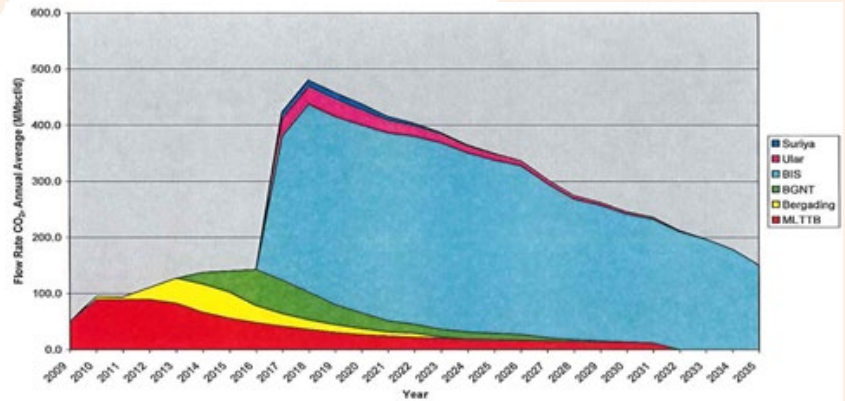


CO₂ SEQUESTRATION OPPORTUNITY ASSESSMENT CASE STUDY

PETRONAS Carigali - PM313
Offshore Peninsula Malaysia

AWT DISCIPLINES

Reservoir Engineering
Production Technology
Flow Assurance
Corrosion Engineering



PROJECT BACKGROUND

As part of the AWT conceptual planning for the PM-313 gas cluster development, AWT conducted a high-level screening of CO₂ disposal or sequestration options with a preliminary screening of reservoirs suitable for CO₂ reinjection, injection requirements, injectivity, downhole / flow line / process metallurgy and chemical treatment options.

Location:
Block PM 313 Gas Cluster Fields

Fluid Properties:
Average CO₂ levels range between 6% and 40%

Estimated Reserves:
~16 TCF of gas, containing ~ 8 TCF of CO₂~16 TCF of gas

AWT WORKSCOPE

The primary objective of the study was to assess the suitable option for the CO₂ disposal. The strategies which have been considered are:

- Atmospheric venting of CO₂
- Produce raw gas with CO₂ to the market/pipeline
- Separation and re-injection of produced CO₂ into an old gas bearing reservoir
- Separation and re-injection of gas into an existing oil bearing formation
- Use of carbon dioxide for IOR processes by injecting gas as a part of a water-alternating gas scheme or a Gravity Stable Injection Scheme.

AWT ADDED VALUE

The quantity of CO₂ to be removed and disposed of ranges from 200 - 500 MMscf/day throughout the forecasted life of the project, therefore venting is not considered tenable.

There are two major alternatives, namely:

- Injection of the CO₂ into depleted gas reservoirs in the region, perhaps as part of the sequential development of the clusters
- Injection of CO₂ into oil reservoirs of adjacent fields (green or brownfields)

From these alternatives, AWT reviewed two available processes:

- GSGI Gravity stable gas injection whereby the CO₂ is injected into the top of the reservoir thus providing enhanced reservoir energy for assisting production
- WAG or CO₂ injection for enhancement of sweep efficiency in oil reservoirs.

It is likely the GSGI and WAG process using CO₂ in an oil reservoir could yield increases in oil recovery of 3 - 6% and 8 - 10% of recoverable reserves respectively.