Development of an Optical Methane Flux Sensor for Casing Gas Venting Quantification

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Abstract

Casing gas vents and storage tanks at oil batteries have been identified as key sources of methane emissions in the upstream oil and gas industry. In collaboration with Natural Resources Canada (NRCan) and the Institut National d'Optique (INO), Carleton University's Energy and Emissions Research Laboratory (EERL) is developing an optical sensor capable of quantifying methane fluxes from these critical point sources. The sensor, given the development name "VentX", is being designed to enable continuous monitoring and quantification as a means to improving gas-oil-ratio measurements, automating and simplifying emissions reporting, and supporting implementation of alternate LDAR technologies that might otherwise be confounded by unquantified, transient venting sources.

The Vent-X is based on the optical technique of tunable diode laser absorption spectroscopy, supplemented with wavelength modulation for increased sensitivity. In this particular implementation, both concentration and velocity of the methane gas in a vent stream are directly measured, enabling direct quantification of methane flux in streams of variable composition and flowrate. The current prototype is being packaged into a field deployable version, which will be used to conduct preliminary tests on the sensor's performance. These tests and the lessons learned will guide the design of a miniaturized electronics package and final optical head being developed in collaboration with INO. To address the desire to monitor casing gas vents and the storage tank vents simultaneously, the final sensor design could include a fiber optic switch to collect methane flux data from two or more optical heads, enabling direct measurements of total methane venting from a site.