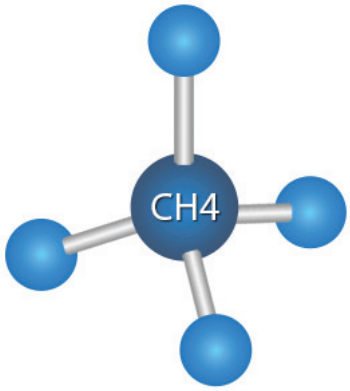
ProAgni

TECHNICAL DATASHEET

Methane
Not just hot air.

Where does methane come from?

Methane is a natural gas that's produced by microbes through the process of anaerobic (devoid of oxygen) fermentation. All plant material is composed of three essential elements- Carbon, Hydrogen and Oxygen that are linked together in numerous ways to build either simple or complex sugar molecules.



The process of 'microbial fermentation' in the rumen breaks up these molecules and reassembles them into other compounds such as short chain volatile fatty acids (VFA) and methane (CH4). Varying species of microbes build these compounds. Microbes that use the available Carbon and Hydrogen to produce methane are known as 'methanogens'.

From an agricultural perspective there are a few sources.

Ruminants - Sheep, cattle, goats, deer... are foregut fermenters; this means that they have a specialised sac in the first part of their digestive tract that's home to a massive population of microbes (bacteria, archaea, virus, fungi, protozoa). This microbial population is responsible for the primary breakdown of plant material when ingested by the animal. This breakdown process releases energy (VFA's) and protein for the animal. Up to 80% of total energy and protein requirement for the animal is obtained this way. The activity and efficiency of the microbial population is directly related to the composition of the feed. The less digestible, higher fibre and lower starch-based diets result in more methane being produced. The methane that's produced is primary released through the mouth, not the back end of the animal.

So, in summary the animal does not produce methane, it is the bugs in the gut that do.

Manure piles and effluent ponds - Two areas are where the right environment exists for methanogens to thrive. They have a ready supply of carbon and hydrogen in the manure, and an anaerobic environment.

Aquatic plant production (e.g. Rice) - The process of growing rice in flooded paddy's is also responsible for methane emissions from the agricultural sector. Again, readily available sources of carbon and hydrogen from plant materials, and the ideal anaerobic environment created by the flooding.

What is the impact of increased atmospheric methane?

Methane is a highly effective compound to trap heat. "Free" methane that accumulates in the atmosphere acts like a blanket, resulting in global warming. This warming may decrease potential crop yields by 15% and increase the rate of respiratory and cardiac disease in humans. While the impact of methane is extremely negative, it has a relatively short life span in the atmosphere, about 12 years. This means that if we act now, we can create meaningful change in our industry within a relatively short time. Leaving the environment in better shape for the generations to come.

While the impact of methane on the atmosphere is significant, it also needs to be considered from a farm

input viewpoint. The loss of methane into the atmosphere is a loss of net energy from production systems. Producers pay a price for that loss of production efficiency. These losses are between 4%-15% of total feed energy, depending on feed type and efficiency of fermentation. Reducing methane can help to capture and divert that energy into increased production without increasing feed costs.

How much methane do ruminants release?

Methane production from ruminants is typically measured as grams of methane produced per kilogram of dry feed consumed. The amount of methane varies according to the feed type that the microbiome is being supplied with.

System	Methane per kg/DMI	Daily CH_4 grams
Northern Tropical Pastures[3]	30.1	364.21
Temperate Grazing Pastures[7]	20.9	252.89
Feedlot[5]	13.1	157.2
Dairy[4]	21.1	548.6
Sheep[6]	20.9	33.85

Can I alter the amount of methane my animals release?

Through management and supplementation you can directly impact methane output from your animals today. Management strategies that decrease the time it takes to have an animal reach market will have a positive impact on overall methane output.

Strategies including:

- Yard weaning
- Yearling heifer joining and ewe lamb joining
- Confinement feeding in drought to control gross energy requirements
- Pasture improvement
- Grazing management

Supplementation is another powerful tool to minimise methane output. Supplements can work in two key ways; either improving overall diet composition and therefore improving efficiency or using supplements that specifically target the activity of methanogens.

High quality energy-dense supplements such as cereal grains help improve the overall efficiency of the rumen and deliver high concentration feeds which decrease overall dry matter consumption (on a daily basis) and therefore decrease methane output. They also cause ruminal pH to dip into a more acid state, interestingly methanogens struggle to be active once the ruminal pH is close to 6- just remember acidosis can be a risk.
A high quality premix like ProTect® C or S will help manage ruminal pH within safe parameters.

The alternative is to use supplements that contain ingredients than can change the activity and fermentation by-products of the ruminal microbiome, and potentially increase efficiency of the rumen. Some essential oils, yeast extracts and plant lipids have all shown impacts on the mitigation of methane. ProAgni loose licks and our ProTect® product range contain all of these mitigating substances.

Estimated Energy Use and CH_4 Emissions by Steers Slaughtered at 550 kg Liveweight.

Slaughter weight (kg)	Age at slaughter (years)	Annual LWG (kg)	Energy requirements for maintenance (%)	Energy requirements for growth (%)	Lifetime CH_4 Production (kg)
550	5.3	100	80	20	301
550	2.5	200	68	32	167
550	1.5	365*	48	52	60

*non-roughage diet
(adapted from Hunter and McCrabb, 1998)

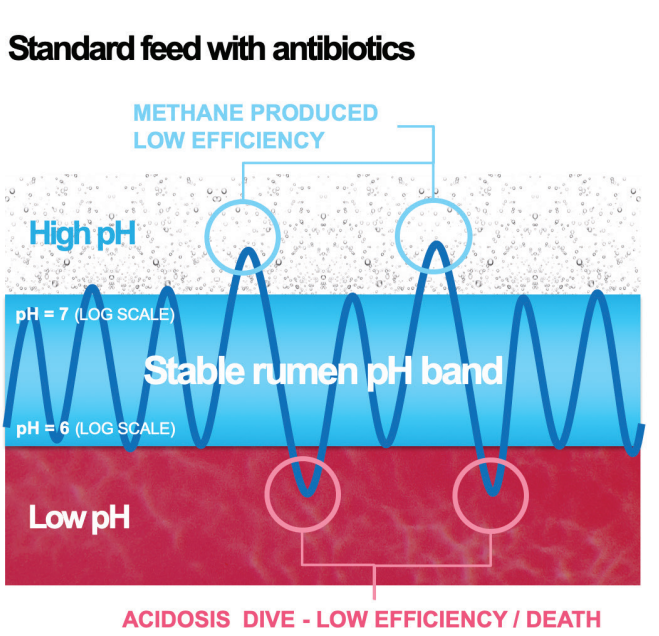
What's ProAgni doing now to reduce methane production NOW?

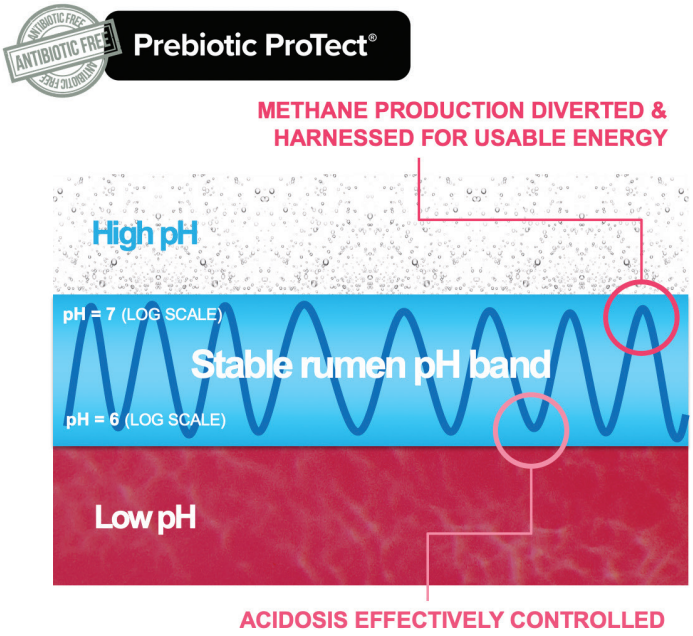
ProAgni has developed methane products and systems that can be implemented by livestock producers today. Our core focus is animal health and welfare; working towards enhancing the economics of production. ProAgni patented technology contains ingredients, certified by The Carbon Trust, as methane reducing and work to stabilise fermentation within the animal.

Through the use of real-time remote monitoring equipment in livestock, we have been able to measure ruminal fermentation trends (based on pH readings) over long periods of time.

This data (UNSW Trial 2017) has conclusively shown that the ProAgni ProTect range of products help maintain stability of ruminal pH. This insight has shown that by reducing the fluctuations in ruminal pH animals can be fed safely and decrease methane production at the same time.

As can be seen below, staying within the boundaries of stable ruminal pH results in more efficiency, higher levels of animal safety and welfare and a decrease in the GHG foot print.





References

1. Methane emissions from cattle production – Issues in meeting the Kyoto targets. JohnRolfe*and VeronikaZeil** Paper presented at the 45th Annual Conference of the Australian Agricultural and Resource Economics Society 22nd – 25th January 2001 Adelaide, South Australia Stamford Plaza Adelaide *Faculty of Business and Law, Central Queensland University, Emerald QLD 4
2. ECONOMICS OF REDUCING METHANE EMISSIONS FROM CATTLE PRODUCTION IN CENTRAL QUEENSLAND Project number NAP3.226. Final Report prepared for MLA by: Dr John Rolfe Centre for Primary Industried Research Central Queensland University Emerald QLD 4720 Meat and Livestock Australia Ltd Locked Bag 991, North Sydney NSW 2059. ISBN 1 74036 218 7 June 2001
3. Comparison of open-circuit respiration chambers with a micrometeorological method for determining methane emissions from beef cattle grazing a tropical pasture. Author links open overlay panel N.W.TomkinsaS.M.McGinnbD.A.TurnercE. Charmleya1
4. Reducing the carbon footprint of Australian milk production by mitigation of enteric methane emissions . Peter J. Moate A D , Matthew H. Deighton A , S. Richard O. Williams A , Jennie E. Pryce B , Ben J. Hayes B , Joe L. Jacobs A , Richard J. Eckard A C , Murray C. Hannah A and William J. Wales A + Author Affiliations . Animal Production Science 56(7) 1017-1034 https://doi.org/10.1071/AN15222. Submitted: 30 April 2015 Accepted: 21 June 2015 Published: 15 September 2015
5. Methane emissions from feedlot cattle fed barley or corn diets. K A Beauchemin 1, S M McGinn. Affiliations expand PMID: 15705762 DOI: 10.2527/2005.833653x
6. Methane emissions from sheep fed fresh pasture S Muetzel & H Clark. Pages 472-489 | Received 02 Feb 2015, Accepted 28 Aug 2015, Published online: 30 Nov 2015
7. Feed intake and methane emissions from cattle grazing pasture sprayed with canola oil. Author links open overlay panelC.S.Pinares-PatiñoabF.E.FrancobcG.MolanobH. KjestrupbE.SandovalbS.MacLeanbM.BattistottibJ.KoolaardbJ.Laubachd