

Written evidence from Bob Whitmarsh (MET0012)

Introduction

In November 2022 the government published a 'methane memorandum' which comprehensively summarises current and planned government action to mitigate the UK's emissions of methane. The following refers to this text as the Memo and, in part, draws attention to a critical omission in its content concerning heat pumps.¹

The Memo notes that "Scientific research estimates that 25% of today's warming is driven by methane from human activities" and states that "Cutting methane emissions is one of the fastest and most cost effective tools available to limit global temperature rise to 1.5°C. Due to methane's short atmospheric lifetime [of 12 years], taking action [now] can rapidly reduce atmospheric concentrations and in turn rates of warming across the next decade. According to the UN Environment Programme's (UNEP) Global Methane Assessment, reducing methane emissions can avoid up to 0.3°C of warming by 2040."

In 2019 methane emissions contributed 11 Gt CO₂eq (18%) of the global total and had grown by 29% since 1990.² Moreover, there has been an acceleration in global methane emissions since 2006.³

A summary of the UK's methane emissions from five sectors since 1990 is presented in Fig.3 of the Memo. In 2021 the principal sources were agriculture (49%), waste (30%), energy (11%) and land use, land use changes and forestry (10%).⁴

1.1 These arguments alone should convince the Committee that acting now to reduce the UK's methane emissions can form an important and effective part of any national strategy to contribute to the mitigation of global heating over the next decade or so.

1. Data measurement and monitoring

Methane is emitted from a variety of natural and manmade sources. Globally, roughly three-fifths of emissions come from fossil fuel use, farming (including livestock), landfills and waste. The remainder is from natural sources, especially vegetation rotting in tropical and northern wetlands.³ Point sources (methane leaks and deliberate venting from oil and gas infrastructure and landfill sites) often have higher gas concentrations and therefore are easier to identify than the diffuse emissions from farming, waste and rotting vegetation.

Some 'waste' methane is burnt (flared) on site as part of oil and gas extraction thereby producing carbon dioxide. However it cannot be assumed that flaring consumes all the methane. A study of oil fields in three US basins found that

“Flares were found to be unlit approximately 3%-5% of the time [implying that they were therefore venting methane] and, even when lit, they were found operating at low efficiency. Combined, those factors lead to an average effective flaring efficiency rate of only 91%”.⁵ Methane is also incinerated in a multitude of gas central heating boilers but in this case the flue gas is mainly carbon dioxide whose global warming potential is 86 times less over 20 years.

2.1 In principle, flaring of methane is expected to contribute far less to global heating than leaks and venting but this may not always be the case (see Memo Fig.7 for some UK data).

Various technical means are available to identify methane leaks ranging from thermal imaging cameras used close to leaks (within metres), airborne sensors used to conduct areal surveys and satellite sensors that can produce repeated, but lower resolution, observations over time.

For example, environmental activists visiting active onshore oil wells in 2021 and 2022 in southeast England with a thermal imaging camera found qualitative evidence of leaks and venting at most sites.⁶

Extensive airborne surveys of part of the onshore oil and gas infrastructure in the USA discovered that methane emissions are roughly three times greater than national government estimates. Emissions were from a small number of “ancillary midstream facilities”, including pipelines, as well as from wells.⁷ This result may cause one to question the efficacy of national bodies relying on data, which has been estimated or possibly supplied by the oil and gas industry, without independent assessment. In the UK, the Memo states, “there have also been proactive abatement initiatives such as facilities installing flare gas recovery systems, increasing equipment efficiency and using leakage detection systems” and, since 2002, iron gas main pipes have gradually been replaced by plastic in order to reduce leaks (as part of the Iron Mains Risk Reduction Programme - IMRRP).

In extreme cases methane leaks can be spotted from satellites. A major UK leak occurred over a three-month period in early 2023 from a gas pipeline in Cheltenham. The amount leaked could have powered 7,500 homes for a year.⁸ Perhaps the worst case to date is in Turkmenistan where methane leaks from just two fossil fuel fields caused more global heating in 2022 than the entire carbon emissions of the UK!⁹

The satellite technology to monitor methane leaks continues to grow with at least two companies able to monitor onshore installations from space with, in one case, about 25m spatial resolution.^{10,11}

The Memo says “Action on methane [on a global scale] is therefore recognised as the ‘last low hanging fruit’ in tackling climate change because measures are readily available and in some cases very cost effective. 40% of current methane

emissions could be avoided at no net cost (IEA) and available measures could reduce emissions by up to 45% by 2030 across energy, waste and agriculture”.

Concerning the UK, the Memo adds (Section 4.1.4) “The Environment Agency is reviewing how they can enable methane emission reductions across regulated industries in England, by fully utilising their powers as an environmental regulator ...”. This will be done with a focus on improving the data and effective regulation.

Section 4.1.1.1 of the Memo also outlines plans by the North Sea Transition Authority (NSTA) to include reducing greenhouse gas emissions from sources such as flaring and venting with the expectation that zero routine flaring and venting will occur by 2030 or sooner.

2.2 The technology exists to detect methane leaks from point sources at all scales and greater efforts at detection can and should be made both globally and in the UK.

2. Fossil fuels

The importance of the contribution to global heating made by leaks of the fossil fuel methane has been emphasised above as well as the opportunity provided to mitigate global heating within a decade by greatly reducing methane emissions to the atmosphere whether careless or inadvertent.

Methane is also burnt in gas or liquid (LNG) form to heat buildings and for cooking. In this case the main incineration product is the greenhouse gas CO₂.

In the UK methane, in the form of natural gas, has been widely used in domestic gas central heating systems since it was first brought ashore from the North Sea in the late 1960s. In 2020, the UK’s incineration of methane in the residential sector is estimated to have generated 16% of the total UK carbon footprint.¹²

Now, sixty years later, it is belatedly being recognised in the face of global heating that heat pumps, which are 2.5 to 4 times more efficient, are the future. Heat pumps do not work by burning fossil fuels but depend on electricity to extract heat from the air. Nationally the electricity they use is increasingly being generated not from fossil fuels but from low-carbon renewable sources (59.2% in 2022).¹³

3.1 Methane, which is a relatively strong greenhouse gas, not only contributes directly to the UK’s impact on global heating but also indirectly through being burnt in gas boilers thereby releasing significant amounts of CO₂ to the atmosphere. This latter impact can be largely reduced by converting heating systems to heat pumps.

3. Agriculture

A very relevant paper, with copious references, has just been published in *Nature Climate Change*.¹⁴ It discusses inventions in the last 30 years aimed at mitigating methane emissions. It remarks that because of an expanding and increasingly affluent global population, the agricultural sector is widely projected to be the dominant growth source of methane emissions in future. The principal sources are expected to be livestock farming, waste disposal or rice cropping from African, Latin American and Asian countries.

¹ <https://www.gov.uk/government/publications/united-kingdom-methane-memorandum/united-kingdom-methane-memorandum>

² https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_TechnicalSummary.pdf

³ Nisbet, Euan. "Rising Methane Could Be a Sign That Earth's Climate Is Part-Way through a 'Termination-Level Transition.'" *The Conversation* (blog), August 14, 2023. <https://theconversation.com/rising-methane-could-be-a-sign-that-earths-climate-is-part-way-through-a-termination-level-transition-211211#:~:text=Rising%20methane%20could%20be%20a,%20'termination%20level%20transition.>

⁴ https://naei.beis.gov.uk/overview/pollutants?view=summary-data&pollutant_id=3

⁵ <https://news.umich.edu/flaring-allows-more-methane-into-the-atmosphere-than-we-thought/#:~:text=Flares%20were%20found%20to%20be,efficiency%20rate%20of%20only%2091%25.>

⁶ [Methane campaigners highlight ongoing emissions | South East Climate Alliance \(seclimatealliance.uk\)](#)

⁷ Sherwin, Evan D., Jeffrey S. Rutherford, Zhan Zhang, Yuanlei Chen, Erin B. Wetherley, Petr V. Yakovlev, Elena S. F. Berman, et al. "US Oil and Gas System Emissions from Nearly One Million Aerial Site Measurements." *Nature* 627, no. 8003 (March 14, 2024): 328–34. <https://doi.org/10.1038/s41586-024-07117-5>.

⁸ Stallard, Esme. "Major UK Methane Greenhouse Gas Leak Spotted from Space." *BBC News*, September 16, 2023. <https://www.bbc.co.uk/news/science-environment-66811312>.

⁹ Carrington, Damian. "'Mind-Boggling' Methane Emissions from Turkmenistan Revealed." *The Guardian*, May 9, 2023. <https://www.theguardian.com/world/2023/may/09/mind-boggling-methane-emissions-from-turkmenistan-revealed>.

¹⁰ <https://www.ghgsat.com/en/>

¹¹ <https://www.kayrros.com/>

¹² <https://assets.publishing.service.gov.uk/media/61f7fb418fa8f5389450212e/2020-final-greenhouse-gas-emissions-statistical-release.pdf>

¹³ <https://www.bbc.co.uk/news/business-63976805#:~:text=Electricity%20generation%20accounted%20for%20around,renewables%20and%2014.7%25%20from%20nuclear>

¹⁴ Jiang, Jingjing, Deyun Yin, Zhuoluo Sun, Bin Ye, and Nan Zhou. "Global Trend of Methane Abatement Inventions and Widening Mismatch with Methane Emissions." *Nature Climate Change* 14, no. 4 (April 2024): 393–401. <https://doi.org/10.1038/s41558-024-01947-x>.