Methane reduction in agriculture

[redacted], [redacted] Clean Cow
[redacted], Clean Cow, [redacted]
[redacted], Sustainability & Business Solutions
[redacted], Public Affairs
[redacted], Public Affairs

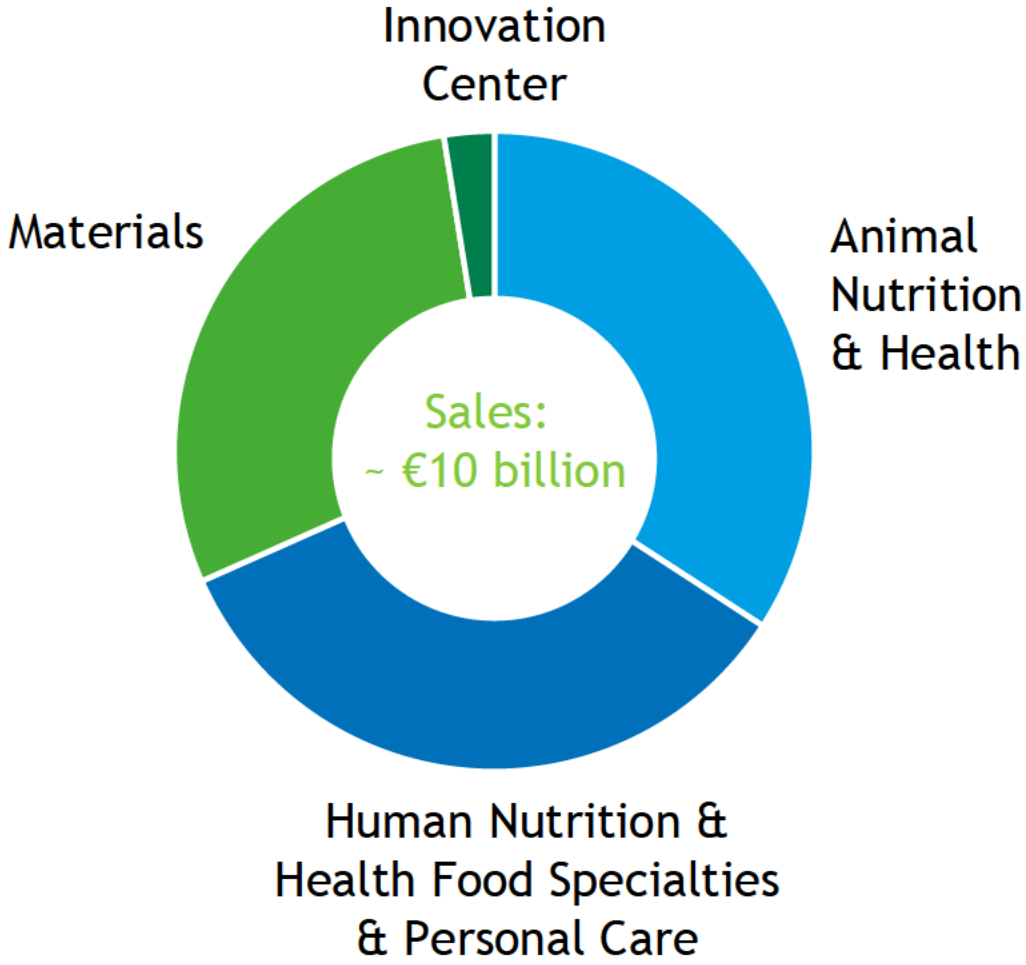
13 January 2021

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

DSM at a glance

2019 numbers

- Global company with 43% of sales to high-growth economies
- Intrinsically innovative with 21% of sales from products launched in the last 5 years
- Highly engaged workforce across the world of ~23,000 employees
- Purpose-led strategy aligned with the UN Sustainable Development Goals



DSM has been a unique partner of the dairy sector for many years and has sustainability at the core of its values

Animal Nutrition & Health

- Micro nutrients (vitamins, minerals, enzymes) to enhance lifetime performance
- Products included in ruminant premixes from facilities around the globe

DSM Food Specialties

- Food enzymes and cultures for Dairy products such as Yogurt & Cheeses
- Antibiotic testing (Delvotest)

Human Nutrition & Health

- Vitamins and Mineral fortified Infant formula and dairy products from premix facilities globally
- DHA / EPA / ARA for infant and adult formula
- Carotenoids for coloration of dairy products


Bovaer®
Bov (ine) + Air
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The world needs cows…

They are valuable converters

Cows digest tough, fibrous plants and produce high-quality protein that we need.

They nourish our world

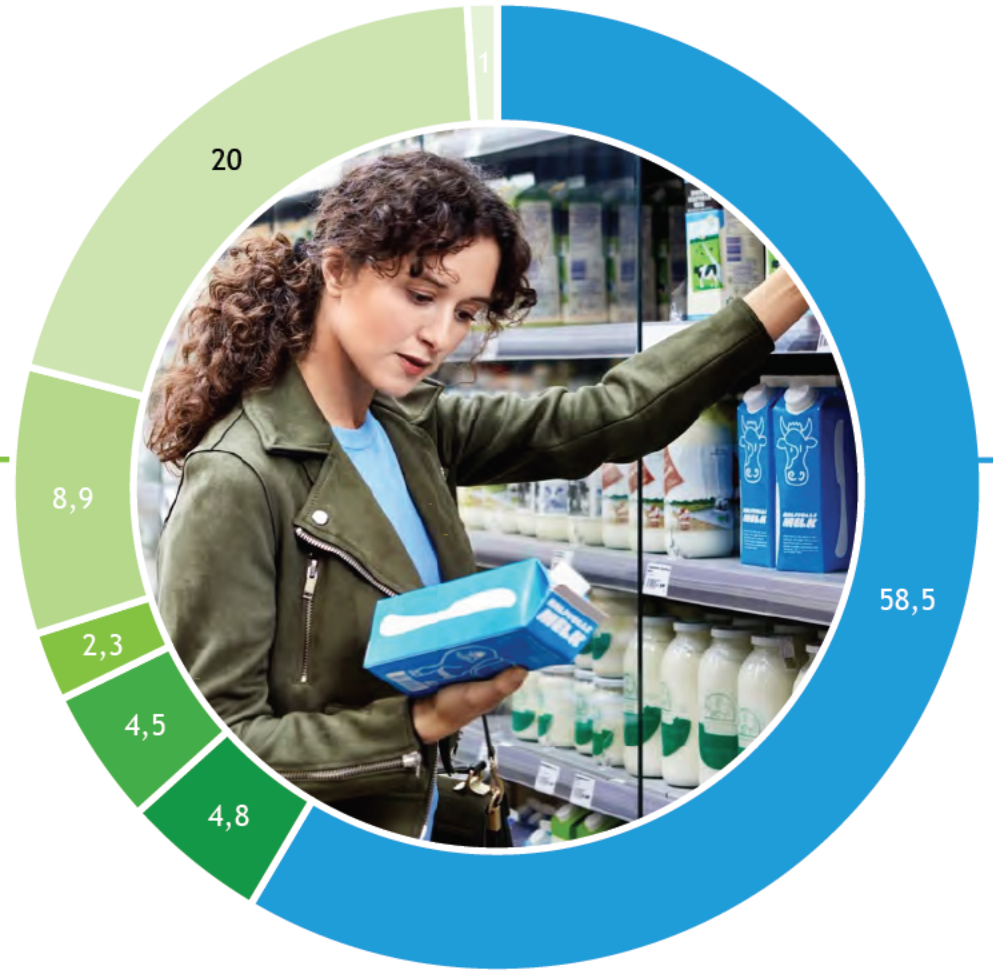
Dairy products provide essential nutrients and affordable nutrition for billions.

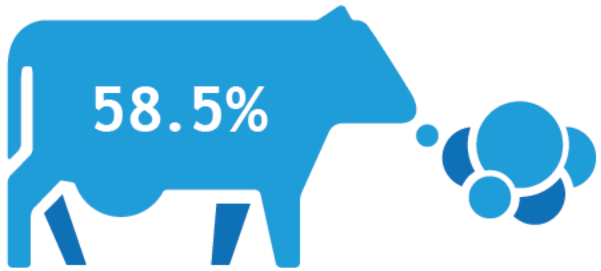
They support our livelihoods

Globally, a billion livelihoods are tied to dairy production.

Footprint of a liter of milk by source (2015)

- Manure management CH4
- Manure management N2O
- Direct energy and indirect C02
- Feed CO2
- Feed N2O
- LUC: soy & palm CO2





58.5% of dairy GHG emissions come from enteric methane.

Source: FAO and GDP 2018

Countries and companies want to lower their footprint

FrieslandCampina

Carbon neutral: 2050
Launched new sustainable dairy line in 2018

Norway

Carbon neutral: 2030

Arla

Carbon neutral: 2050
Reduce emissions by 30% by 2030

Finland

Carbon neutral: 2035

Netherlands

Set dairy sector target of reducing methane by 0,8 Mt CO2e

Valio

Carbon neutral: 2030
Voted most sustainable company in Finland

United Kingdom

Carbon neutral: 2050
UK government has declared a climate emergency

Danone

Carbon neutral: 2050
Reduce emissions by 50% by 2030

Tesco

Carbon neutral: 2050
Reduce emissions by 60% by 2025

Barry Callebaut

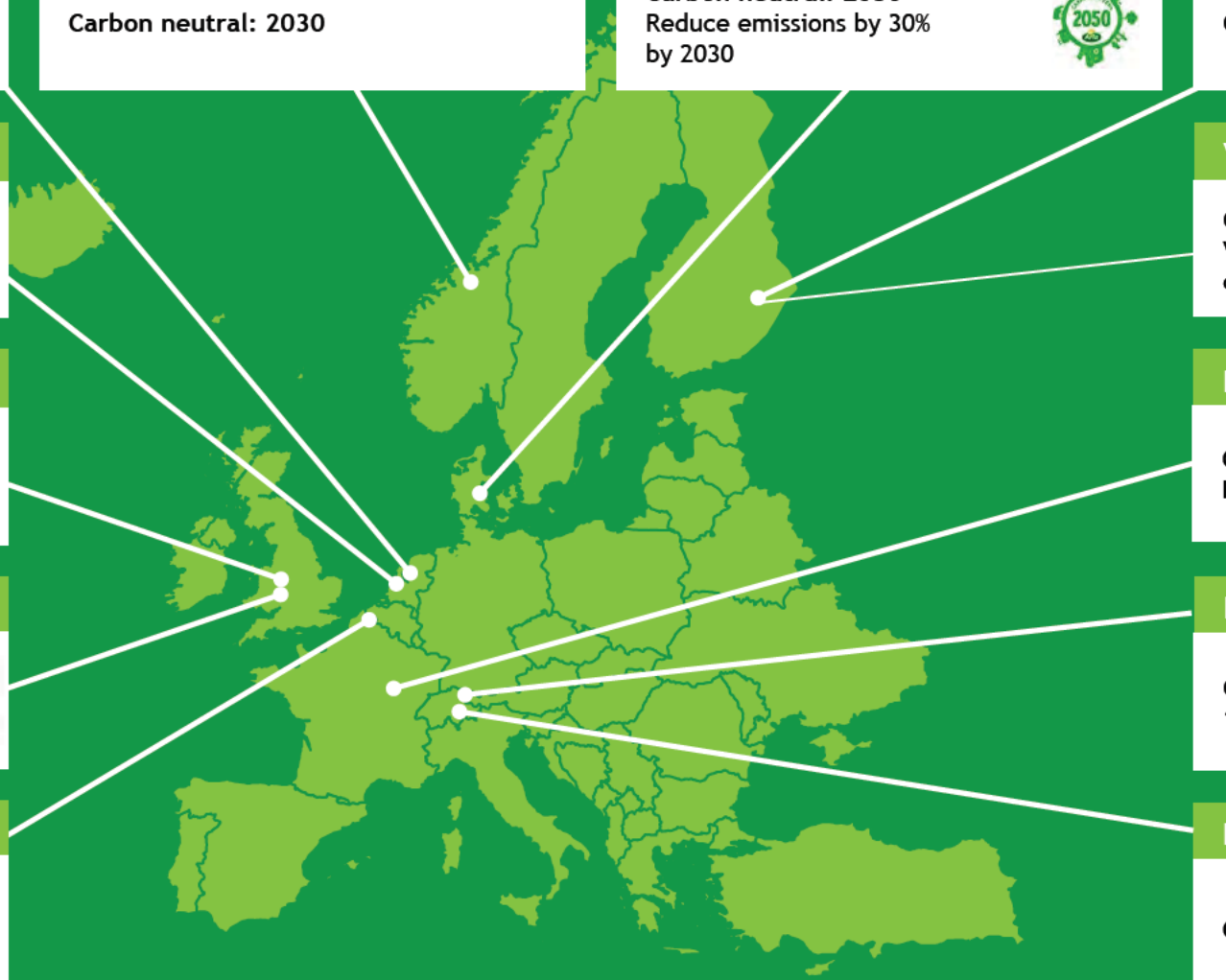
Carbon neutral: 2025
100% sustainable raw materials by 2025

Flemish Region

Flanders committed to reduce enteric methane emissions by 19% by 2030 vs 2005

Nestle

Carbon neutral: 2050



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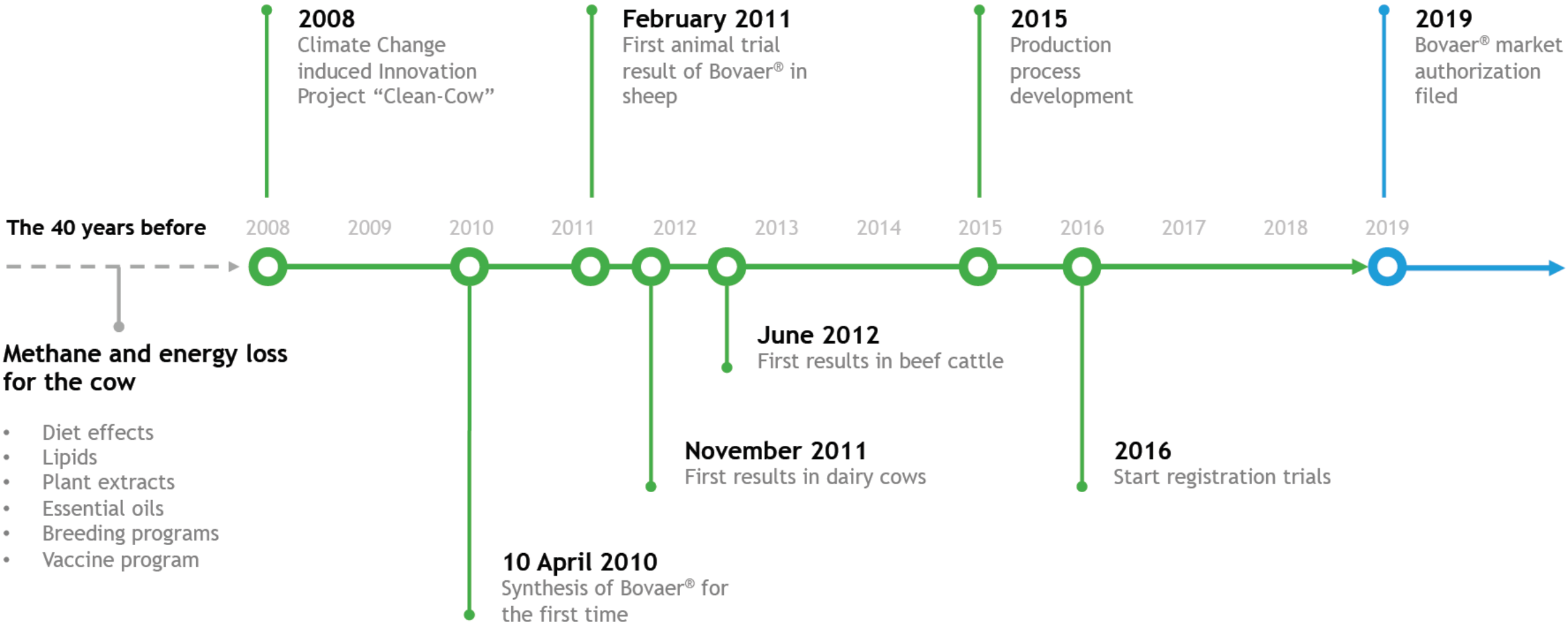
Journey of Bovaer®

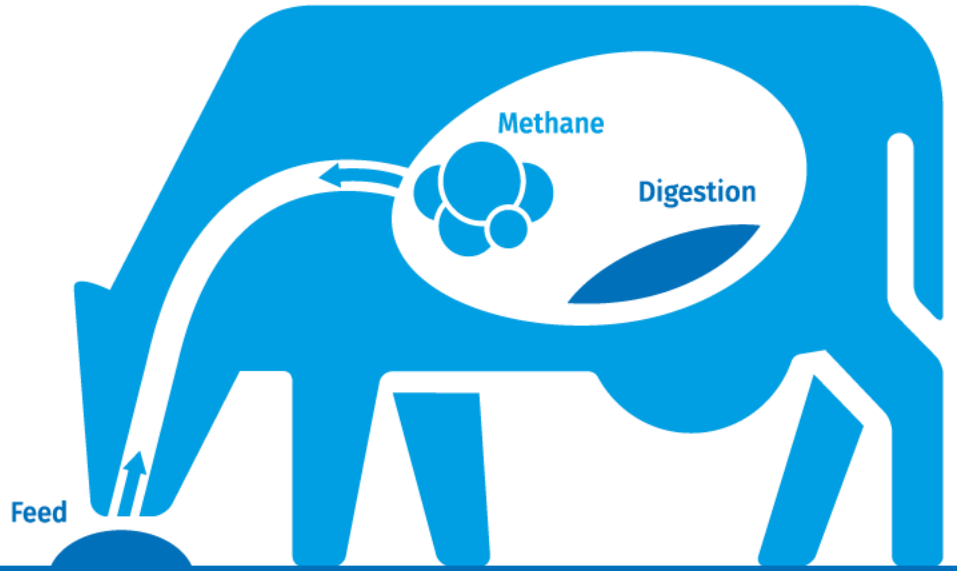


Cows make methane

It's not their fault. Methane is a byproduct of digesting the tough, fibrous food they eat. And it's released into the air burp by burp.

Methane traps heat

Like carbon dioxide (CO_2), methane is a greenhouse gas. Its warming effect is shorter lived, but much more potent than CO_2. So eliminating it begins to pay off right away.



Bovaer® reduces methane

1/4 teaspoon daily in a cow's feed

30% less methane produced

takes effect immediately

proven safe for consumers, for cows, and good for our planet

How it works

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.**

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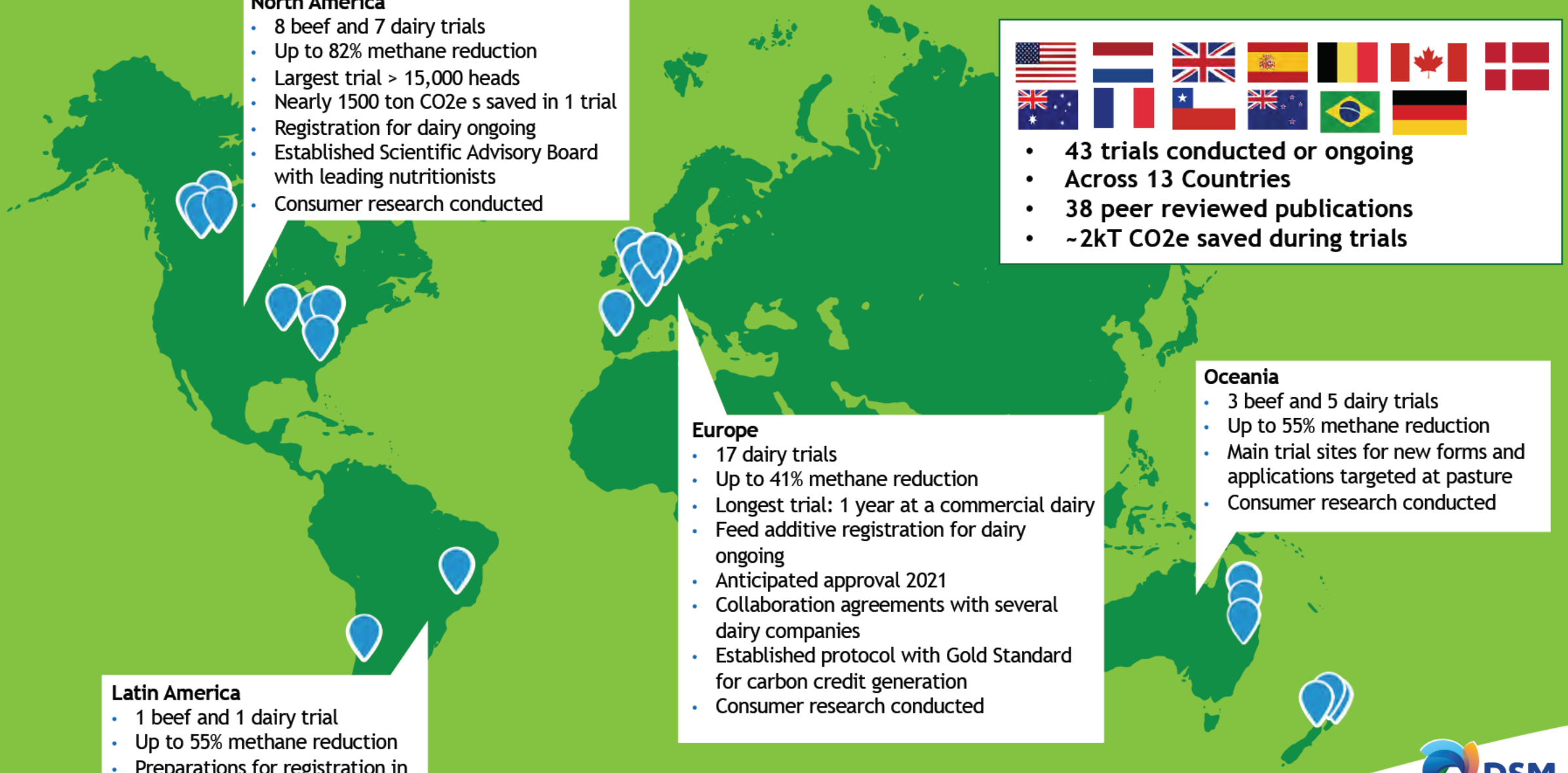
Efficacy of Bovaer® extensively demonstrated globally



North America
- 8 beef and 7 dairy trials
- Up to 82% methane reduction
- Largest trial > 15,000 heads
- Nearly 1500 ton CO2e s saved in 1 trial
- Registration for dairy ongoing
- Established Scientific Advisory Board with leading nutritionists
- Consumer research conducted

- **43 trials conducted or ongoing**
- **Across 13 Countries**
- **38 peer reviewed publications**
- **~2kT CO2e saved during trials**

Europe
- 17 dairy trials
- Up to 41% methane reduction
- Longest trial: 1 year at a commercial dairy
- Feed additive registration for dairy ongoing
- Anticipated approval 2021
- Collaboration agreements with several dairy companies
- Established protocol with Gold Standard for carbon credit generation
- Consumer research conducted

Oceania
- 3 beef and 5 dairy trials
- Up to 55% methane reduction
- Main trial sites for new forms and applications targeted at pasture
- Consumer research conducted

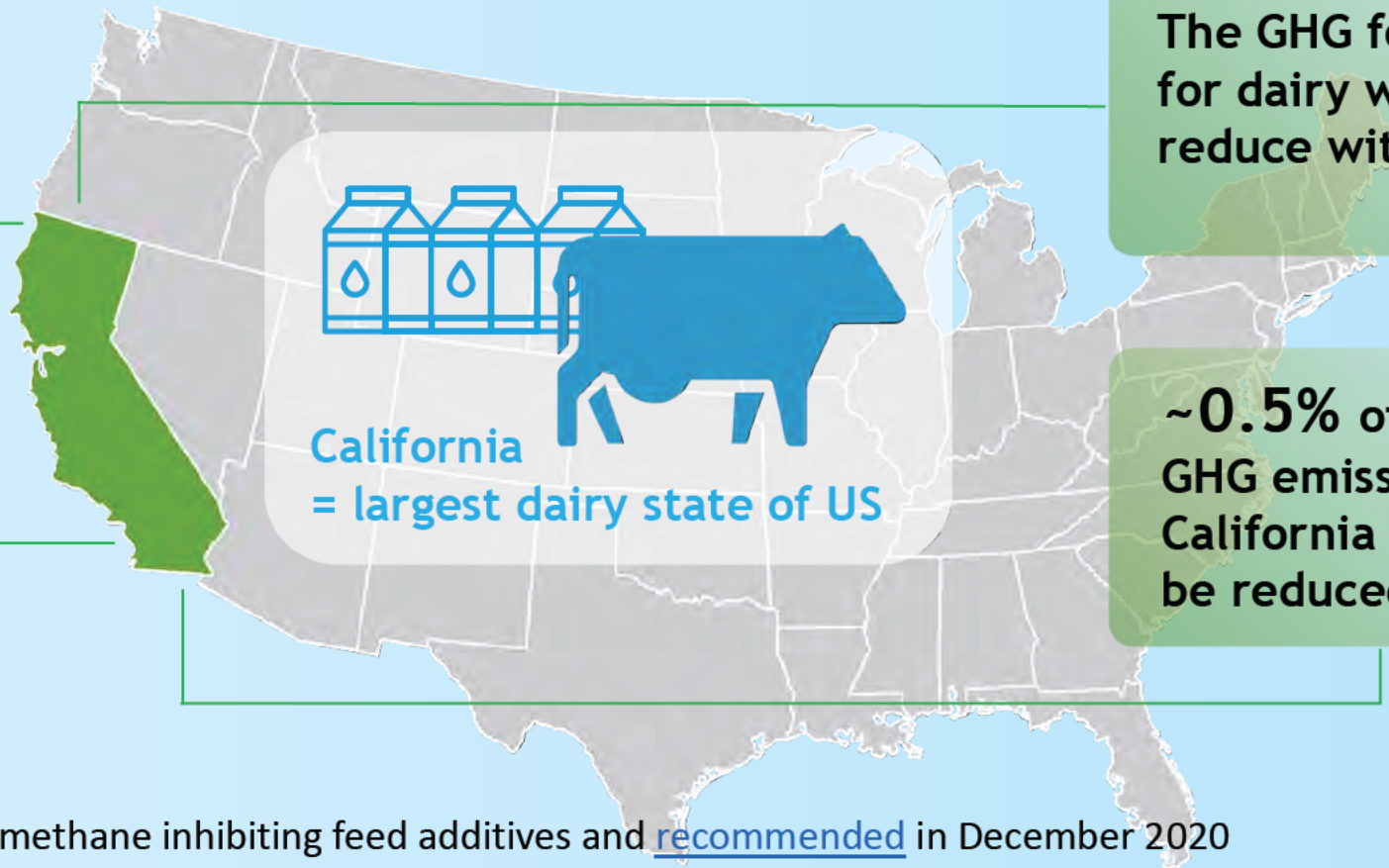
Latin America
- 1 beef and 1 dairy trial
- Up to 55% methane reduction
- Preparations for registration in Mexico and Brazil ongoing

UC Davis assessed the emission reduction impact of feed additive use in Californian dairy cattle (Feng X, Kebreab E (2020))

If Bovaer® is used by all Californian dairy cows (1.73M):

~38% of enteric methane reduction can be achieved

2.33 billion kilos of CO_2eq would be saved



The GHG footprint for dairy would reduce with **12%**

~0.5% of total GHG emissions in California would be reduced

In addition, UC Davis assessed all methane inhibiting feed additives and recommended in December 2020 to the State of California Air Resources Board that Bovaer®/3NOP has the highest potential impact (pending FDA approval)

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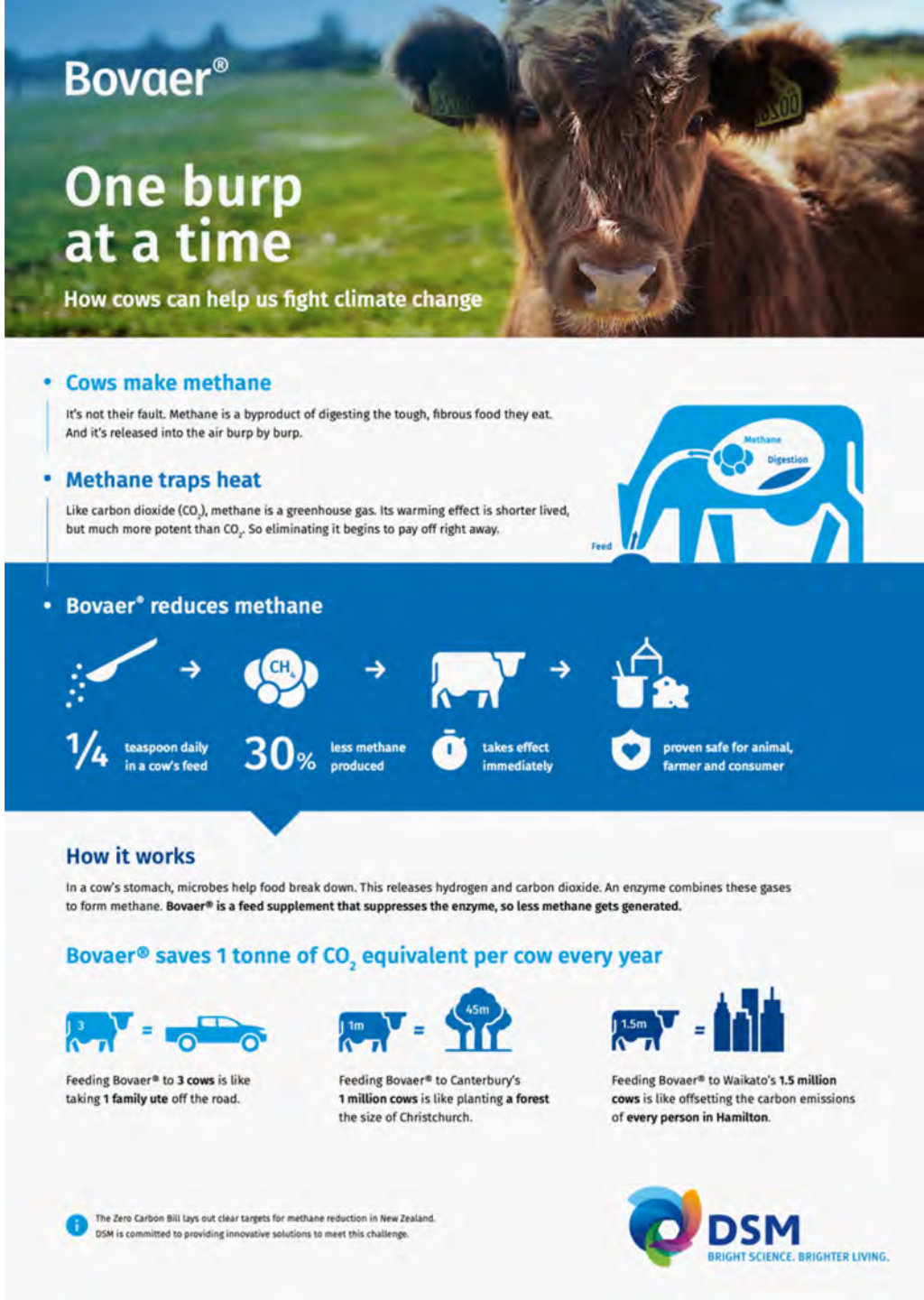
Bovaer®'s benefits resonate with consumers

- Consumer research conducted in New Zealand and United States (n= 2400 consumers)
- >50% of consumers express a *greater* interest in purchasing their usual brand if the dairy product was sourced from a farm which uses Bovaer® (with >40% being neutral)
- Nearly 70% of interviewees think dairy farmers should use Bovaer® (with 23% being neutral)
- 70% indicate a willingness to a pay premium
- Research on communication concepts showed consumers agree Bovaer® is an opportunity to take action on climate change together



Feed additive approval important for long-term success of agriculture sector to credibly lower the footprint

Full-fledged assessment by the European Food Safety Authority

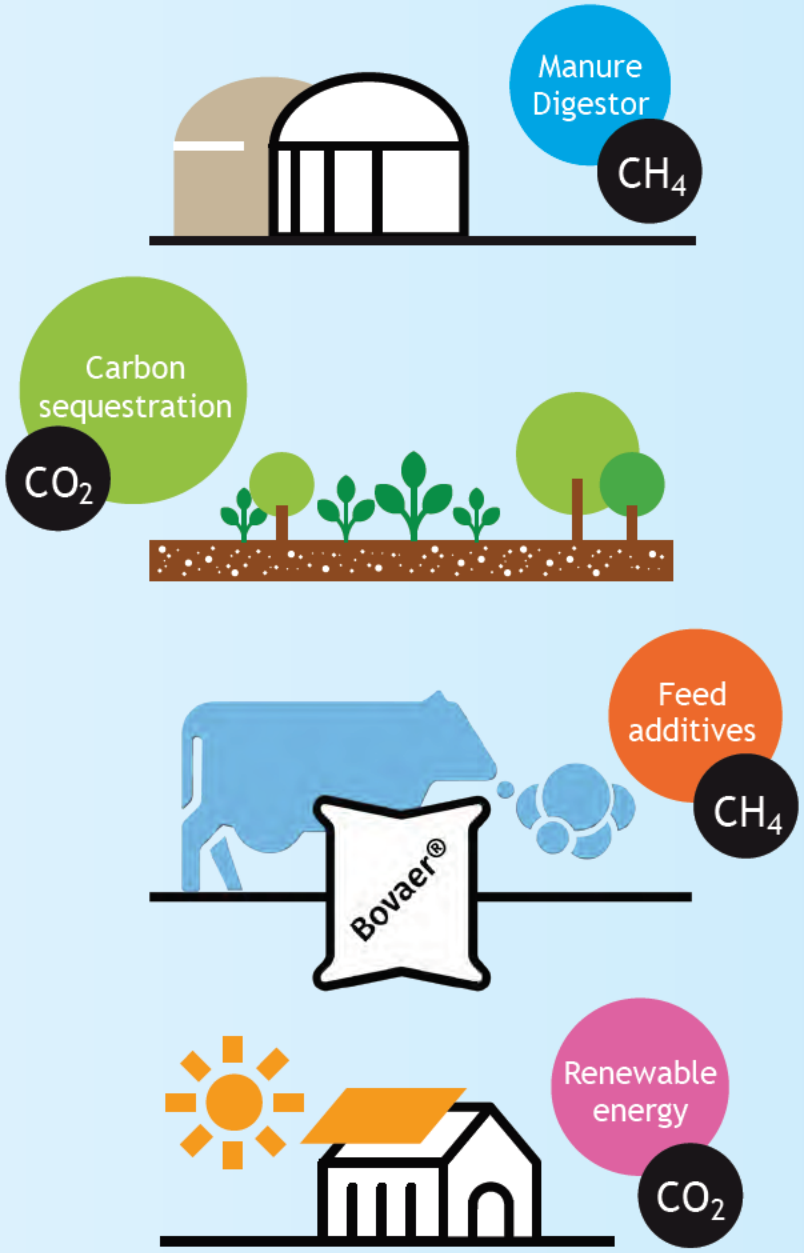
- Public and scientific summary
- Identity, characterization and condition of use
- Safety studies (target species, consumer, environment and worker)
- Efficacy of the additive
- Post-Marketing Plan

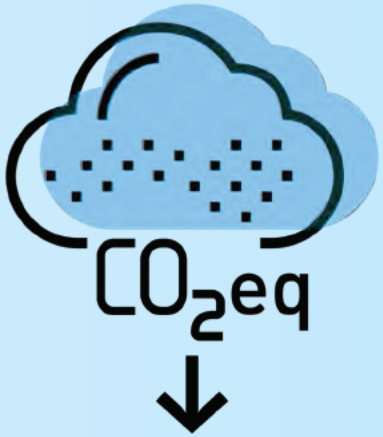
And then by the EC Standing Committee on Plants, Animals, Food and Feed

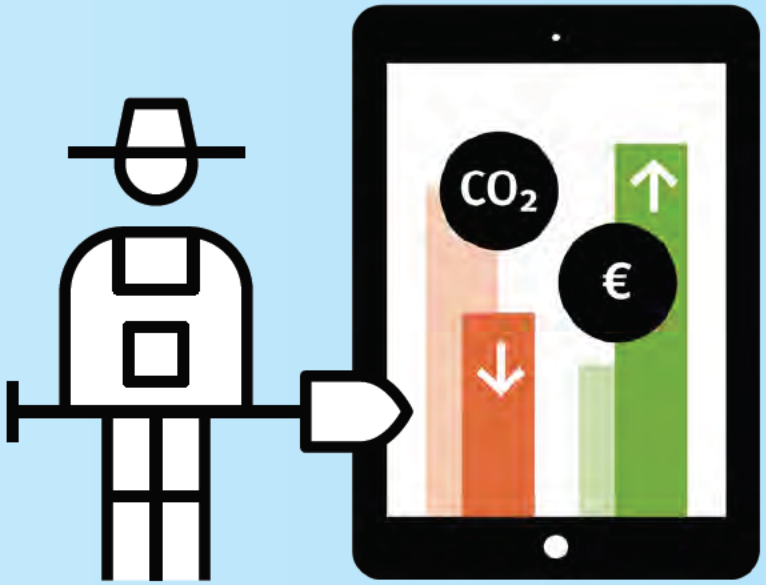
Long-term success for agriculture and the planet

- Absence of safety concern (for the consumer, the animals, the environment and the workers and farmers)
- Efficacy validated
  - Confidence of farmer that product works
  - Enhances ability to credibly track and account for savings
  - Trust with consumer that farmer has indeed lowered footprint
  - Ability to establish financing systems

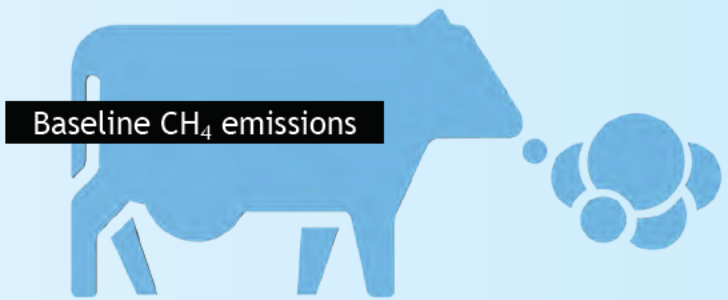
Carbon Farming: variety of tools available to reduce GHGs on-farm







Carbon Farming:
methane (CO2eq) inhibiting feed additives



Gold Standard

Incorporate the impact of the:
- → Type of ration
- → Methane inhibiting feed additive
- → Herd size
- → GWP
- → Production & transport additive

x tons CO_2eq emission reduced

Measure CO2eq reduction:
Gold Standard methodology: third party verified method to quantify reductions of emissions from enteric fermentation via the application of feed additives.

Reporting and verification, by combining:
1. Scientific knowledge on the correlation between nutrition and methane;
2. Proof of efficacy and safety of feed additive (EFSA approval);
3. Proof of use.

Recognize and reward farmer

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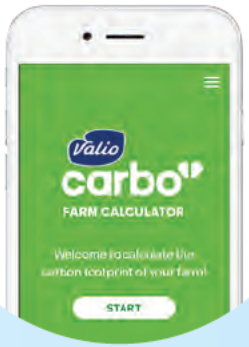
Carbon Farming:
digitizing a farm's carbon footprint



KRINGLOOP WIJZER

CAP'2ER®

FrieslandCampina launches the world's first tailor-made sustainability tool for member dairy farmers

FrieslandCampina is the first dairy co
tailor-made sustainability tool for its
dairy farmers. The online tool which
them in further improving their susta
management.

ARLA NOW ALL OUR BRANDS INSPIRATION SUSTAINABILITY COMPANY

Press release

Arla farmers will use big data to accelerate journey towards carbon net zero

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Bovaer®

One burp at a time

How cows can help us fight climate change

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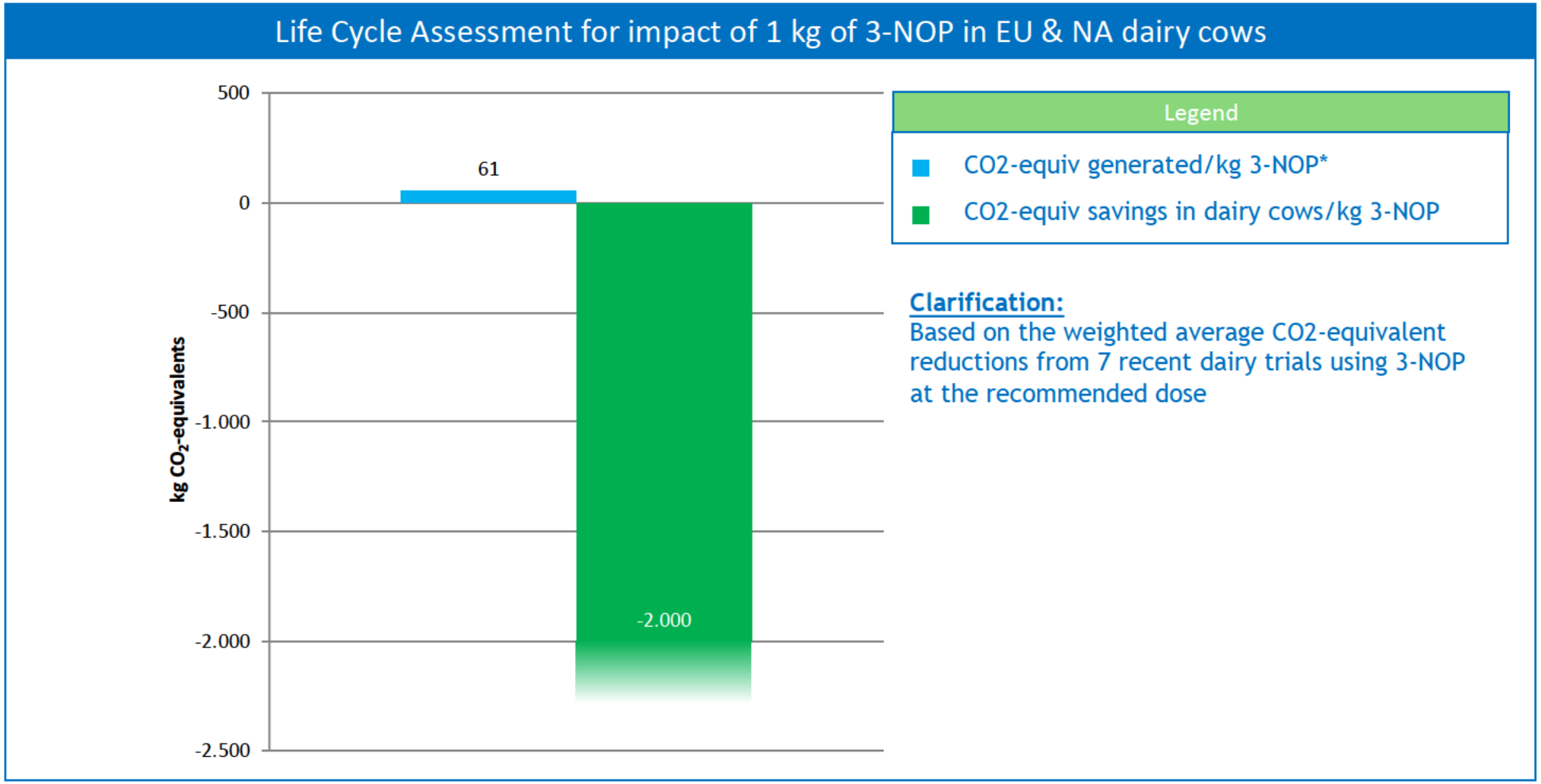
Using 1 kg of 3-NOP in EU & NA dairy cows prevents emission of 2.000+ kg of CO2 equivalents into the atmosphere



Source: DSM

*Calculation: SimaPro 8.0.5.13, method: IPCC GWP 100a, according to DSM SHE-policy