Low Carbon Day

Low Carbon initiatives in Exploration: CCS

Mikel Erquiaga
Director of Regional Exploration
Eastern Hemisphere
Disclaimer

ALL RIGHTS ARE RESERVED
© REPSOL, S.A. 2021

This document contains statements that Repsol believes constitute forward-looking statements which may include statements regarding the intent, belief, or current expectations of Repsol and its management, including statements with respect to trends affecting Repsol’s financial condition, financial ratios, results of operations, business, strategy, geographic concentration, production volume and reserves, capital expenditures, costs savings, investments and dividend payout policies. These forward-looking statements may also include assumptions regarding future economic and other conditions, such as future crude oil and other prices, refining and marketing margins and exchange rates and are generally identified by the words “expects”, “anticipates”, “forecasts”, “believes”, “estimates”, “notices” and similar expressions. These statements are not guarantees of future performance, prices, margins, exchange rates or other events and are subject to material risks, uncertainties, changes and other factors which may be beyond Repsol’s control or may be difficult to predict. Within those risks are those factors described in the filings made by Repsol and its affiliates with the “Comisión Nacional del Mercado de Valores” in Spain and with any other supervisory authority of those markets where the securities issued by Repsol and/or its affiliates are listed.

Repsol does not undertake to publicly update or revise these forward-looking statements even if experience or future changes make it clear that the projected performance, conditions or events expressed or implied therein will not be realized.

Some of the figures included in this document are considered Alternative Performance Measures (APM) in accordance with the guidelines of the European Securities and Markets Authority (ESMA). Further information on APMs (definition, purpose, reconciliation with financial statement figures) may be found on Repsol’s corporate website.

This document does not constitute an offer or invitation to purchase or subscribe shares, pursuant to the provisions of the Royal Legislative Decree 4/2015 of the 23rd of October approving the recast text of the Spanish Securities Market Law and its implementing regulations. In addition, this document does not constitute an offer to purchase, sell, or exchange, neither a request for an offer of purchase, sale or exchange of securities in any other jurisdiction.

The information contained in the document has not been verified or revised by the External Auditors of Repsol.

#RepsolLowCarbonDay
01. Our Starting Point
The Upstream Business in the Energy Transition context

02. Sakakemang Project:
- Discovery & Appraisal
- CCS
- CCS (Carbon Pricing)
- CCS worldwide benchmark
- CCS Technical Assessment
01. Our Starting Point
The Upstream Business in the Energy Transition context

01. Our Starting Point

Repsol: First O&G Company to announce Net Zero commitment by 2050

Decreasing capital employed in conventional O&G exploration activities and geographically concentrated (2021-2025 Strategic Plan)

Exploration personnel skill sets in conventional O&G exploration activities is being re-converted to Low Carbon Exploration initiatives aligned with our Net Zero ambitions:

- Carbon Capture & Storage (CCS) in the subsurface to abate CO₂ emissions
- Exploration for Geothermal Resources to boost low CO₂ energy generation (similar activity to O&G Exploration)
- Hydrogen Storage to provide solution to buffer H₂ production through storage in saline cavities in the subsurface

The expertise of our G&G workforce will be source of Competitive Advantage in the Energy Transition
02.
Sakakemang Project
02. Sakakemang Project

Discovery & Appraisal

- Kaliberau Dalam-2X discovery well: February 2019
- Largest Gas discovery in Indonesia in the last decade (>2 TCF)
- Gas with high CO₂ content (26%)
- New Greenfield Projects need to be Net Zero

**Appraisal campaign following the KBD-2X discovery:**
- KBD-3X appraisal well (2020-2021) – Completed
- Long Duration Test (LDT) on KBD-2X discovery Pressure monitoring in KBD-3X (2021) – Ongoing

**Objectives of appraisal program:** confirm the volumes associated to the discovery and confirm connectivity between KBD-2X & 3X

**Volumes of CO₂ directly related to discovered volumes of gas**
02. Sakakemang Project:

**CCS**

- Development of a 2TCF gas discovery & simultaneous CCS
- First CCS project deployed by Repsol and First in Indonesia.
- Among largest CCS projects worldwide today (only 6 CCS projects operating).
- Storage will commence in 2027 and will be done in two depleted gas fields of Corridor PSC contract (Gelam & Dayun).
- Main Challenges:
  - Regulatory Framework, but the MEMR in Indonesia has already created a Task Force with the objective to have CCS regulation in place by the end of 2021.
  - Financial: cost carried by partners, but captured & stored CO₂ could be subject of further trading.

![Repsol: Total Upstream emissions](image)

Emissions avoided in Sakakemang with CCS

- 2 Mte/yr
- 30 Mte Cum.
02. Sakakemang Project:

**CCS (Carbon Pricing)**

- **CO₂ Capture**
- **CO₂ Compression & Dehydration**
- **CO₂ Transport Pipeline**
- **CO₂ Transport Ship**
- **CO₂ Injection & Geological Storage**
- **CO₂ Monitoring & Verification**

**Sakakemang Project: CO₂ BE @ 10% – 31 $/T**

Capture Not included

- 70% CO₂ gas stream e.g. NGCC Power Generation
- 14% CO₂ gas stream e.g. Coal Power Generation
- 27% CO₂ gas stream e.g. Steel blast furnace

**CO₂ Gas Streams**
- 4% CO₂ gas stream e.g. NGCC Power Generation
- 14% CO₂ gas stream e.g. Coal Power Generation
- 27% CO₂ gas stream e.g. Steel blast furnace

**400 kt CO₂**

- 150 bar <200 ppmv H₂O
- 20 Mtpa 180 km onshore pipeline
- 25 Mtpa 1,500 km offshore geological storage reservoir

**4 Mtpa CO₂**

- 1 Mtpa 300km onshore pipeline
- 2 Mtpa 1,500 km offshore geological storage reservoir

**0.84 $/T**

- Offshore geological storage reservoir
- Onshore good quality geological storage reservoir

**1 Mtpa, 300 km onshore pipeline**

**5.3 Mtpa CO₂**

- 150 bar <200 ppmv H₂O
- 20 Mtpa 180 km onshore pipeline
- 25 Mtpa 1,500 km offshore geological storage reservoir

**100% CO₂ gas stream e.g. Bio-ethanol production**

- **USD 2020 per tonne CO₂**

- **% of Total Cost**

**Sakakemang**

- 2.2 – 2.5 $/T
- 8.1 $/T
- 3.4 $/T
- 7 $/T
- 3.4 $/T
02. Sakakemang Project:

CCS worldwide benchmark

Power generation
- Sinopec Oilfield
- Boundary dam
- Petra nova
- Santos Cooper
- Plant Daniel Cal Capture
- Dry fork Project Tundra
- ZEROS Project
- Prairie State
- Mustang Station

Chemicals
- Sinopec Oilfield
- Air products
- Illinois Industrial
- Illinois Petrochemicals
- Quest
- ACTL Sturgeon
- Lake Charles Methanol
- Porthos
- Carbonnet
- Integrated Mid-Continent Hub

Steel
- Sinopec Oilfield
- Great plains
- Eind Fertilizer
- offshore

Cement
- Shute Creek
- Century Plant
- Lost cabin
- Gorgon
- San Juan
- Abu Dhabi Phase 2
- Norway Full chain

Natural gas processing
- Shute Creek
- Petrobras pre-salt
- Century Plant
- Luttmanniyah
- Gorgon
- Qatar LNG
- Centrica
- Total
- Shell
- Eni
- Petrobras
- BP

Operating
- 2021
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028

Today only 6 true CCS projects worldwide

~40 Mte/yr

~110 Mte/yr

Today only 6 true CCS projects worldwide

From Mckinsey, 2021

In operation

CO₂ → EOR

In construction

Advanced Development

In evaluation

= 1 MTPA of CO₂ (Area of circles proportional capacity)

The Repsol Commitment
Net Zero Emissions by 2050
02. Sakakemang Project: CCS Technical Assessment

SITE SCREENING ➔ SITE SELECTION ➔ SITE CHARACTERIZATION ➔ QUALIFIED SITE

Regional / basin analysis scale

Completed

Depleted Gas Fields
2 candidates (Gelam & Dayung)

Saline Aquifers
For potential upside: corridor tail

Completed

Short list potential & feasible sites

3rd & 4th candidates

Initial Characterization
- Seal Analysis
- Geomechanical Analysis
- Storage complex
- Static modeling
- Dynamic modeling
- Injection modeling
- Risk Assessment
  - Storage Capacity
  - Injectivity
  - Containment

Detailed Characterization
- Models refining
- Risk Management Plan
- CO₂ injection baseline
- Monitoring plan
  - Pilot program executed
  - Wells & completions
    - Monitoring
    - Predictive model
    - Final engineering

Visualization (to be completed by December 2021)

Conceptualization

Definition

Execution

Start up injection
- Geological
- Carbon
- Storage
- Construction & Operations
Low Carbon Day

Investor Relations
investor.relations@repsol.com

#RepsolLowCarbonDay
www.repsol.com