Written evidence from the UK National Centre for Earth Observation (MET0004)

The National Centre for Earth Observation (NCEO) is a distributed research centre across 13 UK institutions that exists to harness the power of Earth Observation (EO) data, linking them with advanced data analysis and environmental modelling to provide the UK with its National Capability in EO Science.

In this document, we have collated responses from world-leading experts within NCEO on atmospheric methane and how changes in its growth rate are linked with emissions and loss rates. We also comment on the role satellites and other data can inform current and future UK methane budgets. We follow a formatting of the questions outlined in the call for evidence website.

International commitments

1) What role could methane emissions reduction play in meeting the UK's domestic and international climate change targets?

The legally binding commitment for the UK is to reach net zero (greenhouse gas emissions) by 2050. This includes methane emissions. If net zero is couched in terms of CO2-equivalent, then reducing methane emissions will have a disproportionate role to play in achieving net zero – currently 14% of the UK GHG budget in 2022 – but the committee will be aware that using Global Warming Potentials (to determine CO2-equivalent) is flawed for short-lived greenhouse gases. In short, reducing methane emissions is important but of secondary importance to reducing CO2 emissions. While UK methane emissions are dwarfed by other countries, any reduction will make a difference.

The UK methane budget is determined by waste management, agriculture, land use and land use change, industrial processes, and energy supply. The two sectors not shared by CO2 emission mitigation are agriculture and waste management. Emissions from waste management have decreased during the 21st century so that since 2010-2011 agriculture is now the largest single emissions source of methane in the UK. There is potential to further decrease waste production emissions. Emissions of methane from agriculture have failed to reduce by more than 15% over the past 30 years. The competing demands of maintaining (even increasing) food supplies and ensuring the production of meat and nutritious food while steadily decreasing methane emissions provides an ongoing challenge to this sector. Offshore emissions of methane via venting are a big unknown, with the UK relying on oil and gas companies self-reporting their emissions. With the exception of large offshore emissions (e.g., Nordstream leak; see below), it is difficult to observe emissions from single assets.

2) What is your assessment of the Global Methane Pledge: is the UK on track to meet it? If not, how could this be accelerated?

Our own assessment is based on atmospheric data. It seems that the atmospheric observations of methane across the UK are consistent with inventory estimates from 2013 to 2020. However, atmospheric data coverage for this period is insufficient to comment meaningfully on the responsible devolved administrations or the sectors that are contributing the biggest emission reductions. The peer-review paper is here: https://acp.copernicus.org/articles/21/16257/2021/. We could still afford to accelerate the reduction towards the goal of the methane pledge, but this would have to focus on agriculture and waste production.

3) What are the implications of the separate Global Methane Pledge for overall UK efforts to reduce greenhouse gas emissions?

Because some sectors emit many greenhouse gases there is scope to develop a more systemic strategy to reduce all greenhouse gases. This does not _appear_ to be happening right now. Instead, there is typically a focus on methane or CO2, and to a lesser extent on nitrous oxide and other greenhouse gases. A cynical perspective might be that the Global Methane Pledge is a sideshow, an easy win, without addressing the larger, more pressing issue of reducing CO2 emissions.

4) Given UK progress in methane reduction in recent years (with notable reductions before 2020) what are the cost/ benefit implications of meeting the pledge?

Meeting the pledge in a sustainable way relies on massive-scale investment that would ensure a timely transition of technologies without compromising the economic viability of the emitting sectors.

5) How significant are UK methane emissions when compared to global emissions? What impact could UK efforts on reducing methane emissions have on total emissions?

This question is kind of missing the point. UK emissions of methane are small compared to other countries – even on a per capita basis – and are dwarfed by emerging natural emissions of methane that are beginning to be linked with rising temperatures for which some fraction is linked with human-driven emissions of methane. The global methane pledge is an opportunity to decarbonise sectors of the economy with new technologies that ultimately will lead to economic growth.

6) What is the UK doing to lead and facilitate international action on methane reduction? Could this be enhanced?

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7) What lessons could the UK learn from abroad?

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Data, measurement and monitoring

8) What is the status of methane accounting, monitoring and reporting in the UK at present and how does it compare internationally? Is UK accounting and reporting considered to be accurate and robust? What improvements, if any, are possible and what benefits would these deliver?

Our role is focused on developing measurement system to monitor changes in methane emissions.

The UK has had a measurement network for methane (CO_2, N_2O and other greenhouse gases) for more than a decade and the UK was for a long time the only country submitting data-driven estimates of national greenhouse gas emissions. This was originally funded by DECC (BEIS, DESNZ), augmented by funding from the UKRI Natural Environment Research Council. This evolving measurement network has provided a blueprint for other countries to develop their own network.

We have also made substantive contributions to our ability to observe methane from space – developing unique data sets and interpreting the data – working closely with colleagues from Japan (GOSAT instrument) and from ESA (TROPOMI instrument). Both GOSAT and TROPOMI measure shortwave infrared wavelengths that are most relevant to estimating surface emissions of methane. Ongoing work within NCEO is combining these data with instruments that measure longer wavelengths to produce height-resolved methane data that can further improve our national capability to infer UK methane emissions. A data visual tool developed by the Rutherford Appleton Laboratory -- http://rsg.rl.ac.uk/vistool -- may help the committee understand the global nature of these data, which been used most recently to study the Nordstream methane release: https://doi.org/10.5194/egusphere-2023-1652

UK capabilities in exploiting satellite observations of methane at the national level capitalize on those developed to exploit global satellite observations and are well positioned to exploit the next generation of "operational" satellites to monitor globally 2025-45, including upcoming ESA satellites, e.g. Sentinel-5 and CO2M.

NCEO staff also sit on various international committees that help shape future satellite missions and how their data will improve Measurement Reporting and Verification systems. Example reports:

https://www.copernicus.eu/sites/default/files/2019-09/CO2_Green_Report_2019.pdf

https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202203012343---SO-in-GST-2022-final.pdf

A broader description of our involvement is found in a report some of us wrote for DSIT: https://assets.publishing.service.gov.uk/media/65c4a6363f634b000d42c6b3/cs-now-wp-g1-future-role-of-measurements.pdf This report, overseen by Ricardo, include recommendations that address improvements to the measurements, inventories, and the computational models needed to translate the data into emission estimates.

9) What progress is being made on methane monitoring and data collection in the UK using technologies such as satellite data and drones?

There is substantial work being developed in the UK involving ground-based remote sensing instruments (similar measurement principle to that used by satellites), satellite data and drones. A lot of this is led by researchers in the NCEO but some are in collaboration with the National Physical Laboratory (NPL), the National Centre for Atmospheric Research, and the University of Bristol. This expertise includes translating the raw data collected by the satellites into atmospheric methane quantities and translating atmospheric methane into regional methane emission estimates; all techniques include robust assessments of uncertainties.

As part of the UK strategy to ensure rigorous measurement standards for atmospheric methane, the Rutherford Appleton Laboratory run the UK site for the global Total Carbon Column Observing Network (https://tccon.caltech.edu/). These ground-based data act as a gold standard for orbiting satellite instruments that measure atmospheric methane.

As part of a recently funded research programme called GEMMA (Greenhouse Gas Emissions Measurement and Modelling Advancement), coordinated by NPL, NCEO is building a new ground-based remote sensing network using instruments distributed across England, Wales, Scotland, and Northern Ireland that will complement the existing tall tower in-situ air sampling network run by the University of Bristol, and contribute towards improved emissions estimates. Project website: https://www.npl.co.uk/greenhouse-gas-emissions-measurement-modelling

The Earth Observation Climate Information Service (EOCIS, https://eocis.org/), led by NCEO and including over a dozen research organisations, is developing the first "UK climate data supply chain," building on a strong, continuing heritage of research, data creation and national digital infrastructure. EOCIS has been designed intentionally to support the worlds of science, decision-making and business. This broader initiative includes an ability to deliver methane emissions for the UK based on methane data produced globally by the Rutherford Appleton Laboratory from the IASI satellite instrument.

NCEO is also working with a range of methane satellites – including ESA/NASA satellites and private satellites such as GHGSat – that can observe methane plumes on small scales (tens of metres) that can help identify the source of leaks.

GHG measurement technology on drones is being pioneered by Grant Allen at the University of Manchester. This technology is focused on characterising point sources, e.g. landfills.

A broad description of UK activities is described in a report written for DSIT: https://assets.publishing.service.gov.uk/media/65c4a6363f634b000d42c6b3/cs-now-wp-g1-future-role-of-measurements.pdf

There is also a healthy technology development activity organised by the Centre for Earth Observation Instrumentation (CEOI, https://ceoi.ac.uk/) funded by the UK Space Agency. This acts as technology incubator that will eventually form the basis of the next generation of methane satellites.

10) Are there significant methane leakages in the UK, and if so where do they usually occur?

In short, we don’t know because we don’t systematically measure atmospheric methane at that scale. There have been case studies in which leaks have been document. A prominent case study was a leak found by GHGSat near Cheltenham by NCEO researchers (see link below) but is likely due to engineering works. Ad hoc mobile surveys often pick up leaks associated with urban gas networks but without a comprehensive measurement programme it will be difficult to answer this question with any certainty. Satellites will progressively help address measurement gaps but we the UK is a small, cloudy island and the relevant methane instruments cannot see through clouds.

https://egusphere.copernicus.org/preprints/2023/egusphere-2023-2246/

11) What are the advantages and disadvantages of available metrics used to report and compare methane emissions including GWP100 and GWP*?

Others will have better explanations but GWP* treats short-lived greenhouse gases such as methane so they can be more fairly compared with CO2.

UK Methane emissions and sectors

12) What progress has the UK made on reducing methane emissions and where is there room for improvement?

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13) Which sectors are most promising for achieving further methane emissions reductions? And which are likely to be at least relative cost?

Agriculture and waste management for the reasons outlined earlier. But this has done in collaboration with the farming sector.

14) Are there sources that could be mitigated quickly and easily in the short term, and which would take longer or be more complex?

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15) To what extent is there existing regulation in each emitting sector to mitigate methane emissions, and how well is this working?

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Agriculture

16) Are there emerging technologies, such as methane suppressant feed products or approaches to slurry management, that could aid with methane emissions reduction in agriculture? What impact could they deliver?

AI and big data are being used to develop so-called digital twins of UK. In short, a digital twin is a computer model that describes the real work, including all the linkages between associated with complex agroecosystems. A self-learning digital twin is clever enough to improve its knowledge of how the environment works based on these data. This way, the technology will be able to inform decision making for more environmentally friendly land use – improving livestock welfare and productivity and better pasture management – to reduce greenhouse gas emissions to help meet our net zero obligations.

17) How effective are existing policies and incentives, such as Slurry Infrastructure Grants, in driving methane reduction?

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18) What other policy tools, frameworks or incentives could be employed in agriculture to drive methane reduction?

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19) How can efforts to mitigate methane emissions in agriculture be integrated into broader approaches to facilitate and incentivise climate and nature-friendly farming practices?

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20) How can efforts to reduce methane reduction be balanced against other important considerations in the agricultural sector, including food security?

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Waste and waste management

21) What further progress could be made in the waste and waste management sector on reducing methane emissions? Are there interventions and/or technologies that could bring emissions down?

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22) Given the regulations already in place for methane reduction in the waste sector, why are emissions from the waste sector static over recent years? Are existing regulations monitored and enforced?

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23) Is the UK on track to meet the Government’s deadline of all local authorities collecting food waste separately from landfill by March 2026?

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24) To what extent will improved methane captured at landfill sites, remain necessary to reduce methane emissions after this date?

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Fossil fuels

25) Are there further methane reductions that could be made in the UK fossil fuels sector (e.g., oil, gas or other fossil fuels), or at a faster pace?

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26) How can we ensure that reducing methane emissions in the oil and gas sector are not at the expense of reducing CO_2 emissions?

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27) What impact would bringing forward the ban on flaring and venting have on both emissions and the industry?

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