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Using Quantum Gas Lidar for Continuous Methane Emissions Quantification of Gas to Grid Plants in Water Sewage Treatment Works.

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The recent global focus on anthropogenic methane emissions mitigation has accelerated the development and deployment of novel technologies to detect, quantify, locate and prioritize mitigation of fugitive and process emissions of methane, particularly within the oil and gas supply chain. The majority of emissions within this infrastructure result from large and intermittent sources. One study[1] showed that the largest 5% of emissions (i.e. super emitters) typically contribute over 50% of the total emission volumeand another study[2] found that most sources (66%) are intermittent, and account for most (48%) of the emissions. The largest impact on emissions mitigation therefore can be realized by deploying detection methods and technologies that are matched to how these two classes of emissions manifest in the infrastructure. Continuous monitoring solutions that can image and pinpoint emission sources are especially well-suited for use at sites that are expected to have intermittent process emissions.

We present recent work utilizing novel Quantum Gas Lidar for continuous methane emissions monitoring in sludge treatment works where methane-rich biogas is produced from the anaerobic digestion of sewage sludge. Some of the biogas is consumed on site and the rest is cleaned, upgraded and fed into the natural gas distribution network. Monitoring campaigns are ongoing at three such plants in the UK, owned and operated by Severn Trent, two of which have full gas to grid infrastructure. The third site uses combined heat and power engines to convert the biogas into electricity for use on site. Specific elements of the infrastructure are targeted for continuous, automated measurement by the lidar system (especially the digesters, gas storage, combined heat and power engines and gas to grid plants) and any detected methane emission plumes are imaged, their origins are pinpointed, and their emission rates are quantified. This results in a methane emission rate dataset having both high spatial and temporal resolution which can be used for both component and site-level emissions reporting within, for example, the OGMP 2.0 level 4 and level 5 framework, and IPCC Tier 3 (facility level) reporting. [3] The individual emission sources are intermittent and can have emission rates that vary in time depending on various process variables (i.e. varying pressures within the equipment) so that an accurate accounting of the overall emissions over time is reliant on the high-accuracy quantification and high temporal resolution that the lidar system provides. The continuous measurements have so far identified some previously unknown emission sources and have allowed the actual emissions of those sources to be accurately quantified for the first time, offering a high-confidence, measurement-based accounting of the methane emissions at these sites.

[1] https://pubs.acs.org/doi/10.1021/acs.est.6b04303

[2] https://pubs.acs.org/doi/10.1021/acs.estlett.1c00173

[3] https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/