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Gas Flaring Efficiencies of Selective Oil and Gas Facilities in the Sultanate of Oman

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Flaring is the controlled burning of natural gas, a common practice in the oil and natural gas (O&G) industry. Ideally, the combustion process is supposed to convert the potent methane (CH_4) completely into carbon dioxide (CO_2), yet in real-world situations this is not the case. According to the International Energy Agency (IEA), flaring is responsible for about 10 % of the total methane emission of the O&G sector. Therefore, it is important to understand and quantify how efficiently the carbon in the flared fuel is converted to CO_2, to support the mitigation of flaring emissions. This is especially the case for countries with high reliance on the O&G industry, and a clear commitment to achieve net zero emissions by 2050, such as the Sultanate of Oman.

This study presents the first thorough examination of flaring emissions in Oman using a novel airborne platform. The measurements were performed during the METHANE-To-Go-Oman field experiment funded by UNEP's International Methane Emissions Observatory (IMEO), which was conducted from November to December 2023. It used a unique helicopter-towed probe called HELiPOD. The experiment covered six pre-selected O&G facilities within three concession areas in northern and southern Oman, during ~70 flight hours.

In this study, VIIRS Nightfire data were used to identify the flaring plume positions and measured in situ data from the HELiPOD were used to capture the plume composition. The airborne in-situ instruments include: Picarro G2401-m to measure CH_4 and CO_2 with a high precision (1 ppb), Licor-7700 for high CH_4 temporal resolution measurements up to 40 Hz, and Licor-7500A for CO_2. Also, a variety of data related to combustion products and by-products were collected such as aerosols, water vapor, and temperature, which can be used to verify and understand the chemical and physical characteristics of the flaring plumes. Furthermore, various meteorological data were collected during the experiment, such as the 3D wind vector, which was crucial for the flaring plume identification.

The lowest flaring efficiency observed in this study was related to a gas facility. Providing valuable insights into the flaring emissions is the aim of this study, which could be translated into mitigation opportunities for policymakers and the industry.