Please fill in the name of the event you are preparing this manuscript for.	International Petroleum Technology Conference 2023 (15th IPTC)
Please fill in your 5-digit IPTC manuscript number.	IPTC-22849-Abstract
Please fill in your manuscript title.	Application of Technology for Green Development of Sour Gas Field

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Abstract

Objective/Scope
In alignment with the COP26 to limit global temperature rise, PTTEP has announced its new target to achieve Net Zero Greenhouse Gas (GHG) Emissions by 2050. This target brings on technical challenges for a new development of the sour gas field, located in Sarawak. This paper describes how the projects leverage the application of gas treatment technology to address those technical challenges, to develop the sour gas field with minimum impact on the environment.

Methods, Procedures, Process
Various aspects beyond conventional practice are applied to reduce GHG emissions in this project. One key contaminant of the reservoir gas is CO_2 (up-to 18% of 1,200MMSCFD capacity) would create a significant emissions concern if conventional practice were retained. Thus, Carbon Capture and Storage (CCS) has been considered as a solution to reduce the CO_2 emissions from the reservoir gas separated directly from the onshore sour gas development.

Another key contaminant is H_2S, up-to 2%, which will be processed into sulfur pellet as by-product. It is important to ensure that best available technology was selected to maximize sulfur recovery rate and minimize air pollutant emissions to the environment, particularly SO_x in this case. BAT (Best Available Technology) Selection for SRU (Sulfur Removal Unit) evaluated various sulfur recovery technology to achieve the maximum sulfur recovery rate and minimum SO_x emission.

Results, Observations, Conclusions
To minimize GHG emissions, new initiative raised to substitute continuous venting/flaring, instead, leveraging on the Carbon Capture and Storage (CCS) application. This is enabled by selecting technology at the Acid Gas Removal Unit (AGRU) suitable for removing both CO_2 and H_2S to meet sale gas specification. The removed contaminants are then processed in Acid Gas Enrichment Unit (AGEU), where H_2S will be removed to be further processed in SRU and CO_2 will then be compressed for re-injection to existing depleted gas reservoirs located offshore. This injection facility is designed for maximum injection rate of 190MMSCFD. Overall, this CCS application will reduce the GHG Emission Intensity of the project significantly, from 336 to 184 tonnesCO_2e/ktonne (approximately 45% reduction).

Minimizing the carbon footprint of the CCS transport and injection chain on the environment is also a key value enabler for its long-term sustainability. A development decision has been made to insulate the transport pipeline to conserve heat of compression from shore ensuring the CO_2 to be injected into the offshore with minimal flow assurance risk. Compared to an offshore electric heater, up to 58 ktonnes CO_2e reduction in yearly emission from the CCS transport and injection system can be realized.

The results from BAT Study for SRU showed the most optimum technology recommended, which is two-stage SRU with Tail Gas Treating Unit using a formulated solvent (amine-based), can achieve sulfur recovery efficiency >99.9%. This technology also limits the SO_x emission to be within 150mg/Nm3 (World Bank Standard), which is significantly lower than the local regulatory requirement (Clean Air Act-2014) of 400mg/Nm3. In addition, this selection also eliminates significant chemical waste generated from other technology (Caustic Scrubber).

Novel/Additive Information

The application of CCS is new in PTTEP and in industry but essential in achieving the GHG emissions reduction target. The re-injection facilities also address new technical challenges associated with high-pressure dense phase CO_2. Despite the identified challenges, conscious decision was taken to ensure that all risk reduction measures evaluated must be both technically and environmentally feasible and is an exemplar concept engineering framework to be followed for future CCS projects.

In the technology selection of SRU, it is demonstrated in this paper that the BAT implementation can review various available options holistically to arrive at the most optimum selection that minimizes emission levels from the facilities beyond the local regulatory requirement.