Remote sensing quantification of methane emissions from 10 biogas plants in Denmark and Germany

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ABSTRACT

A key benefit of biogas production is mitigation of anthropogenic greenhouse gas emissions by substituting fossil fuels. However, several life cycle assessment studies have shown that methane loss from biogas production may significantly reduce greenhouse gas mitigation due to the high global warming potential of methane gas. It is therefore important to minimise methane emission from biogas production to ensure the societal value and thereby the validity of providing subsidies to support biogas production.

Accurate measurement methods are needed to quantify methane emission from biogas plants and thus assess the need for taking actions to reduce leakage. Recent developments in analytical instrumentation have provided new opportunities for accurate remote sensing of fugitive emissions. We have applied a remote sensing technique referred to as the "tracer gas dispersion method" to measure total methane emissions from 10 biogas plants. The method relies on the continuous release of a gaseous tracer combined with downwind measurements of methane and tracer gas using a mobile analytical platform, where a high precision gas analyser was installed.

Methane emission rates varied from 1.3 kg CH_4 h^{-1} to 25.5 kg CH_4 h^{-1}. The average methane loss corresponded to 2.0 % of the gas production, where the loss calculated for the individual measurement campaigns on the various plants ranged from 0.3% to 21.0%.