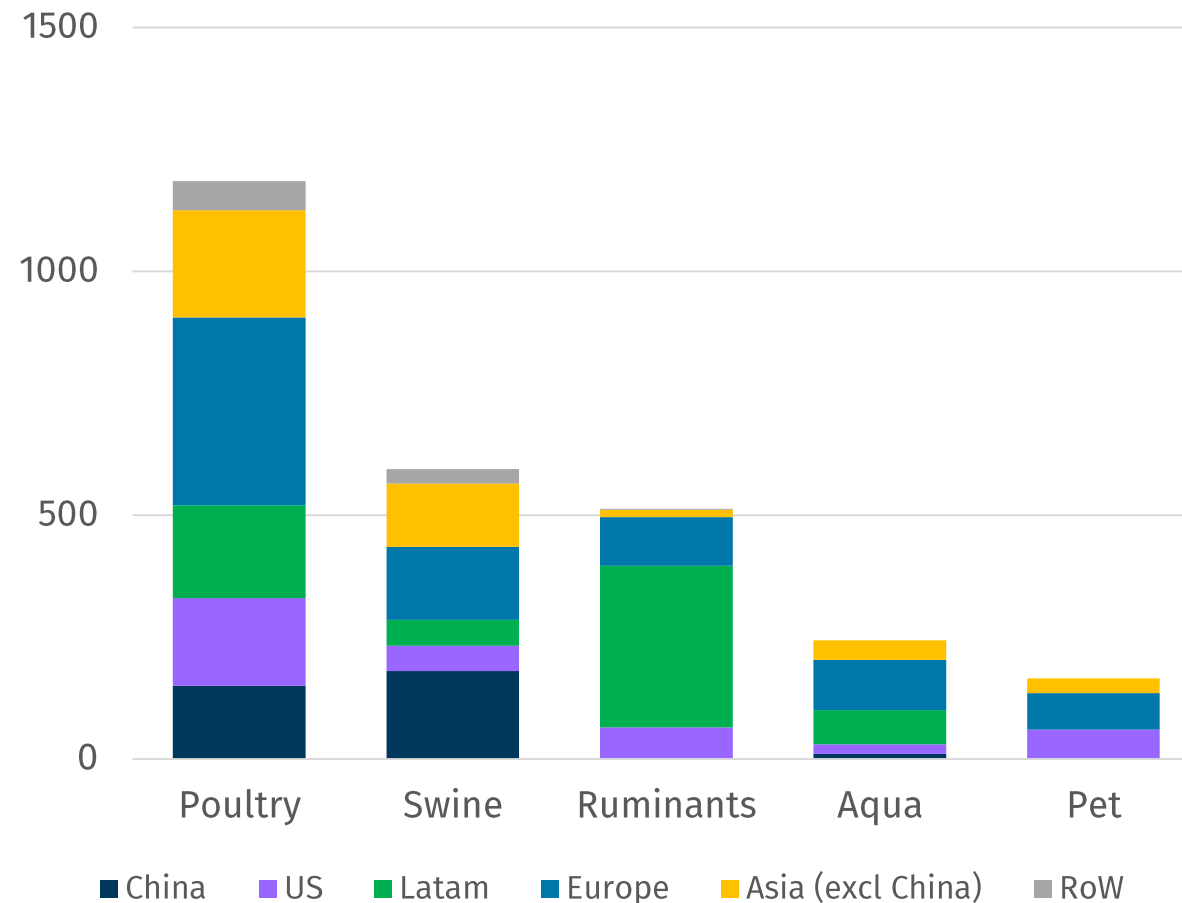


AN&H | Global animal Protein production & DSM's sales by species & region

Global Animal Protein Production 2018¹
(million of tonnes)



DSM ANH Sales¹ (€m)

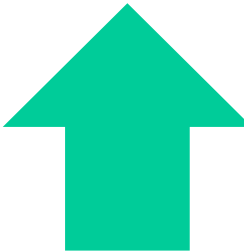
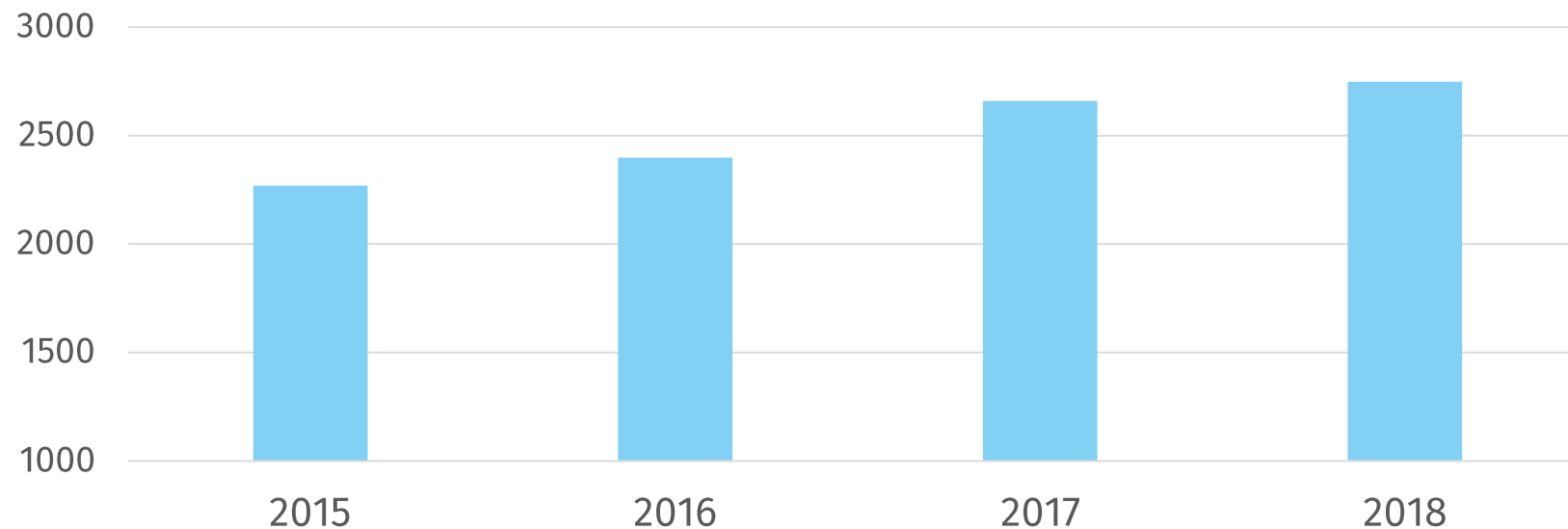


¹Source: FAO 2018 & DSM estimates

ANH | business above-market growth

€2.7bn* sales (2018)

Sales (€ million)



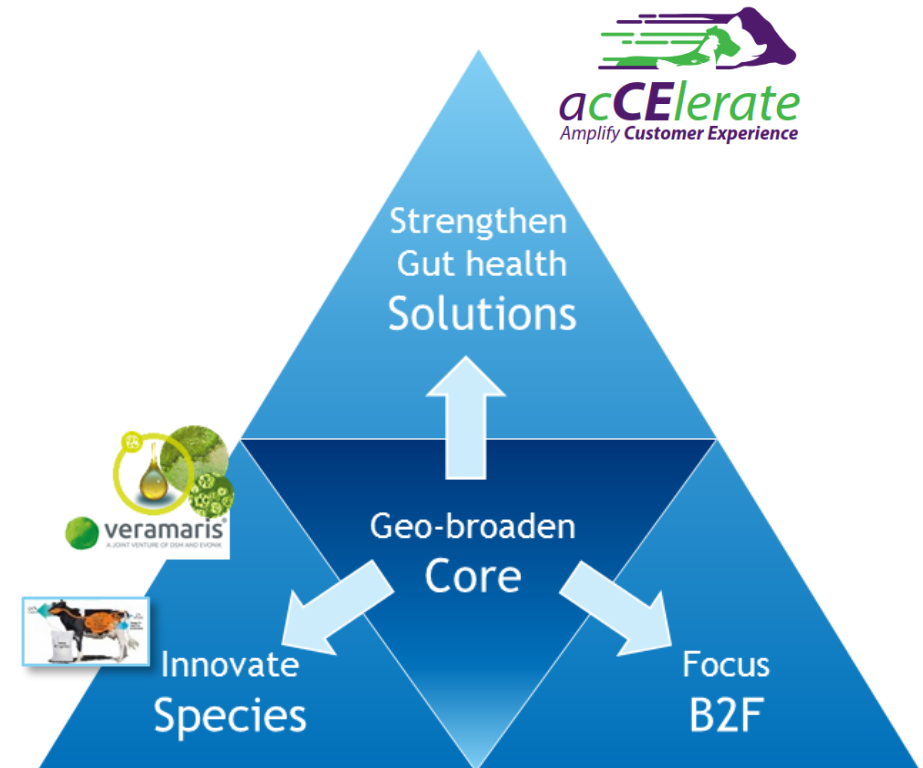
7%
Organic CAGR
2016-2018

*2018 sales of the underlying business corrected for DSM's best estimate of the 2018 temporary vitamin effect due to exceptional supply disruptions in the industry in the first nine months of 2018

ANH | Strategy

Continue to grow the business above market

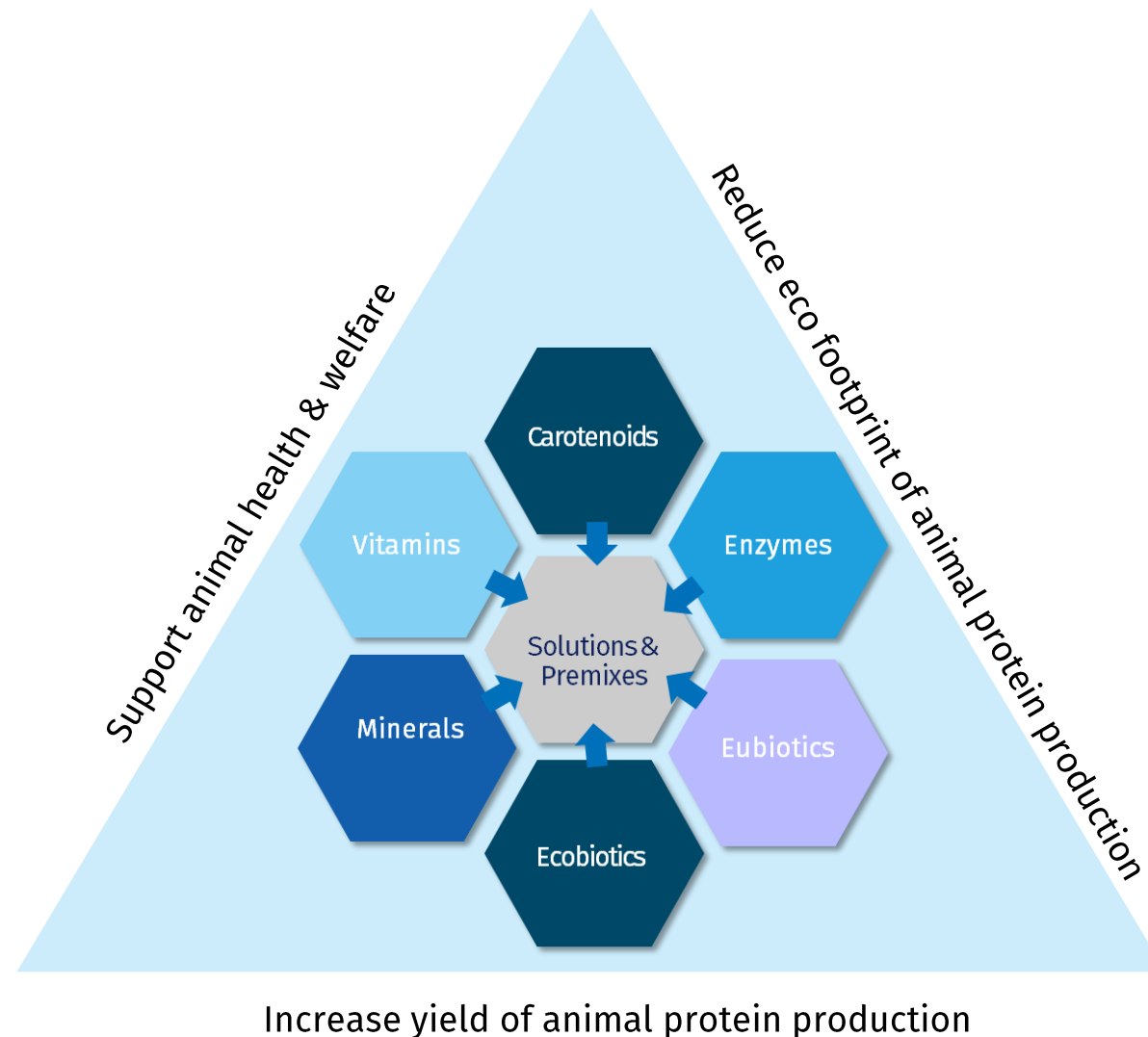
- Strengthen the core: our position in **premises solutions** and **species**
- Further build specialty business model with **solutions capability** and **data management**
- Sustaining growth through **Marketing & Sales excellence** and **Customer Centricity & Agility** (acCElerate program)
- **Radical innovation** for core sustainability topics (e.g. Veramaris, Bovaer, Baliancius™, nitrogen reduction)
- **Further invest** in go-to-market capabilities including Direct-to-Farmer sales



Target mid single digit ~5% organic CAGR

ANH | Focused on sustainable animal nutrition

Contribution to higher yields, better animal health & welfare and reduction of eco-footprint

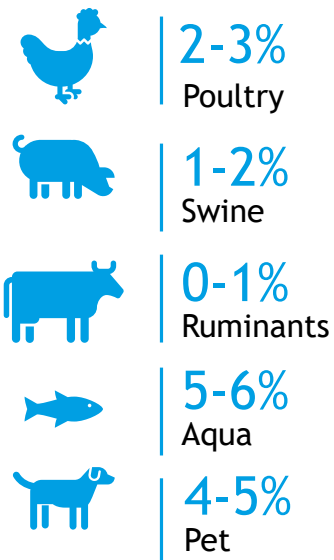


- We work at species and country level to make tangible, measurable impacts
- We scale our solutions to enable transformational change

Leveraging DSM's unique business model – basis for market-outperformance

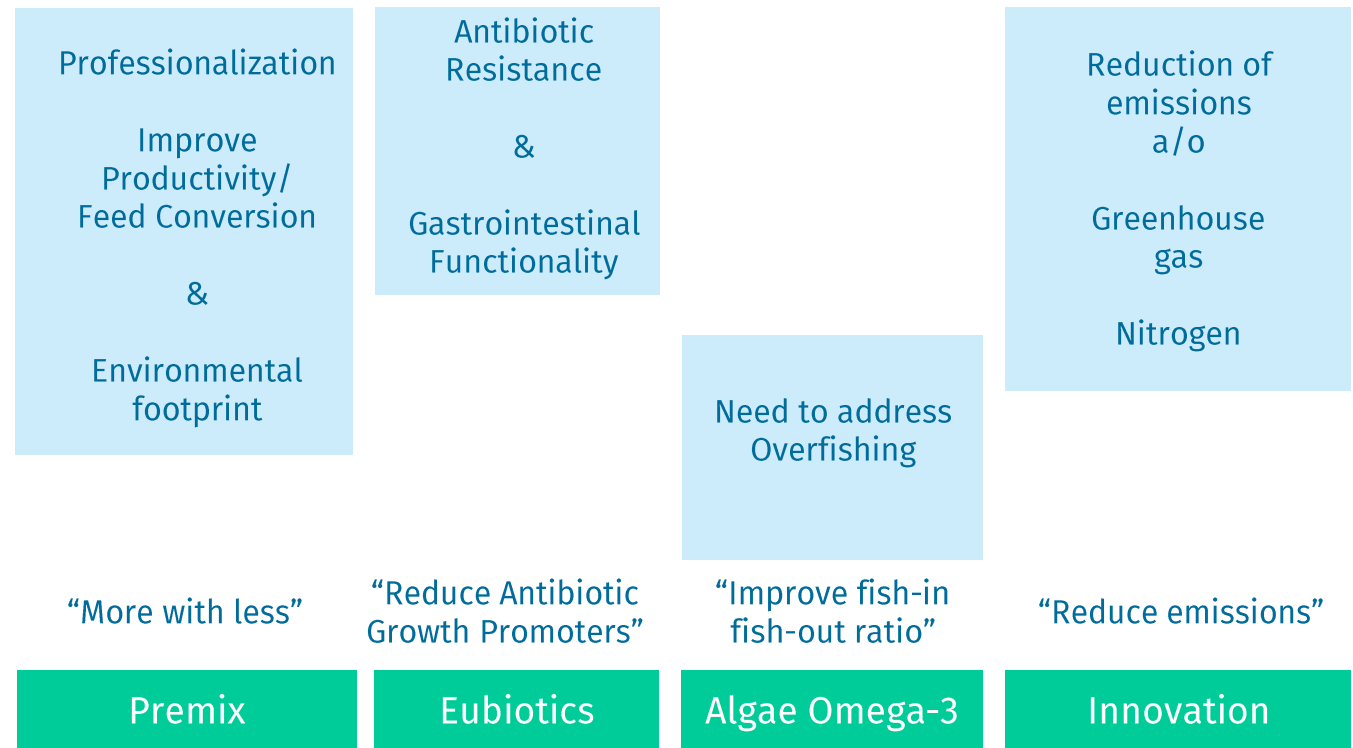
Outgrowing the market through premix, sustainability, innovation and Direct-to-Farm

Market growth (CFE¹)



Σ around 2-3%

Animal Nutrition & Health growth enhanced by



Σ around 5% organic sales growth ambition

AN&H | Veramaris

Omega-3 from natural algae for animal nutrition

- DSM's Veramaris® is a joint venture with Evonik
- It is using new algae-based technology, producing EPA & DHA Omega-3 for fish feed
- Replacing fish oil from wild caught fish, conserves natural biodiversity of our oceans



AN&H | Veramaris

Omega-3 from fermentation



A NATURAL PRODUCT

- Marine algae-derived oil rich in EPA and DHA fatty acids, essential for human and animal health (brain + heart), with a concentration exceeding 50%
- Addresses the decline in omega-3 levels in salmon (↓ fish oil), help sustainable farming
- Large range of applications: early life nutrition, animal (incl. pet, shrimp & fish)

BIO-TECH DRIVEN

- Sugar and algal strains – GMO-free - are used in the fermentation process
- Fermentation bypasses the food chain providing a highly-concentrated, stable and reliable supply of algal oil that can attain 15% of the current market demand for the salmon industry
- Similar to fish oil, but exempt from its price fluctuations & free from seaborne contaminants

SUSTAINABLE

- One ton of algal oil conserves 60 tons of wild-caught fish, reducing the pressure on over-fishing and enabling the aquaculture industry to grow sustainably
- A waste-free production process

READINESS & POTENTIAL

- JV combines DSM bio-tech & Evonik operational knowledge of large-scale manufacturing for fermentative amino acids. Plant in Blair (Nebraska) opened in Jul'19.
- Production expected to ramp up in 2020/2021; estimated €175-200m sales at full operation
- Salmon enriched with Veramaris' Omega 3 already available to DE, FR & UK retailers via Norwegian commercial partner



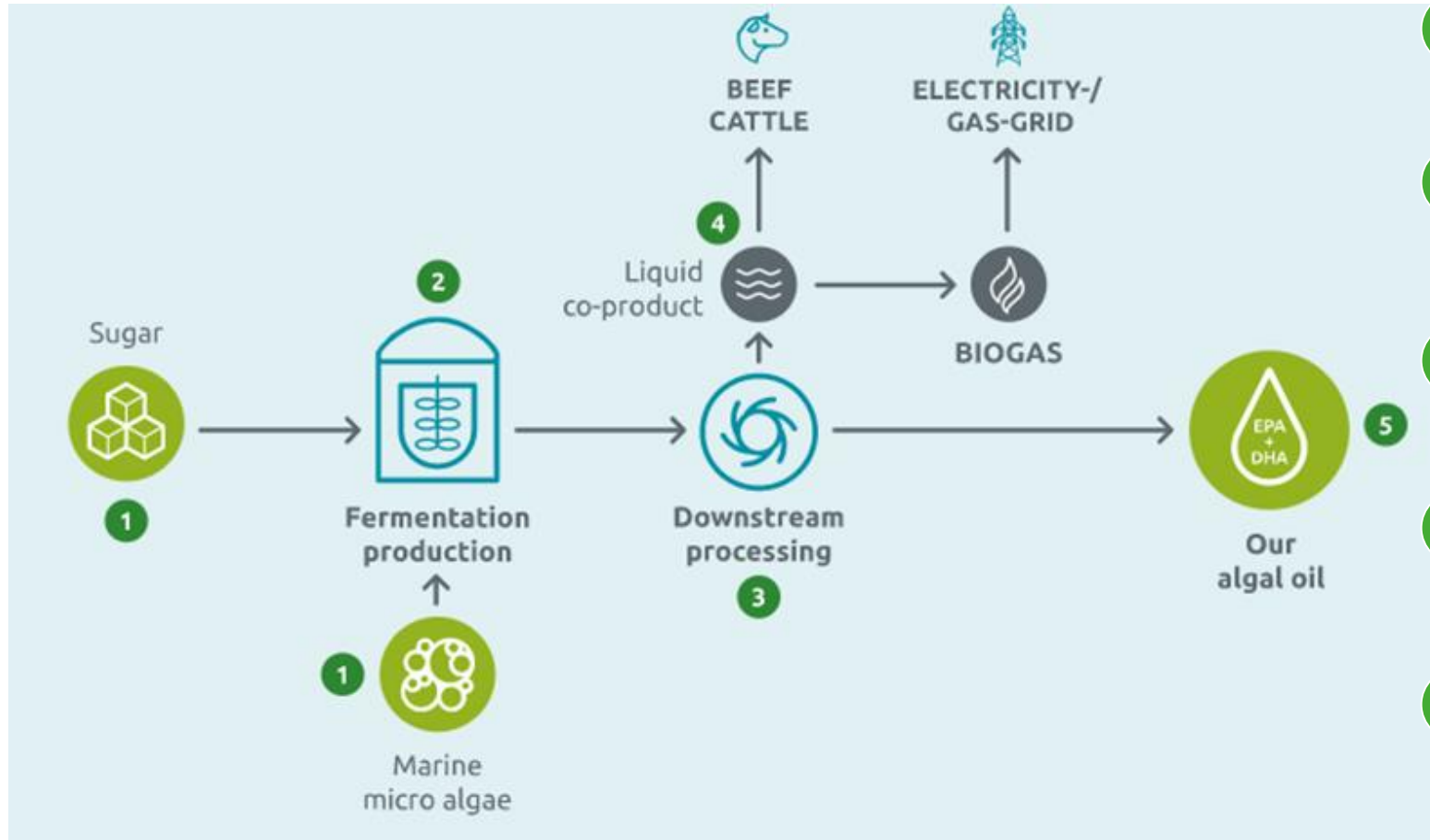
AN&H | Veramaris

How does it work?



A waste-free fermentation process

The production steps

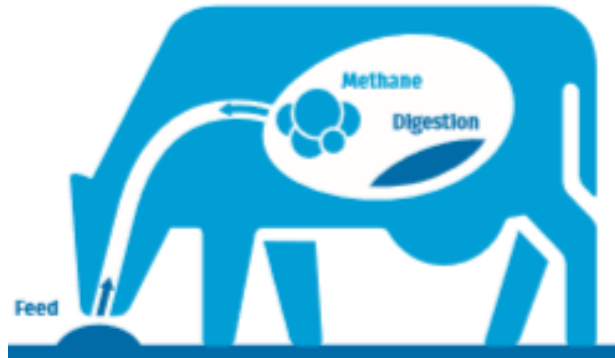


- 1 Sugar is fed to the algal strain seeding the fermentation in Blair (Nebraska, US); both GMO-free
- 2 The algae multiply exponentially and convert sugar into omega-3
- 3 Centrifugation separates oil from water, resulting in a highly concentrated oil & a liquid co-product
- 4 The co-product can be used for cattle feed or converted into bio-gas for energy production
- 5 The algal oil, rich in EPA and DHA fatty acids is a natural, stable product with a concentration >50%

AN&H | Bovaer® - One burp at a time

How cows can help us fight climate change

Ruminants contribute significantly to the world's methane emissions



- In a cow's stomach, microbes help food break down. This releases hydrogen and carbon dioxide. An enzyme combines these gases to form methane. Bovaer® is a feed additive that suppresses the enzyme, so less methane gets generated
- Like carbon dioxide (CO₂), methane is a greenhouse gas. Its warming effect is shorter lived, but much more potent than CO₂. So eliminating it begins to pay off right away.

Bovaer® - (Clean Cow) inhibits methane production by ~30%



Feeding Bovaer® to 1 cow
saves the equivalent of
127.000 smartphone charges



Feeding Bovaer® to 3 cows is like
taking 1 family-sized car off the road



Feeding Bovaer® to 1 million cows is
like planting a forest of 45 million
trees

AN&H | Bovaer® - Farm wise & climate friendly

Significant reduction of methane emissions from cattle



A NATURAL
PRODUCT

- Feed additive that blocks enzyme responsible for the methane emissions in cows (↓ 30%)
- Safe, doesn't leave traces in milk, stable, its effect stops as soon as the additive is not fed
- Increases cow productivity by freeing-up energy from the digestive process: 1 cow generates 3 tons of CO2 equivalent every year in the form of enteric methane

BIO-TECH
DRIVEN

- The molecule in the inhibitor, 3-NOP hampers an enzyme responsible for the methane production in the rumen: A quarter of teaspoon powder per cow a day is needed
- The additive will break down into compounds already naturally present in the stomach

SUSTAINABLE

- Ruminants (mainly cows) emit about 20% of all methane gasses globally. Reducing global methane emissions from cows will thus result in immediate impact and therewith help slow the pace of global warming in the next decade already, to facilitate society taking longer-term action on CO2 reduction. Bovaer® could therefore significantly contribute to various UN Sustainable Development Goals, including Climate Action.

READINESS &
POTENTIAL

- Data collection completed, 26 studies published. Bovaer® has recently been filed for registration in Europe where it will be available as soon as market authorization is granted with a launch in the region anticipated in late 2020/early 2021. Registrations of the feed additive in other regions will follow
- Commercialization will follow the registration phase: estimated market of €1-2bn
- Further expansion in beef market with different forms





BRIGHT SCIENCE. BRIGHTER LIVING.™