

Integrated Assessment of Methane Reduction Technologies in Canada's Oil and Gas Sector

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Methane is a potent greenhouse gas with a GWP approximately 28 times that of carbon dioxide over 100 years and 82 times over 20 years. Its short atmospheric lifetime of about 12 years makes it a key driver of near-term climate change. Reducing methane emissions offers an effective strategy for immediate greenhouse gas mitigation. In Canada, methane emission inventories are still being improved and detailed process-specific modelling could aid in effective emissions quantification. The federal and provincial governments have implemented methane reduction directives and plans to reach net zero greenhouse gas emissions by 2050. To meet these targets, methane reduction technologies must be deployed, but the ultimate reduction potential and associated costs are currently unknown. In this study, a bottom-up methane-emissions model of the oil and gas sector is developed, encompassing the natural gas (tight gas, conventional gas, associated gas, coalbed methane, and shale gas formations), conventional oil (light and heavy oil) and oil sands (in-situ and surface-mined) sub-sectors. These sub-sectors are modelled over a period of 60 years (1990-2050), with historical years used to validate the model. Using Alberta as a case study, numerous methane emission reduction technologies are assessed, with pneumatic devices, vapour recovery units, compressor packing upgrades, and leak detection and repair as key technologies in the natural gas and conventional oil sub-sectors. Additional technologies include, but are not limited to, plunger lifts, flash tank separators, and electric motors. Emerging technologies, such as catalytic oxidizers, are also explored for their potential applications across all three sub-sectors. In the oil sands sub-sector, tailings pond methane capture and vapour recovery units are critical technologies. This research will project the market adoption of technologies, the maximum methane reduction technical potential, and the cost-effective reduction potential. Preliminary findings indicate that Canada is on track to surpass its 75% methane emissions reduction goal by 2030. The findings of this study will provide valuable insights to policymakers and industry decision-makers in identifying cost-effective pathways for methane emissions reduction, as well as if net-zero targets are achievable.