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Background Overview

In light of recent reports that global monthly average temperatures have been record highs for ten consecutive months[1], indicating a possible breach of the target to limit global average temperatures to below an increase of 1.5°C above pre-industrial levels, the UK and all nations should do whatever can be done to reduce all greenhouse gas emissions. This includes not only carbon dioxide, but also methane which a more powerful greenhouse gas[2] and has been the cause of significant warming since the industrial revolution. Jones *et al* (2023) state that UK per capita methane emissions in 2022 were approximately 25% of the 1990 CO_2eq levels. The European Environment Agency (EEA) (2022) claims that the EU has seen a 36% reduction over the same three decades and that for 2020 methane constituted 12% of their GHG emissions In 2022 methane was still responsible for 14% of the greenhouse gas emissions by the UK[3]. So, reducing emissions further will help to make it possible to achieve net-zero. However, this is not a given as the UNEP (2022) emphasizes: there is a significant gap between the estimated GHG emissions based on nationally determined contributions (NDCs) and total GHG emissions. The UNEP (2021) says that reducing global methane by 40% would be the most cost effective way to achieve internationally agreed targets to according to Hardy and Benton (2023). However, some caution must be used when using data and potential reduction benefits. As van der Veen *et al* (2022) point out using EU data from the EEA: the total methane emissions in the EU were 15.2 Gkg in 2019, which was approximately 5% of the global anthropogenic methane emissions, but comparing the greenhouse effect of methane with carbon dioxide needs to take account of the timeframe over which the gases are in the atmosphere. As van der Veen *et al* continue:

[1] Data from Copernicus accessed online 10-4-24. Available from: https://climate .copernicus.eu/Copernicus-march-2024-tenth-row-be-hottest-record

[2] Lopez *et al* (2023) quote the IPCC sixth assessment report that methane has a warming potential 83 times higher than carbon dioxide over a twenty year period.

[3] 2020 UK Greenhouse Gas Emissions, Final Figures (publishing.service.gov.uk)

This amounts to about 10% of greenhouse gas emissions in the EU in 2019 when applying the conventional 100-year global warming potential factors. If a 20-year time period is considered, it is more than 30% of EU GHG emissions[4] .

This 20- or 100-year calculation method must be interpreted carefully as figures and claims can be misleading unless clarified and used transparently. Nevertheless, there is solid evidence that cutting methane emissions will significantly help in reducing atmospheric GHG levels, which may in turn help to limit global warming and climate change.

A further reason or co-benefit to reducing methane emissions is that atmospheric methane contributes towards the formation of tropospheric ozone. This ozone has been linked as being responsible for reducing crop productivity and increasing incidences of asthma, lost days from work, and years of life lost.

The main industries resulting in anthropogenic methane emissions include agriculture, fossil fuel extraction and waste management. UNEP (2021) global data indicate that methane emissions arise from:

- 12% from municipal solid waste
- 8% from waste water
- 46% from agricultural sources including livestock and rice cultivation
- 23% from oil and gas extraction
- 12% from coal mining

The UK may boast a 62.5% reduction in methane emissions since 1990, but this is in part due to the reduction in coal mining and a shift away from fossil fuel use in electricity generation in the UK rather than purely due to specific policies to reduce methane. Clearly as oil and gas extraction results in approximately a quarter of anthropogenic methane emissions then reducing leaks, venting and capturing methane is most advisable as recommended in many reports such as Lopez *et al* (2023), Whitehouse (2021) and European Environment Agency (2022), and similar proposals are included in the People's Republic of China Methane Emissions Control Action Plan (2023).

[4] Using a GHG emissions volume in the EU-27 in 2019 of 4,067 Mton CO_2-eq., a GWP100 of methane of 28, and a GWP20 of methane of 86.

According to the Climate Change Committee (2020) agricultural emissions relevant to the UK include enteric fermentations and manure waste, in addition those from municipal waste and fossil fuel extraction. This papers reviews some of the evidence of these sources of emissions, how they can be monitored and makes some suggestions to help reduce the methane emissions. This is in response to the House of Lords Environment and Climate Change Select Committee's call for written evidence as part of the *Methane Inquiry,* which poses several questions. This paper only addresses some of these questions under the headings of:

- International commitments
- Data, measurement and monitoring
- Agriculture
- Waste and waste management
- Fossil fuels

International commitments

The UK has seen substantial reductions in methane emissions relative to other countries over the last 30+ years. The country took a lead as being one of the first signatories to the Global Methane Pledge and used its time during the presidency of the G7 to promote the reduction of methane emissions. Now the UK should be closely scrutinizing the Methane Emissions Reduction Plans from other countries like USA and China in addition to those from economic regions such as the EU and ASEAN to see if there are policy instruments being used by others that would benefit the UK.

Data, measurement and monitoring

There are an increasing number of satellites that monitor methane emissions around the globe. They have different resolution abilities and tracking periods. This data is becoming more and more available to the general public and can identify point source emissions such as gas venting and leaks but is less able to identify or pinpoint more diffuse sources such as those from agricultural settings. These include GHGSat, Tropomi and more recently Google as outlined by Kleinman (2024). It has been seen that middle secondary school are able to master using satellite data to generate maps. A group of students mastered the use of UN Biodiversity Lab

to create maps, visualise and analyse spatial data from NASA Landsat, MODIS, VIIRS and SRTM datasets[5]. The user-friendliness of the software makes it accessible to a range of abilities. Therefore, with simple training, local community groups and councils could be able to monitor the methane emissions in their localities and areas of interest. Empowering local people to monitor their own environment for unhealthy pollution sources and leaks will help them to raise concerns with environmental and health agencies so that prompt action be taken to limit emissions.

Agriculture

Skuce (2022) lists several diseases in cattle and sheep that have negative impacts on methane emissions. This suggests that keeping animal health at the forefront of farmers minds will not only improve the quality and quantity of their produce but also help reduce GHG emissions. Mason *et al* (2021) note that depending on whether GWP100 or GWP20 accounting is done then enteric fermentation accounts for 38% or 56% respectively and waste and manure management are 8% or 13% of total agricultural emissions. Interventions include (but are not limited to):

- additives to ruminant animal feeds, which have included natural such as seaweed or biochar and synthetic such as 3-nitroxyproponol or propionate precursors like fumaric acid. These have varying claims of GHG reduction potential and may have associated productivity, health and food safety impacts.
- Low cellulose diets of more starch and less fibre can lead to higher production per animal
- Livestock breeding as is now underway in New Zealand and reported by Rykers (2023)
- Slurry store covers are one of the most cost effective options to reduce methane emissions

van der Veen *et al* (2022) emphasise that there is a degree of latitude between low and high estimations of the potential of different measures to reduce methane emissions in agriculture. This includes:

[5]This is an example of citizen science as encourage by Waller, A.R. (2023) who ran an after school activity "Satellite Imaging Club" for school students from September to December 2022. The students followed and completed the Learning for Nature UNEP micro-course *Using Spatial Data for Biodiversity.*

- feed changes and additives 1% - 12%
- selective breeding 3% - 8%
- changes in manure management 4% - 7%

However, by far the greatest reduction is estimated by consumer adopting healthier diets (30% - 38% reduction in overall methane emissions). They classify an advised diet as constituting 52% less pork, 49% less beef and 25% less dairy. These figures are wide open to interpretation as it depends what is used to replace these reductions and whether the overall farm to plate GHG emissions is reduced by these dietary changes. Nonetheless, it is reasonable to assume that there are many co-benefits to adopting more sustainable diets. This also links to what the Dimbley Report says about systemic food waste, if there was less systemic food waste there would also be less waste from many agricultural sources. Therefore, less methane emissions overall.

Waste and waste management

As landfill sites are being filled most aerobic decomposition of organic materials (including paper, cardboard, textiles, wood, garden and food waste) produces carbon dioxide. However, whilst materials are buried and sites are sealed once full the anaerobic breakdown produces a variety of gases including methane in the mix. Although methane could be trapped and used for the generation of electricity, it is not straightforward to manage and therefore can pose a public health risk for several years.

A quick search of the UNEP International Methane Emissions Observatory data shows a number of emissions within Southeast England and the North Sea between October 2020 and February 2024. According to 2023 BBC Radio 4 programme *Buried* 34 million tonnes of UK waste passes through criminal hands every year. In an interview on the podcast Dr Ray Purdy stated that there was satellite evidence of vast numbers of illegal dump sites in the UK[6]. This data is in a report by Purdy and Crocker (2021).

[6] Ray Purdy was interviewed in episode 6 of *Buried*: the BBC radio podcast can be accessed online at: https://www.bbc.co.uk/programmes/m001hp0d

Purdy and Crocker (2021) report that approaching 2 million of tonnes of waste is illegally dumped at various sites around the UK. They continue claiming that nearly two-thirds of businesses offering to handle waste are not registered to do so. If these reports are verified, then it is a reasonable assumption that there will be associated methane emissions at these locations. Whether the extent of these diffuse methane emissions are detectable by satellites remains to be seen. However, once sites are identified other technologies such as drones or fence monitors are available for determining the cocktail of pollutants being released. This will explain *in part* why emissions of waste have remained static, and more worryingly may reveal that actual levels of methane from waste are higher than estimated. Either way, "burying our heads in the sand" and pretending that illegal dumping is not a major socio-environmental issue in the UK won't resolve the problem.

If an ordinary member of the public wants to report illegal dumping they may not find it straightforward to report. A Google search of where to report dumping leads to the UK government GOV.UK Waste management[7] advice which links readers to local councils for fly tipping and also to the charity Crimestoppers for more significant waste crime. Crimestoppers state that they cannot process reports of fly-tipping. However, councils are only responsible for their own lands. The East Devon council recommends that for large scale fly-tipping people should contact the police or the Environment Agency. The Environment Agency *Report an environmental incident* webpage has some useful links to find registered waste sites and transporters in your area. However it says that you should only report incidents at Environment Agency-regulated sites to them, and to contact Crimestoppers for any other or anonymous reporting. At this point the search for an interested department begins to have the appearance of going in circles. How many people just give up the trail at this point before getting dizzy?

The process could be made much simpler and user-friendly. Furthermore, if people are reporting to various different district councils does the number of report and subsequent prosecutions and clear up procedures get reported to central

[7] Report fly-tipping or illegal waste dumping links are available online at: https://www.gov.uk/report-flytipping

government so that the scale of the issue can be addressed nationally? When Crimestoppers were contacted as part of the research for this written evidence they sent an automated reply, but as yet no details on the extent of reported waste crime. Since Crimestoppers are a charity, surely the government advice should be providing a direct link to the Environment Agency for reporting such environmental hazards such as illegal waste, sewage discharges or chemical leaks?

Fossil fuels

The Oil and Gas Authority (2021) *Emissions Monitoring Report* says that:

> Methane emissions comprise around 10% of [oil and gas] industry emissions on a CO_2 equivalent basis. Roughly half of these are associated with venting of natural gas. Most of the remaining methane emissions come from flaring, due to combustion inefficiency or cold flaring, where gas passes through the flare without ignition." *p*.8 Oil & Gas Authority

The North Sea Transition Authority (2022) *Emissions Monitoring Report* notes that:

- GHG emissions from upstream oil and gas activity accounted for 4% of net UK territorial GHG emissions in 2020 according to data from the NAEI.
- Methane emissions halved between 1990 and 2006 and have remained relatively flat at an average of 1.6 Gkg CO_2 per year.

According to the Offshore Energies UK (2022) *Emissions Report* there was a 36% reduction of methane emissions from this industrial sector. The Oil and Gas Authority report claims that the period from 2014-2020 saw a 57% reduction in flaring. Further reductions are planned through:

- reducing times from cold flaring to flaring
- managing methane slip
- reducing leakages

Lopez *et al* (2023) highlight that immediate action to curb methane emissions is:

- good for the climate as makes contributions towards achieving global warming targets,
- good for business as capturing methane can be sold and therefore often offsets costs,
- good for energy security as currently about 260 million m^3 of methane are lost to the atmosphere from the global oil and gas industries alone.

References

Collins, W.J., Webber, C.P., Cox, P.M., Huntingford, C., Lowe, J., Sitch, S., Chadburn, S.E., Comyn-Platt, E., Harper, A.B., Hayman, G., and Powell, T. (2018) "Increased importance of methane reduction for a 1.5 degree target" Environmental Research Letters 13: 054003 [Accessed online 20-3-24. Available from: https://doi.org/10.1088/1748-9326/aab89c].

Copernicus (2024) "March 2024 is the tenth month in a row to be the hottest on record" [Accessed online 9-4-24. Available from: https://climate.copernicus.eu/copernicus-march-2024-tenth-month-row-be-hottest-record].

Dimbleby, H. (2021) The National Food Strategy Independent Review: The Plan [Accessed online 21-6-23. Available from: https://www.nationalfoodstrategy.org/].

European Environment Agency (2022) Methane emissions in the EU: the key to immediate action on climate change Briefing Paper [Accessed online 20-3-24. Available from: https://www.eea.europa.eu/publications/methane-emissions-in-the-eu].

FAO. 2023. Methane emissions in livestock and rice systems – Sources, quantification, mitigation and metrics. FAO; Rome [Accessed online 14-3-24. Available from: https://doi.org/10.4060/cc7607en].

Hardy, L. and Benton, D. (2023) Why the UK should do more to cut methane emissions The Green Alliance Trust, London. [Accessed online 14-3-24. Available from: https://green-alliance.org.uk/wp-content/uploads/2023/08/Why-the-UK-should-do-more-to-cut-methane-emissions.pdf].

IEA (2024) EU Methane Regulations [Accessed online 20-3-24. Available from: https://www.iea.org/policies/18209-eu-methane-regulations].

Jones et al. (2023) – with major processing by Our World in Data. "Methane emissions" [dataset]. Jones et al., "National contributions to climate change". [Accessed online 14-3-24. Available from: https://ourworldindata.org/grapher/methane-emissions].

Kleinman, Z. (2024) "Google joins mission to map methane from space" BBC News 14 February 2024 [Accessed online 9-4-24. Available from: https://www.bbc.com/news/technology-68293896].

Króliczewska, B., Pecka-Kiełb, E., and Bujok, J. (2023) "Strategies Used to Reduce Methane Emissions from Ruminants: Controversies and Issues" Agriculture 13(3):602. [Accessed online 13-3-24. Available from: https://doi.org/10.3390/agriculture13030602].

Lopez, G., Ratner, B., Garcia, J., McCormick, J. and McMullen, B. (2023) The Methane Emissions Opportunity JPMorgan Chase & Co. [Accessed online 14-3-24. Available from: https://www.jpmorgan.com/content/dam/jpm/cib/complex/content/redesign-custom-builds/carbon-compass/JPMC_methane.pdf].

Mason, R., Rees, Y., Ballinger, A. and Chowdhury, T. (2021) Farm-level Interventions to Reduce Greenhouse Gas Emissions. Eunomia Research and Consulting Ltd., Bristol [Accessed online 14-3-24. Available from: https://www.eunomia.co.uk].

Offshore Energies UK (2022) Emissions Report 2022. [Accessed online 14-3-24. Available from: https://www.OEUK.org.uk].

Purdy, R. and Crocker, M. (2021) "An Independent Study into Fly-tipping and Unregistered Waste Carriers in England" Technical Report for Material Focus [Accessed online 11-4-24. Available from: https://www.researchgate.net/publication/353380047_An_Independent_Study_into_Fly-tipping_and_Unregistered_Waste_Carriers_in_England].

Rykers, E. (2023) How New Zealand is reducing methane emissions from farming BBC News 15 December 2023 [Accessed online 11-4-24. Available from: https://www.bbc.com/future/article/20231214-how-new-zealand-is-reducing-methane-emissions-from-farming].

Skuce, P. (2022) Acting on methane: opportunities for the UK cattle and sheep sectors. Moredun Research Institute. [Accessed online 14-3-24. Available from: https://www.ruminanthw.org.uk].

The White House (2021) U.S. Methane Emissions Reduction Action Plan [Accessed online 20-3-24. Available from: https://www.whitehouse.gov/wp-content/uploads/2021/11/US-Methane-Emissions-Reduction-Action-Plan-1.pdf].

UNEP (2021) Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions. Nairobi: United Nations Environment Programme [Accessed online 10-4-24. Available from: https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions].

UNEP (2022) Emissions Gap Report 2022: The Closing Window – Climate crisis calls for rapid transformation of societies Nairobi [Accessed online 20-3-24. Available from: https://www.unep.org/emissions-gap-report-2022].

van der Veen, R., de Vries, M., van de Pol, J., van Santen, W., Sinke, P., de Vries, J., Kampman, B., and Bergsma, G. (2022) Methane reduction potential in the EU Between 2020 and 2030 CE Delft. [Accessed online 14-3-24. Available from: www.cedelft.eu].

Waller, A.R. (2023) "Citizen Science for Planetary Health" Ch.6 in Waller, A.R. and Macer, D.R.J. (Eds.) Planetary Health and Bioethics pp. 156-176. Eubios Ethics Institute: Christchurch, New Zealand and Tsukuba Science City, Japan.