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Methane: cows, hydrogen and the future of the Arctic

8 MIN READ

RADAR

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Welcome to Regnan 'Radar', a new range of short-form documents providing information on relevant topics. We hope you find these 'quick reads' informative, relevant and digestible.

Key take-aways

While much attention in the climate change and decarbonization debate has rightly centered on carbon emissions, methane is starting to come into focus and face tighter scrutiny – methane accounts for 23% of greenhouse gases, the largest contributor to climate change after carbon dioxide.[1]

Half of methane derives from human activity, which means that corrective actions can have fast and large-scale benefits.

Most of the solutions already exist and can be deployed at scale, with many providing both environmental benefits and cost savings:

- Leak detection and reduction measures in existing gas infrastructure can help make blue hydrogen a credible low-carbon solution.
- Emissions from animal farming can be reduced through better capture and conversion technologies in manure and feed additives. Switching to plant-based diets would also bring benefits.
- Innovations within the waste management sector are diverting more waste away from landfills.

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[1]Global Carbon Project, https://www.globalcarbonproject.org/methanebudget/20/files/GCP_MethaneBudget_2020_v2020-07-15.pdf

Methane emissions: a climate wildcard

There is often a misunderstanding when talking about carbon emissions. Carbon emissions do not just come from carbon dioxide; carbon is an omnipresent molecule that finds partners very easily – which makes it the source of the problem. Methane, for example, comprises one carbon and four hydrogen molecules (CH_4) is another key greenhouse gas.

While methane is not as plentiful as carbon dioxide, it has a very high warming potential. Over a period of 100 years, CH_4 has a global warming potential 28 times larger than CO_2 on a molecule by molecule basis. Over shorter time frames, this warming potential compounds to much higher levels.

As carbon dioxide emissions are being tackled, methane's contribution will become more apparent as it becomes a larger share of the mix. Already methane emissions have been growing much faster than scientists expected.

Humanity's influence

Methane's natural cycle is heavily influenced by human activity. About 50% of methane derives from human activity (anthropogenic).[2]

Natural sinks such as soils absorb a significant proportion of carbon dioxide. They do the same for methane, but these are not enough on their own. Excess methane is accumulating in the atmosphere, contributing to climate change. This imbalance needs to be addressed.

The largest source of anthropogenic methane is agriculture, representing about 20% of emissions. Rice fields are a big source. So too is animal farming, particularly enteric fermentation by cows - the process by which carbohydrates are broken down by microorganisms into simple molecules for absorption into the bloodstream – and manure. Fossil fuels are responsible for another 17% while landfills represent 8%.

These statistics represent the methane cycle today. These could change dramatically as a result of climate change. The wildcard within this system is permafrost. Thawing of permafrost leads to decomposition of materials which generates methane. While this represents a small fraction of emissions currently, global warming could lead to a great increase in emissions.

The Arctic is particularly exposed as global warming is not evenly distributed. Temperatures in the Arctic region have been increasing at double the global average rate – what scientists call "Arctic amplification".[3]

Because methane has a short atmospheric life, and the extent of human interference on its natural cycle, rapid action now can quickly reduce atmospheric concentrations.

[2]Ibidem.
[3]US National Oceanic and Atmospheric Administration, https://www.climate.gov/news-features/featured-images/2020-arctic-air-temperatures-continue-long-term-warming-streak

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Why decarbonization needs a methane strategy

A substantial part of anthropogenic methane emissions comes from natural gas production. While it has long been discussed as a transition fuel, recent research has raised doubts about the environmental merits of natural gas including due to leakages throughout the natural gas supply.

Fixing this issue matters for three reasons. First, the transition to renewable energy is one of the strongest drivers of methane emissions abatement.

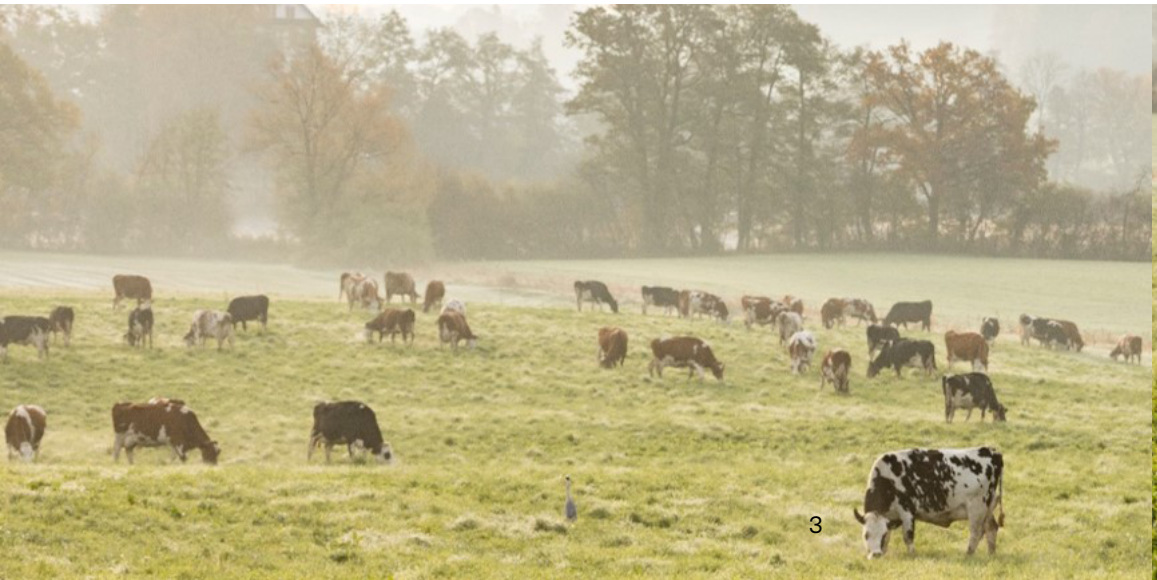
But even with renewable energy industries scaling up at increasing speed, the transition will take time. Bloomberg New Energy Finance forecasts renewable energies will not reach 50% of global electricity generation before the late 2040s.[4] In the meantime, reducing the lifecycle footprint of existing natural gas-fired power plants by addressing emissions from methane leakages is helpful.

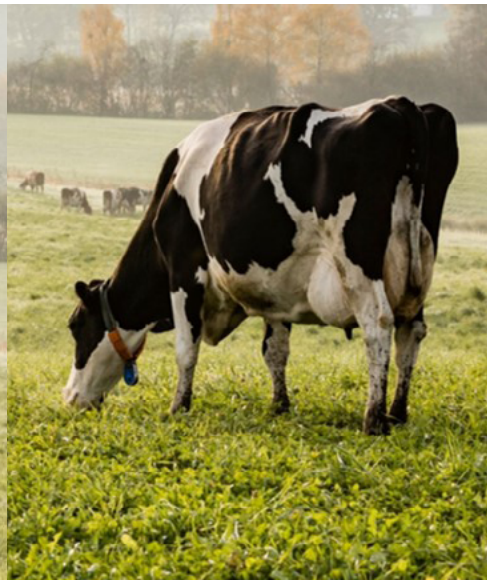
Second, while renewable sources such as wind and solar will be the dominant sources of electricity in the future, most energy transition scenarios include some gas combined with carbon capture and storage as back-up capacity in order to balance grid networks. In this case, investment now in reducing methane leakage in natural gas production will continue to provide benefits into the future.

Third, electrification is unlikely to cover all energy needs. Some will have to come from molecules, not electrons, which brings in the potential for hydrogen. 'Green' hydrogen can be produced using renewable energies, but this does not make sense in all regions, notably due to water scarcity, an issue explored in more detail in our "*H_2 beyond CO_2*" report. Therefore some of the required hydrogen will need to be "blue hydrogen", produced using natural gas as a source fuel coupled with carbon capture and storage. Addressing fugitive emissions (leaks and other irregular releases of gases or vapors from a pressurized containment such as pipelines) can help make blue hydrogen a credible low-carbon solution.

The ramifications of humanity's impact on the methane cycle go beyond energy production. Agriculture is a large source of methane, with livestock and rice fields being the main culprits. Both these sources continue to grow rapidly as we seek to feed a growing global population. Emissions from these and other related activities will need to be addressed.

[4]Bloomberg New Energy Finance, New Energy Outlook 2020, https://www.bnef.com/insights/24509/view





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Solutions are ready and need to be scaled up

Methane emissions are not an intractable problem. Technical solutions already exist today. The Global Methane Assessment, provided by the United Nations, is a useful roadmap. Overall, just over 50% of available measures have cost benefits – the measures pay for themselves quickly by delivering cost savings.

Detecting fugitive emissions is a prerequisite. For a long time the problem of methane emissions was underestimated, because it was not adequately measured. Innovative methods are being developed to accurately measure fugitive emissions. Infrared cameras have become the most widely adopted technology. Satellite imagery is increasingly used as well. This has been the foundation of some of the recent reassessments of the emissions footprint of natural gas, with studies suggesting that US natural gas leakages may have been underestimated by as much as 60%.[5]

Avoiding methane emissions is, of course, the best option when it is technically and economically feasible, for example, by renewable energies displacing fossil fuel-based power generation.

Innovations within the waste management sector are diverting more waste away from landfills. However, for existing landfills, reducing fugitive emissions can be achieved with equipment upgrades and capture technologies.

Landfills across the globe are increasingly being equipped with methane capture and purification technology, which enables methane to be used as renewable natural gas.

Targeted measures	
Fossil fuel sector (oil, gas and coal)	**Upstream and downstream leak detection and repair.**
	Recovery and utilization of vented gas: capture of associated gas from oil wells; blowdown capture; recover and utilization of vented gas with vapor recovery units and well plungers; installation of flares.
	Improved control of unintended fugitive emissions from the production of oil and natural gas: regular inspections (and repair) of sites using instruments to detect leaks and emissions due to improper operations; replace pressurized gas pumps and controllers with electric or air systems; replace gas-powered pneumatic devices and gasoline or diesel engines with electric motors; early replacement of devices with lower-release versions; replace compressor seals or rods; cap unused wells.
Waste sector	**Solid waste management:** (residential) source separation with recycling/reuse; no landfill of organic waste; treatment with energy recovery or collection and flaring of landfill gas; (industrial) recycling or treatment with energy recovery; no landfill of organic waste.
	Wastewater treatment: (residential) upgrade to secondary/tertiary anaerobic treatment with biogas recovery and utilization; wastewater treatment plants instead of latrines and disposal; (industrial) upgrade to two-stage treatment, i.e., anaerobic treatment with biogas followed by aerobic treatment.
Agricultural sector	**Improve animal health and husbandry:** reduce enteric fermentation in cattle, sheep and other ruminants through; feed changes and supplements; selective breeding to improve productivity and animal health/fertility.
	Livestock manure management: treatment in biogas digesters; decreased manure storage time; improve manure storage covering; improve housing systems and bedding; manure acidification.
	Rice paddles: improves water management or alternate flooding/drainage wetland rice; direct wet seeding; phosphogypsum and sulphate addition to inhibit methanogenesis; composting rice straw; use of alternative hybrids species.

Additional beneficial measures	
Fossil fuel sector (oil, gas and coal)	**Renewables for power generation:** use incentives to foster expanded use of wind, solar, and hydro power for electricity generation.
	Improved energy efficiency and energy demand management: (residential) use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling, encourage rooftop solar installations; (industrial) introduce ambitious energy efficiency standards for industry; improve consumer awareness of cleaner energy options.
Waste sector	Reduced consumer waste and improved waste separation and recycling, improved sustainable consumption.
Agricultural sector	**Reduced food waste and loss:** strengthen and expand food cold chains; consumer education campaigns; facilitate donation of unsold or excess food.
	Adoption of healthier diets: decrease intake where consumption of ruminant products is above recommended guidelines.

Source: Global Methane Assessment.[6]

[5]Science, https://science.sciencemag.org/content/361/6398/186.full?ijkey=42lcrJ/vdyyZA&keytype=ref&siteid=sci
[6]Climate and Clean Air Coalition, United Nations, https://www.ccacoalition.org/en/resources/global-methane-assessment-full-report

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Avoiding a methane bubble

As discussed in our *Sustainable Food and Agriculture* report, switching to a plant-based diet may be an effective way of reducing one's methane footprint – as well as reducing water, carbon and biodiversity footprints. The impressive growth of plant-based protein, as evidenced by the rise of numerous companies providing an increasingly diverse choice of products, helps in this regard.

But while vegetarian and flexitarian diets are becoming more common, animal farming is likely to remain a large industry with a significant footprint.

Yet solutions are emerging. Additives for animal feed that reduce rumination are being commercialized. At the same time technology capturing methane from manure to make renewable natural gas is also being expanded.

Awareness of the need to address methane emissions is gathering momentum. International agencies are publishing more research highlighting the ramifications of methane abatement, which should ensure the issues remain prominent in stakeholders' thinking. Additionally, the Biden administration has announced plans to put stricter regulatory limits on methane emissions in the US. Regulation often drives adoption leading to practices that were commonplace in the past – such as venting of unwanted natural gas on oil fields or leaving landfills to leak methane – becoming unthinkable and uneconomic tomorrow.

There are reasons to be optimistic as solutions exist to effectively tackle this issue. Regulation is catching up and the economics will increasingly make methane management more attractive, which we expect to lead to attractive growth but also help tackle climate change.

Policy attention on methane emissions is accelerating. The European Commission adopted the EU Methane Strategy as part of the European Green Deal in October 2020. In the US, the Biden administration also included methane emissions as part of its decarbonization plans.

About Regnan

At Regnan we've been thinking forward and shaping the responsible investment movement since 1996 – long before it became mainstream.

2020 marked our expansion into funds management supported by the investment platform of J O Hambro and the Pendal Group. We've brought together proven sustainability and impact teams with track records tested through cycle, with the depth of insights provided by our engagement, advisory and research team.

Our collective purpose is to contribute to a more sustainable future by developing and promoting principled, rigorous and outcome-oriented approaches in responsible investment.

Client solutions sit at the heart of all that we do and are based on four key pillars:

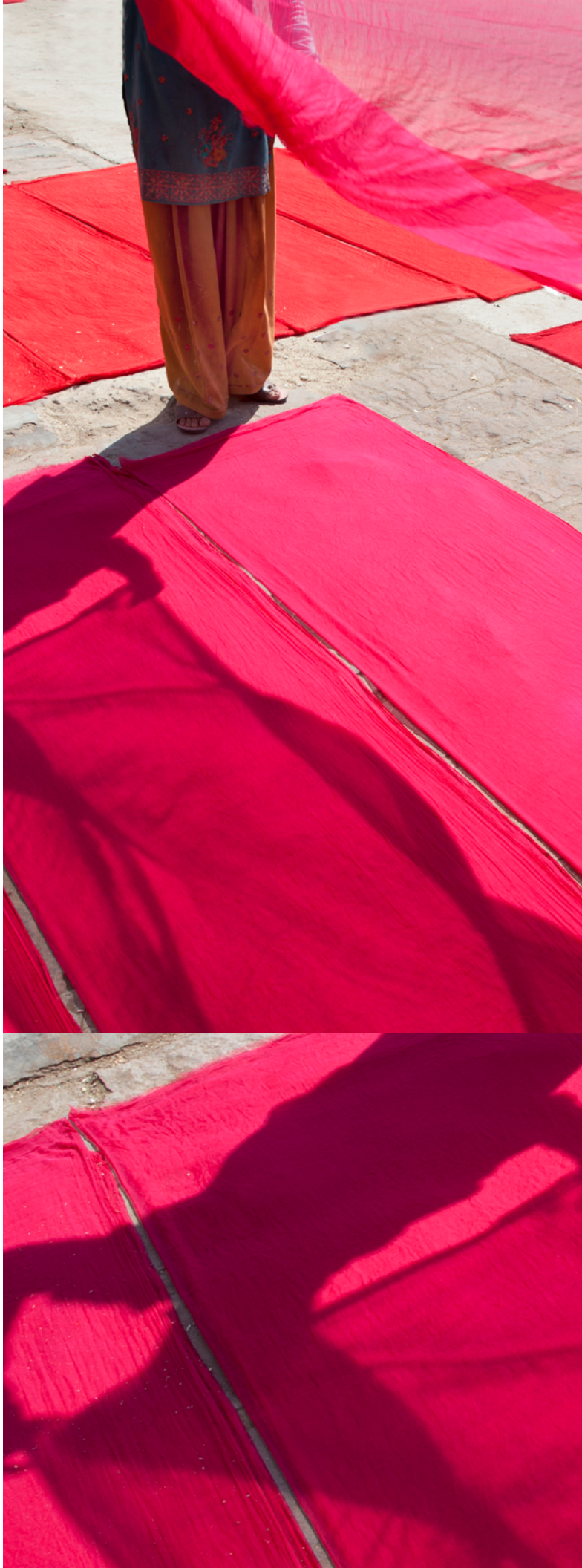
- Delivering our clients attractive investment returns; we aim to grow their real wealth over the long term.
- Understand the materiality of sustainability issues to deliver improve decision-making and real world outcomes.
- Creating differentiated, innovative strategies that serve a purpose in client portfolios.
- Our strategies are authentic and provide significant exposure to underlying sustainability opportunities.

Regnan Global Equity Impact Solutions

The Regnan Global Equity Impact Solutions strategy is a solutions-first approach, focused on investing in mission-driven businesses that address underserved environmental and social challenges and deliver real, systematic change for the better. It is a high-conviction, global, multi-capitalization portfolio with low turnover and a strong emphasis on driving impact by engaging companies to improve measurable outcomes.

Regnan Sustainable Water and Waste

Our Thematic Investing team joined Regnan in April 2021 and launched the Regnan Sustainable Water and Waste Strategy in September 2021. Combining exposure to both water and waste-related companies makes this strategy a distinctive thematic investment proposition with diversification benefits.



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