Written evidence from GHGSat (MET0026)

This evidence has been prepared by Dan Wicks, Managing Director of GHGSat UK and relates to data, measurement, and monitoring.

Satellite instruments measure atmospheric methane from solar backscatter in the shortwave infrared (SWIR). Detection of emissions above background levels can be attributed to multiple industrial sectors quickly across the globe and flag them for repair or mitigation. Furthermore, satellites are uniquely able to contribute toward independently assessing compliance with national and international methane reduction commitments. *Global mapping satellites* (e.g., TROPOMI, GOSAT, Sentinel 2) with course resolution can systematically survey the Earth's surface at regular cadence, although they are limited by low detection sensitivity (~10,000kg/hr) and the ability to spatially attribute emissions to a given location. High-resolution *point-and-shoot satellites* (e.g., GHGSat), allow the attribution of emissions to specific facilities due to high detection sensitivity (~100kg/hr) but are limited in field of view and therefore unable to achieve good coverage with a single satellite. This is mitigated by operating multiple satellites in a constellation, the requirement for which is determined by the often-intermittent nature of large methane emissions needing frequent repeated measurements. In general, a layered approach considering measurement at different scales, spatially and temporally, allows a more complete picture of emissions activity.

Despite widespread utility of satellites for the repair and mitigation of methane emissions, there remain some blockers to adoption in national inventory approaches. These centre around understanding performance, particularly in the context of alternative land and air-based measurement technologies (e.g., drones, optical gas imaging detectors and handheld detectors), availability of and access to these technologies, as well as defined protocols for use. Currently, reporting to the UNFCCC relies on bottom-up methods for estimating emissions. These methods, however, rely on source dependent activity data and emissions factors that can introduce significant errors and uncertainties. Alternative top-down methods, which are instead based on measurement driven inverse modelling, may be considered. The IPCC guidelines highlight the value of these methods for quality control of emissions estimates but combining top-down and bottom-up approaches in emissions measurement will enable the development of more precise inventories. Increased evidence exists to highlight the discrepancy between estimated and measured emissions data which speaks to the requirement for an evolved approach. The UK is one of a handful of countries who give independent verification data using top-down methods, but this could be strengthened through the inclusion of satellite-based measurements.

It is strongly recommended, that the UK government implements a complete *atmospheric measurement network*, including satellites, and a range of atmospheric and inverse models to quantify the size, spatial distribution, and uncertainty of UK Greenhouse Gas emissions. Further specific recommendations to support this objective, with respect to satellites, are given as follows:

- Intercomparison and empirical validation exercises including controlled releases. Tests should include offshore releases, undisclosed location testing, onshore releases with varying weather and ground cover, diffuse-source releases, and multi-source releases.
- A programme of systematic observation collection across the UK to baseline measurements across different technologies.
- Development of standards to allow the transparent, independent, and evidenced quality assurance assessment of satellite-derived methane emission data products.
- Definition of clear protocols for the use of different measurement technologies ensuring defined detection thresholds and monitoring frequencies that would be operationally effective and allow the use of different technologies in tandem.
- Establishing multi-stakeholder consensus over the capabilities to allow trust and their integration into national and international methane policy and accounting.
- Integration of satellite-based measurements into the verification work done to cross check UK inventory emissions estimation.

Consideration should also be made of complementary technologies such as big data and Artificial Intelligence (AI). The analysis of measurement data collected from different sources, alongside company asset information are routinely being used to independently assess emissions (e.g., Climate TRACE). This has the potential to support stronger alignment between government priorities, and emissions reduction activity by the private sector.

GHGSat was established in 2011 as a private sector solution to climate change, headquartered in Montreal with offices in Ottawa and Calgary, and international offices in Houston and London. The vision of GHGSat is to use satellites to become the global reference for the measurement of greenhouse gas emissions from any source in the world, enabling stakeholders in the energy, resource, power generation, agricultural, waste management, and sustainability sectors to make informed environmental decisions. Whilst there are several satellites in orbit today that can measure greenhouse gas emissions, our satellites are the only ones today that can do so from sources as small as individual oil and gas wells, a capability that is crucial for attribution, accountability, and action. In 2023 we enabled mitigation of 6MTCO2e which is the equivalent of approximately 1.5 million cars off the road for one year. Further information about our work can be found here: https://www.ghgsat.com/en/scientific-publications/.