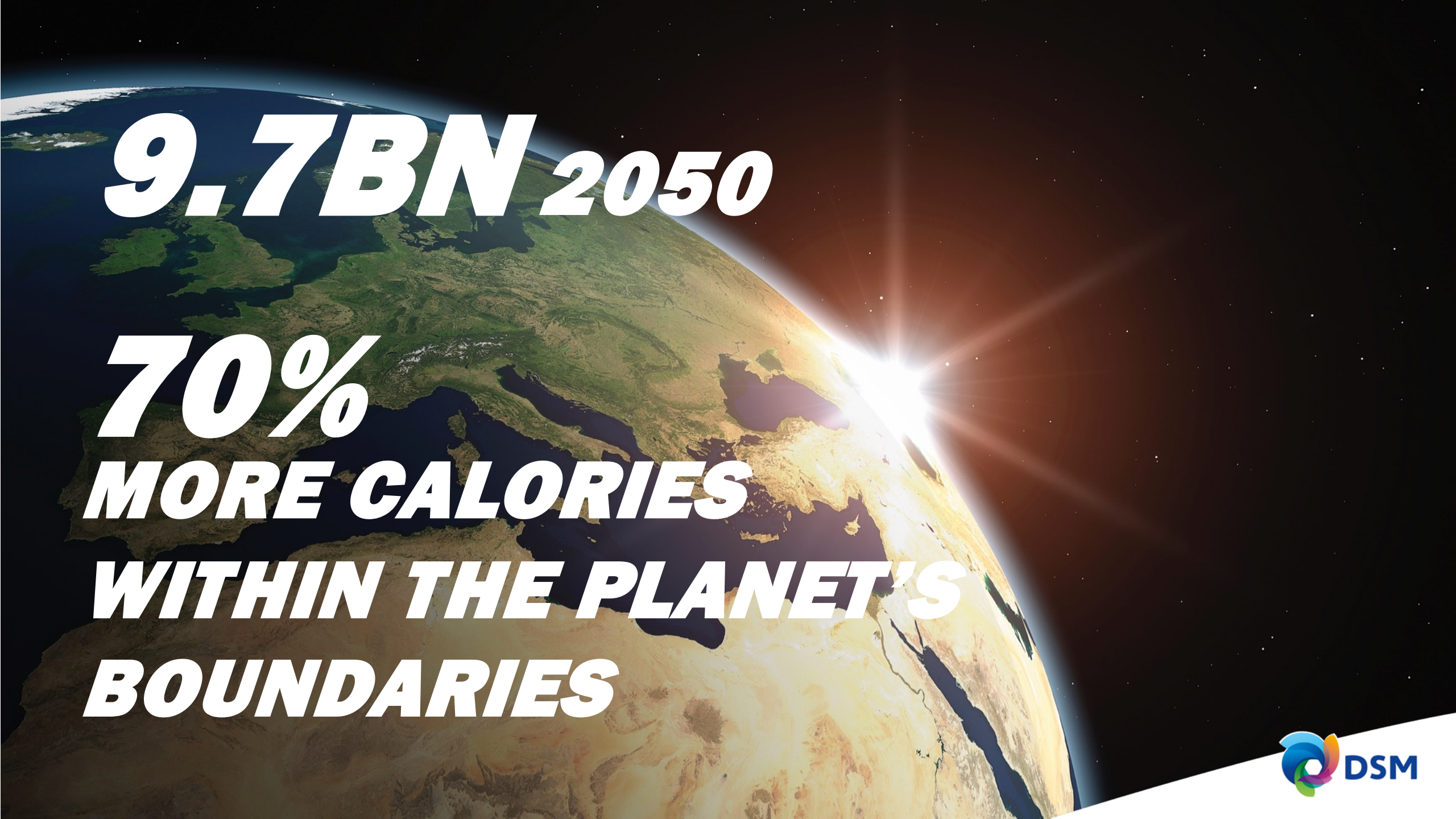
CREATING BRIGHTER LIVES FOR ALL.

DRIVING SUSTAINABILITY AND INNOVATION IN ANIMAL PRODUCTION

Dr David Nickell

VP Sustainability, DSM Animal Nutrition & Health


9.7BN 2050
70%
MORE CALORIES
WITHIN THE PLANET'S
BOUNDARIES

FOR ANIMAL PROTEIN TO PLAY A ROLE IN BALANCED NUTRITION, IT MUST BE SUSTAINABLE

Expand food production without expanding agricultural land & produce within boundaries.

Protect & restore natural ecosystems & limit agricultural land-shifts.

Increase fish supply via sustainable aquaculture.

Reduce GHG emissions, and nitrogen & phosphorus flows to the environment.

Dietary shifts and reducing food loss & waste.

Source: WRI 2018: EAT Lancet Commission 2019

LARGE FOOTPRINT & MANY AREAS TO IMPROVE

GHG EMISSIONS

PHOSPHORUS & NITROGEN

ANIMAL WELFARE

LAND USE

WATER USE

FARMER LIVELIHOODS

FOOD LOSS & WASTE

SOIL HEALTH

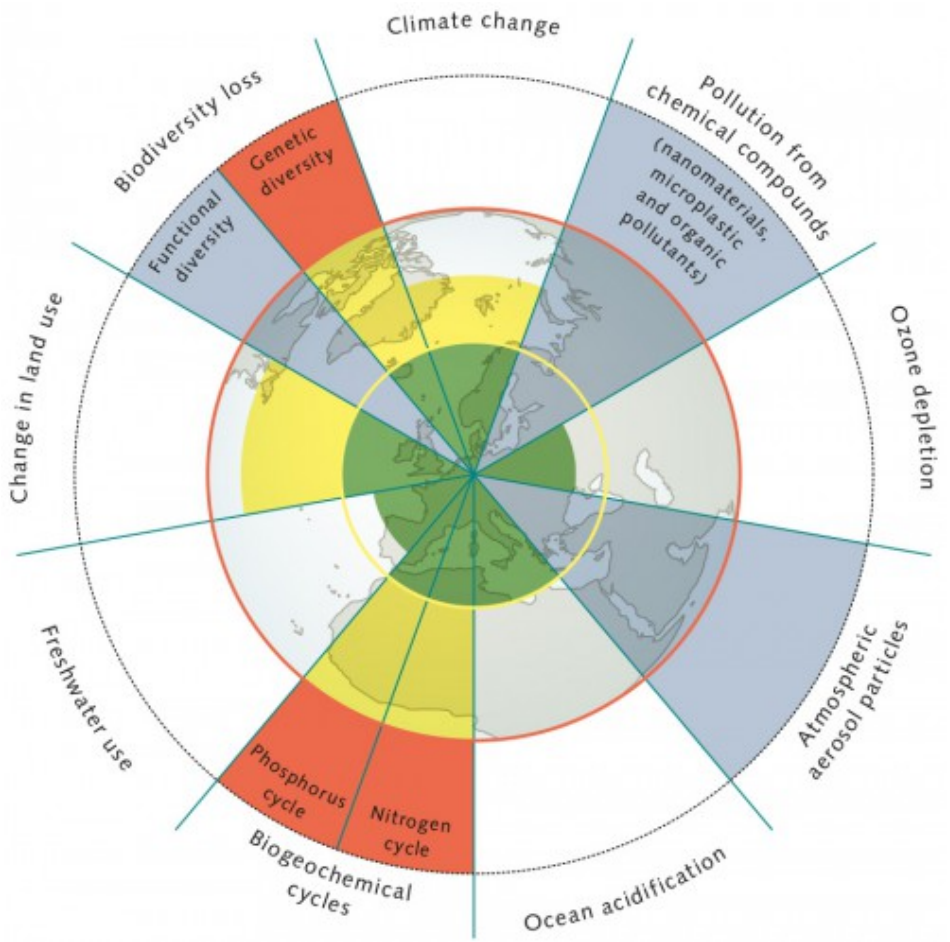
MARINE RESOURCES

ANTI-MICROBIAL RESISTANCE

BIODIVERSITY

CIRCULAR RESOURCE USE

THE VALUE CHAIN & STAKEHOLDERS ARE FOCUSED ON THE TRUE COST OF ANIMAL PRODUCTION



Source: Steffen *et al.*, 2015

WHICH MEANS A FOCUS ON

- GHG emissions
- Sustainable use of raw materials
- Natural resource protection
- Land use and water use
- Nitrogen and Phosphorus flows
- Biodiversity loss
- Soil depletion & degradation

- Improving animal welfare
- Reducing the use of antibiotics
- Reducing food loss and waste
- Farmer / socio economic factors

ENABLING BETTER FOOD, NUTRITION & HEALTH FOR ALL WITHIN PLANETARY BOUNDARIES

OUR KEY NUTRITION GOALS

Advocate healthy, balanced nutrition

Improve the nutrient content & quality of feed & food

Enable the feeding of a growing population within the natural resources available

Reduce the eco-footprint of producing food (keep within planetary boundaries)

DSM

IN DSM WE FOCUS ON SIX PLATFORMS FOR SUSTAINABLE ANIMAL PRODUCTION

WE WORK AT SPECIES AND COUNTRY LEVEL TO MAKE TANGIBLE, MEASURABLE IMPACTS

REDUCING OUR RELIANCE ON MARINE RESOURCES

AQUACULTURE IS A KEY SOURCE OF ANIMAL PROTEIN, BUT ITS GROWTH IS HIGHLY DEPENDENT ON FINITE MARINE RESOURCES

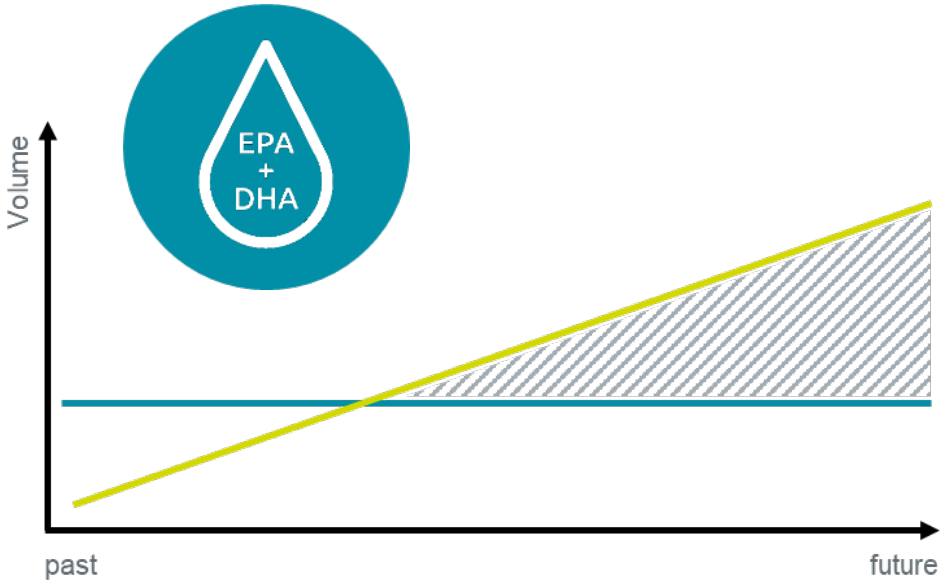
TECHNOLOGY IS AVAILABLE FOR THE SUSTAINABLE GROWTH OF THE AQUACULTURE INDUSTRY

DEMAND FOR OMEGA-3 EPA & DHA IS OUTSTRIPPING THE FINITE NATURAL SUPPLY

17% of global wild catch is consumed for the production of fish oil and fishmeal

5Mt tons fishmeal

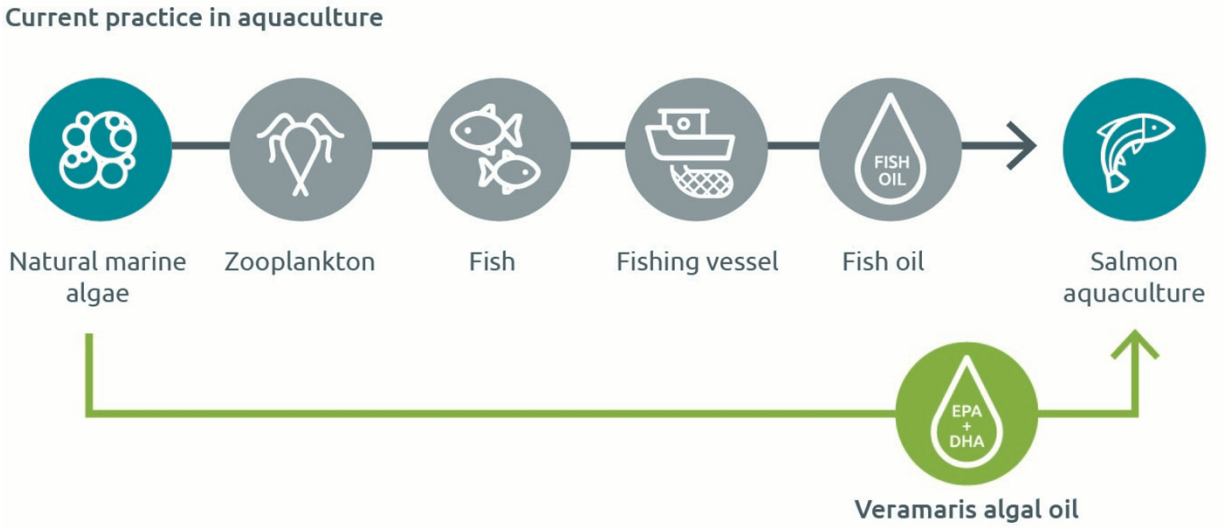
1Mt ton fish oil



DSM

ENABLING GROWTH, REDUCING DECLINE

EXAMPLE: VERAMARIS OMEGA-3 EPA AND DHA FOR AQUACULTURE



AQUACULTURE BECOMES A NET FISH PRODUCER

<1 kg wild catch
+ veramaris
= 1 kg salmon

EPA/ DHA

1 ton veramaris = 60 ton wild catch

1.2 MILLION TONS

veramaris®
A JOINT VENTURE OF DSM AND EVONIK

https://www.veramaris.com

DSM

EFFICIENT USE OF NATURAL RESOURCES

NEED FOR GREATER FEED EFFICIENCY AND NITROGEN RETENTION IN ANIMAL PRODUCTION

MUST REDUCE NITROGEN (N) & PHOSPHORUS (P) FLOWS TO THE ENVIRONMENT, WHILE REDUCING THE RELIANCE ON HUMAN EDIBLE GRAINS FOR ANIMAL PRODUCTION

FEED ENZYME TECHNOLOGY HELPS ADDRESS THESE SUSTAINABILITY ISSUES

EXTRACTING MORE VALUE OUT OF FEED CROPS IS KEY TO SUSTAINABLE FOOD SYSTEMS

- Reduce use of unsustainable soy
- Improve protein efficiency
- Reduce N pollution

- Enable local feed raw material & by-product use
- Reduce feed-food competition

- Reduce the reliance on finite mineral resources
- Reducing P pollution

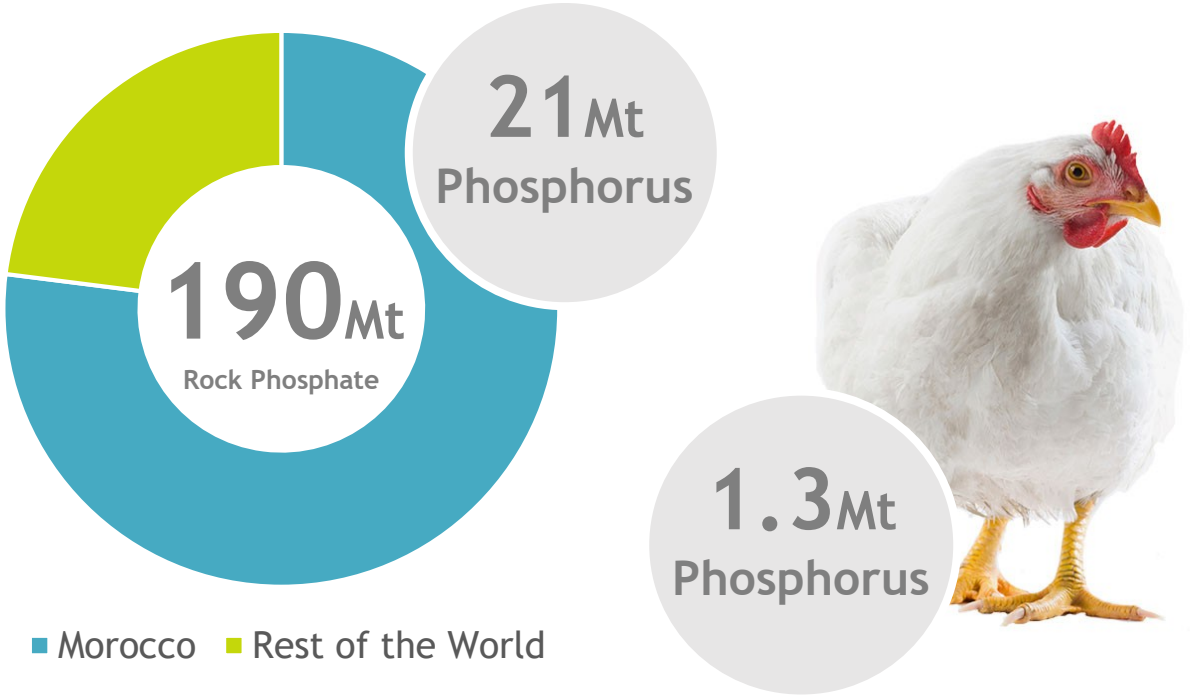
- Optimize diets & costs
- Affordable animal protein
- Improve animal performance

FEED ENZYME TECHNOLOGY HELPS ADDRESS THESE SUSTAINABILITY ISSUES

DSM

REDUCING OUR RELIANCE ON FINITE PHOSPHORUS RESOURCES & REDUCING ENVIRONMENTAL IMPACT

EXAMPLE: PHYTASE USE IN GLOBAL BROILER FLOCK



Amount of Phosphorus saved by phytase use per year

Uncertain timeframe on the availability of mined phosphorus.

Saving finite global phosphorus resources.

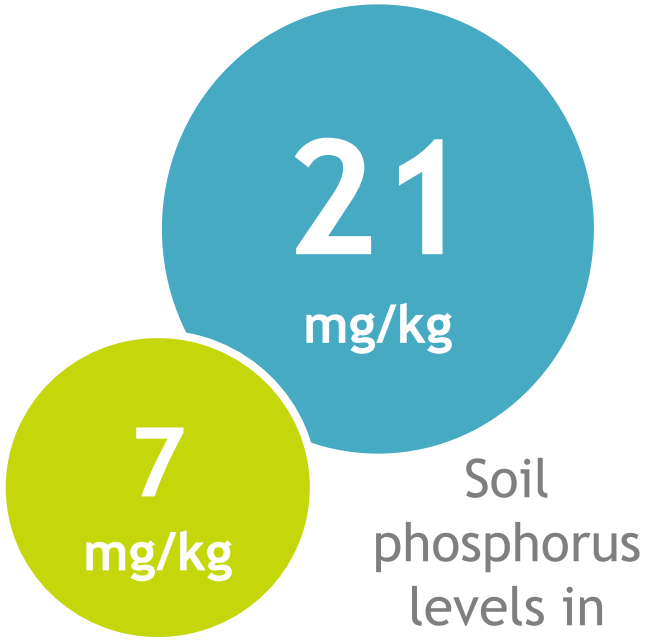
Reduce the dependence on foreign P resources.

Help to close regional P-cycles.

Reducing the CO_2 footprint of animal production.

PHOSPHORUS CHALLENGE

EXAMPLE: CHINA



China accumulated ~30Mt of phosphorus in its soil over two decades.

Driven by demand for animal protein and greater crop productivity.

It is estimated that current soil phosphorus in Northern China is adequate to achieve 80% crop yield for 5 years.

Issues with leaching to freshwater and algal blooms.

Phosphorus management is a key sustainability issue.

Source: ESPP SCOPE Newsletter 10.2014 (II) No. 108

REDUCING PHOSPHORUS FLOWS TO THE ENVIRONMENT

EXAMPLE: PHYTASE (RONOZYME® HIPHOS)

11 g/kg DM

Typical amount of phosphorus excreted when feeding a diet containing mineral phosphorus

4.5 g/kg DM

Amount of phosphorus excreted when using Ronozyme HiPhos & replacing mineral phosphorus

60% reduction

Phytase significantly reduces phosphorus content of manure.

This reduces the land mass required to spread manure.

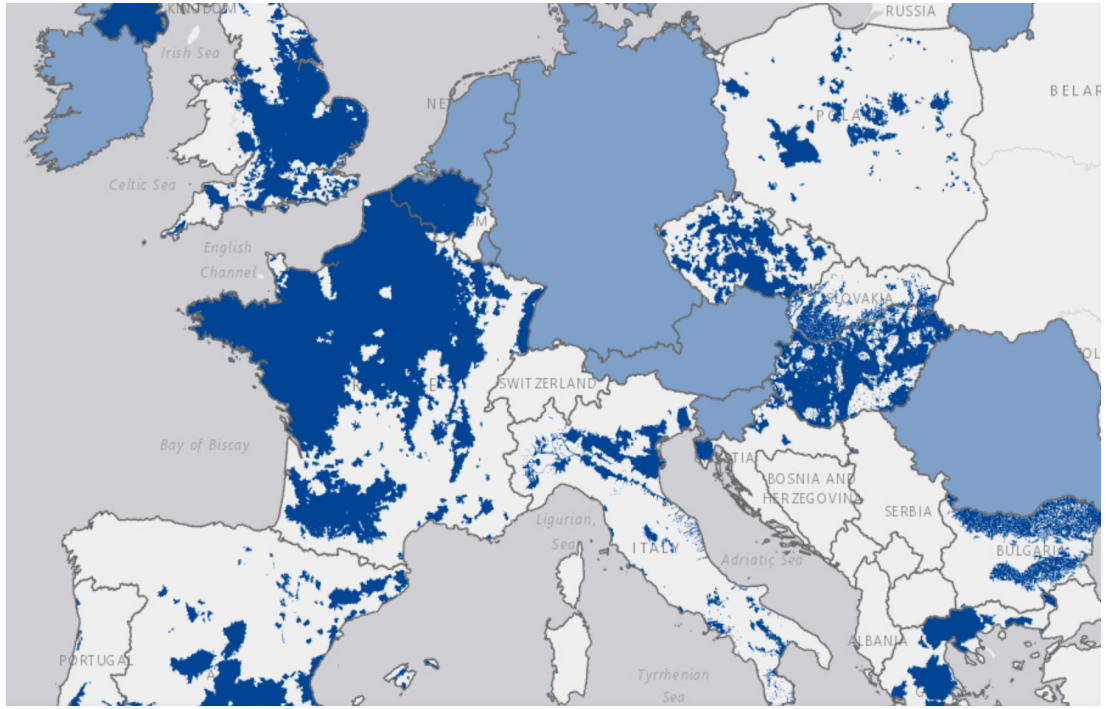
Helps improve soil quality & chemistry.

Less P in manure reduces the amount of run-off to freshwaters & algal blooms.

Source: DSM field trials

DSM

REDUCING PROTEIN USE IN ANIMAL FEEDS & NITROGEN FLOW TO THE ENVIRONMENT



EU Nitrate Vulnerable Zones (NVZs) dark blue

Nitrogen is vital for crop growth, but high concentrations are harmful to people & nature.

Excess nitrogen from agricultural sources is one of the main causes of water pollution in Europe.

Driven by intensification of animal and crop production.

Nitrogen is monitored (NVCs) and limits on manure application are set (170kg N/ha/yr).

REDUCING PROTEIN IN ANIMAL FEEDS & NITROGEN FLOW TO THE ENVIRONMENT

EXAMPLE: RONOZYME® PROACT

Without Ronozyme® ProAct

22.5%

Nitrogen in feed

75.6%

Digestibility AID

Nitrogen in manure

With Ronozyme® ProAct

20.5%

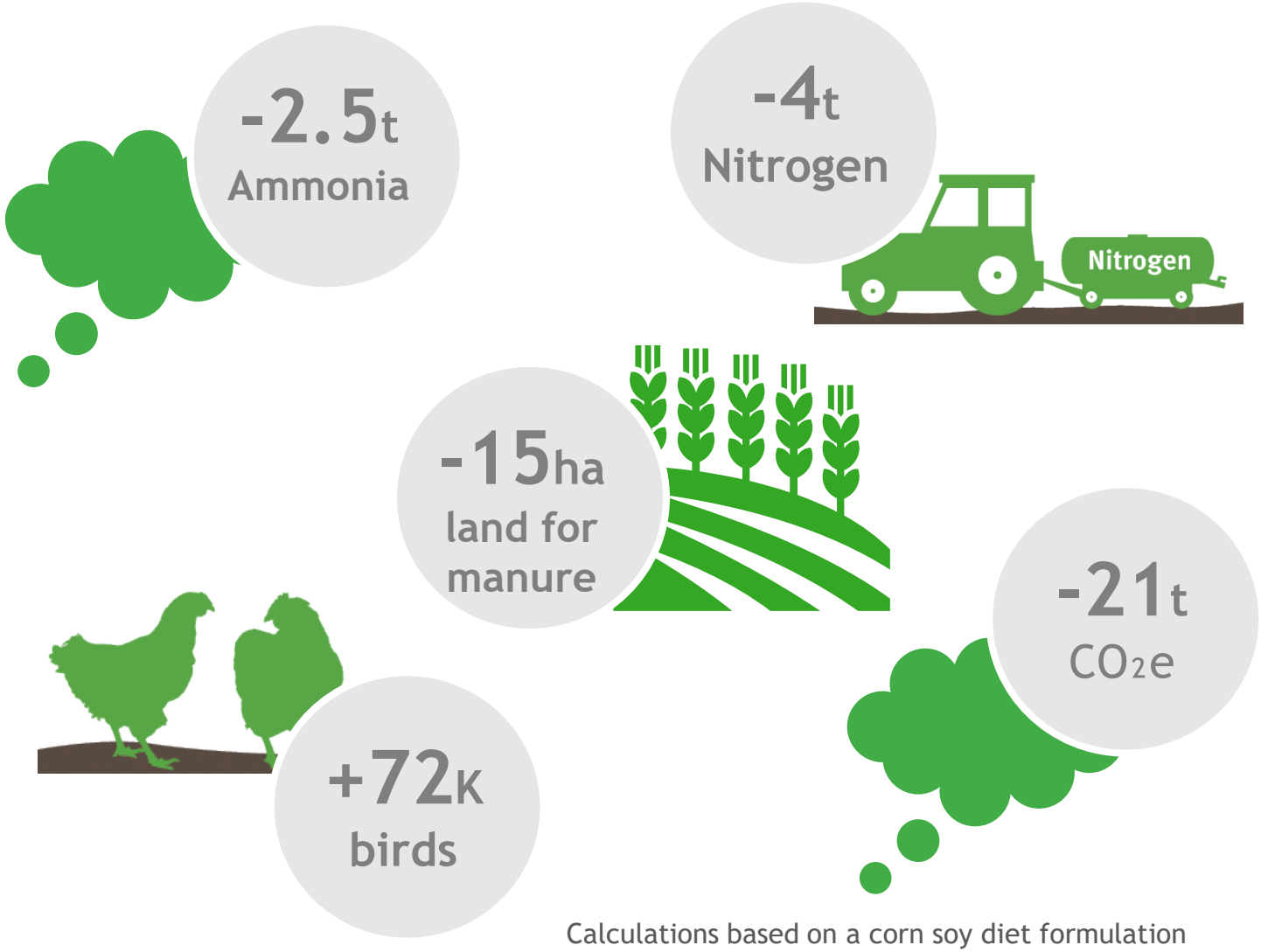
82.6%

Nitrogen in manure -35%

Source: Angel *et al.*, 2011

IMPROVING NITROGEN SUSTAINABILITY

EXAMPLE: RONOZYME® PROACT IMPACT ON 1 MILLION BROILERS



Calculations based on a corn soy diet formulation

Ronozyme® ProAct

Improves protein digestibility & enables dietary protein reduction.

Enables greater use of alternative feed raw materials & feed formulation flexibility.

Reduces nitrogen flow to the environment.

Reduces CO_2 footprint of animal production.

DSM

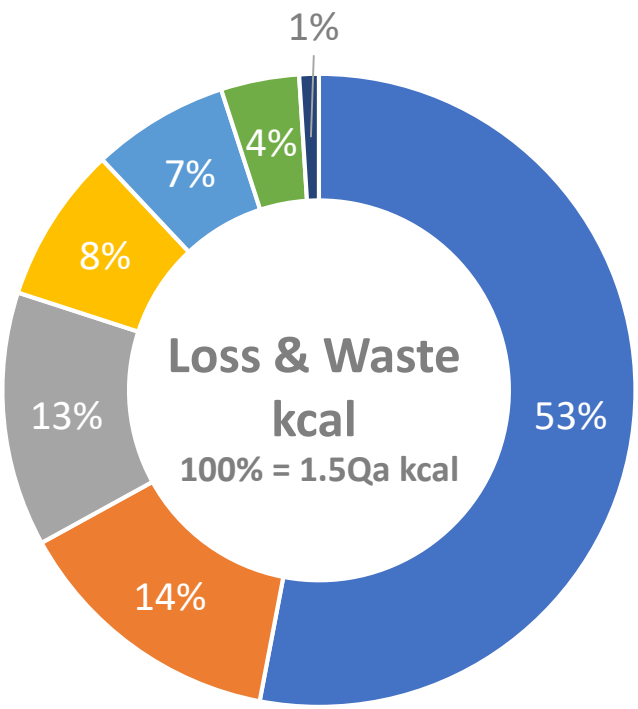
SAFE QUALITY NUTRITION WITH LESS FOOD LOSS & WASTE

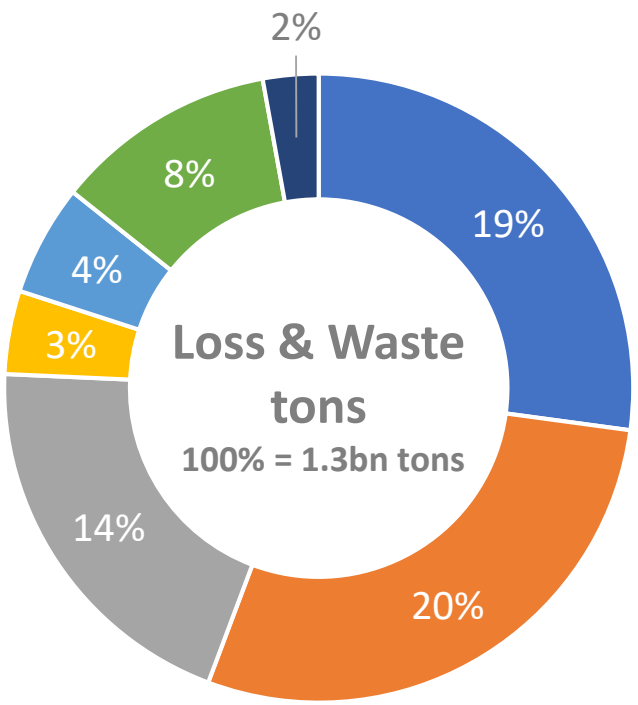
ABOUT 32% OF FOOD BY WEIGHT IS LOST OR WASTED

ABOUT 24% OF THE CALORIES PRODUCED FOR PEOPLE ARE NEVER EATEN

SEEN AS A COUNTRY FOOD LOSS & WASTE GHG EMISSIONS WOULD BE THE THIRD LARGEST AFTER CHINA AND USA

IT IS A HUGE SUSTAINABILITY ISSUE





- Cereals
- Roots & tubers
- Fruits & Vegetables
- Oilseeds & pulses
- Meat
- Milk
- Fish & seafood

Source: Lipinski et al., 2013 WRI Reducing Food Loss & Waste

Current metrics only capture FLW from point of harvest onwards. Yet upstream nutritional interventions during animal production can reduce FLW

We focus on reducing egg breakages through vitamin D fed to hens throughout the lay cycle.

We focus on extending the shelf life of meat with vitamin E fed to animals throughout lifetime.

We focus on upstream productivity improvements in dairy.

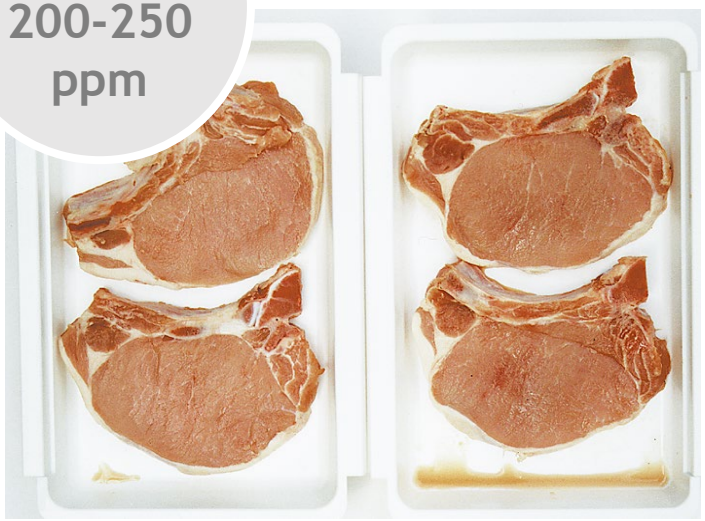
IMPROVING THE SHELF-LIFE OF MEAT

EXAMPLE: VITAMIN E NUTRITION AND SWINE

Consequences of lipid oxidation

- Drip loss
- Off flavors
- Cholesterol oxidation
- Muscle pigment oxidation

Vitamin E 200-250 ppm



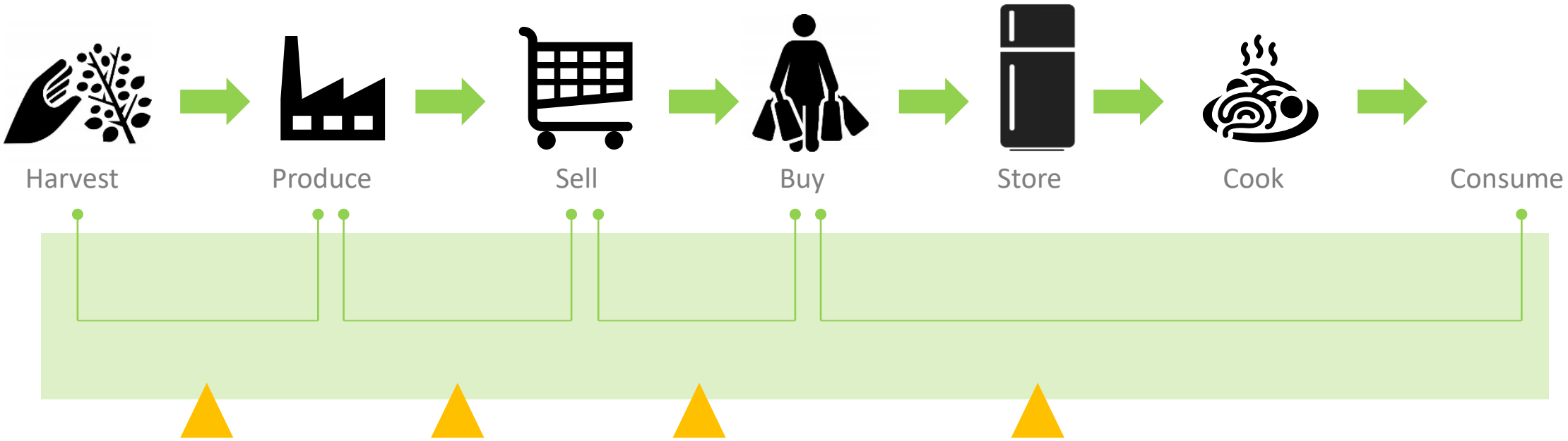
3-6 days Shelf life extended for fresh meat

2-3 months Shelf life extended for frozen meat

8-9 days Delay in off flavors following storage

DSM

MEASURING BEYOND TRADITIONAL BOUNDARIES



Measuring along the value chain provides deeper insight into how nutritional solutions and innovation improve the sustainability of animal production

PARTNERING WITH THE VALUE CHAINS TO ENABLE SUSTAINABLE ANIMAL PRODUCTION




DSM


IF NOT US, WHO?
IF NOT NOW, WHEN?
https://www.dsm.com/anh/en.html
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
DSM

BRIGHT SCIENCE. BRIGHTER LIVING.™