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Commercialization Potential of Industry-Specific Methane Biofilters (MBFs)

Devika Subash

Background & Methodology

In Canada, over the past decade methane emissions reduction has received focus from provincial and federal governments due to high industry emissions especially from top contributors such as oil and gas (37%), landfills (27%) and agriculture livestock (24%) (IEA, 2022). There is active research aiming to develop technologies for methane reduction and overall climate change mitigation. One such technology is Methane Bio-Filters (MBFs) (La H. et al., 2018a). This filter uses methane-eating bacteria to convert methane (CH_4), a key greenhouse gas, to less polluting end products (Mancebo et al., 2010) (La H. et al., 2018b). MBFs are designed to treat point-source low volume methane emissions with flow rates up to 100 m^3 per day (Gunasekera et al., 2018). This technology can be used as an alternative to flaring and venting activities, as low volume emissions are not sufficient enough to be collected for heat or electricity generation, but in time can add up to significant levels (Gunasekera, 2018).

This research evaluated the data gathered from six active MBF pilot installations in oil and gas, agriculture, and landfill sectors in Western Canada. These pilot projects had a high-degree of success and this study explored the feasibility of this technology being commercialized as a product capable of climate cost reduction. As per the STEP (Strategic Technology Evaluation Program) methodology (Jain et al., 2003) used, economics aspect was identified as a gap in knowledge. Hence, my research was focused on, whether this technology is economically feasible based on financial analysis of pilot installations?

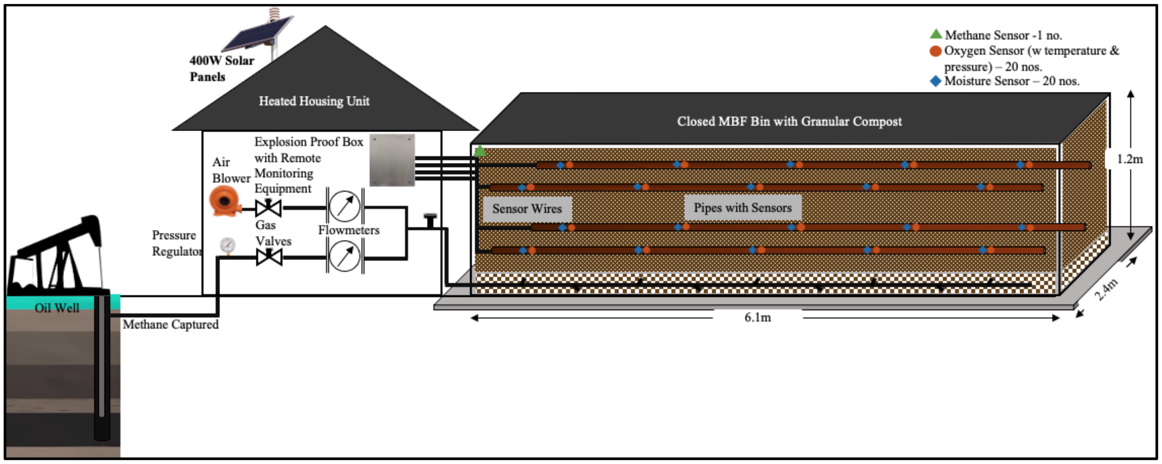
Results & Conclusions

The MBF pilot installations evaluated were of six designs – Oil & Gas Closed MBF with Active Aeration, Oil & Gas Open/Closed MBF with Passive/Active Aeration, Agriculture Closed MBF with Active Aeration, Agriculture Floating and Hanging Designs with Passive Aeration, and Landfill Open MBF with Passive Aeration.

Factors considered were the CH_4 loading and oxidation rates, system efficiency, associated setup, emission and maintenance costs for each MBF. The CH_4 gas oxidized by the MBF is the benefit from the system. The emissions data for each MBF depended on its size, the gas distribution system, the sensor system, the solar panels used and the transportation to the destination site for installation.

The application of MBFs has high potential but the choice to adopt the technology is largely dependent on the lifecycle costs and benefits. Research concluded economic viability at \$10-\$16/tCO_2e for evaluated designs with the Oil & Gas Closed MBF with Active Aeration type (schematic below) rated the best at \$10/tCO_2e. It is key to note that the costs vary based on the size and additional requirements as per regulations at the installation sites. This work is multi-disciplinary focusing on energy, environment and economic dimensions.

The cost to reduce per tCO_2e, for different CDR technologies (McKinsey & Company, 2020) when compared with MBF estimated costs showed that, the latter costs are at par with the lower-tier pricing of Afforestation and Reforestation and Soil Carbon Sequestration methods. This is primarily due to the use of sustainable materials as main components such as the recycled wood, compost and naturally occurring microbes.



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