



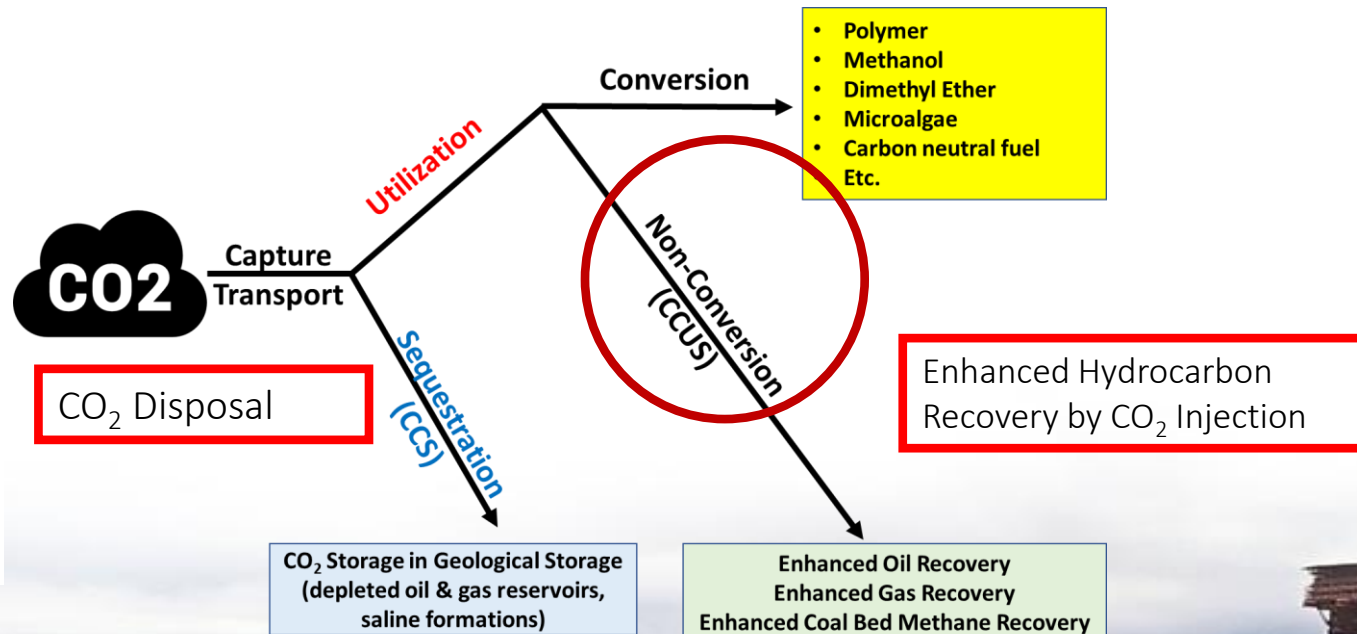
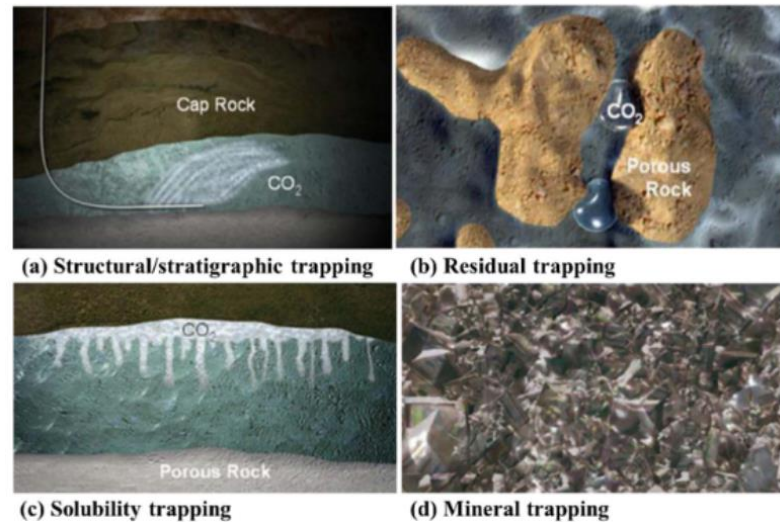
**Encouraging Energy Investment in Indonesia  
Through Transboundary CO<sub>2</sub> Hub Development**

**Prof. Doddy Abdassah  
Centre of Excellence CCS/CCUS  
Institut Teknologi Bandung**

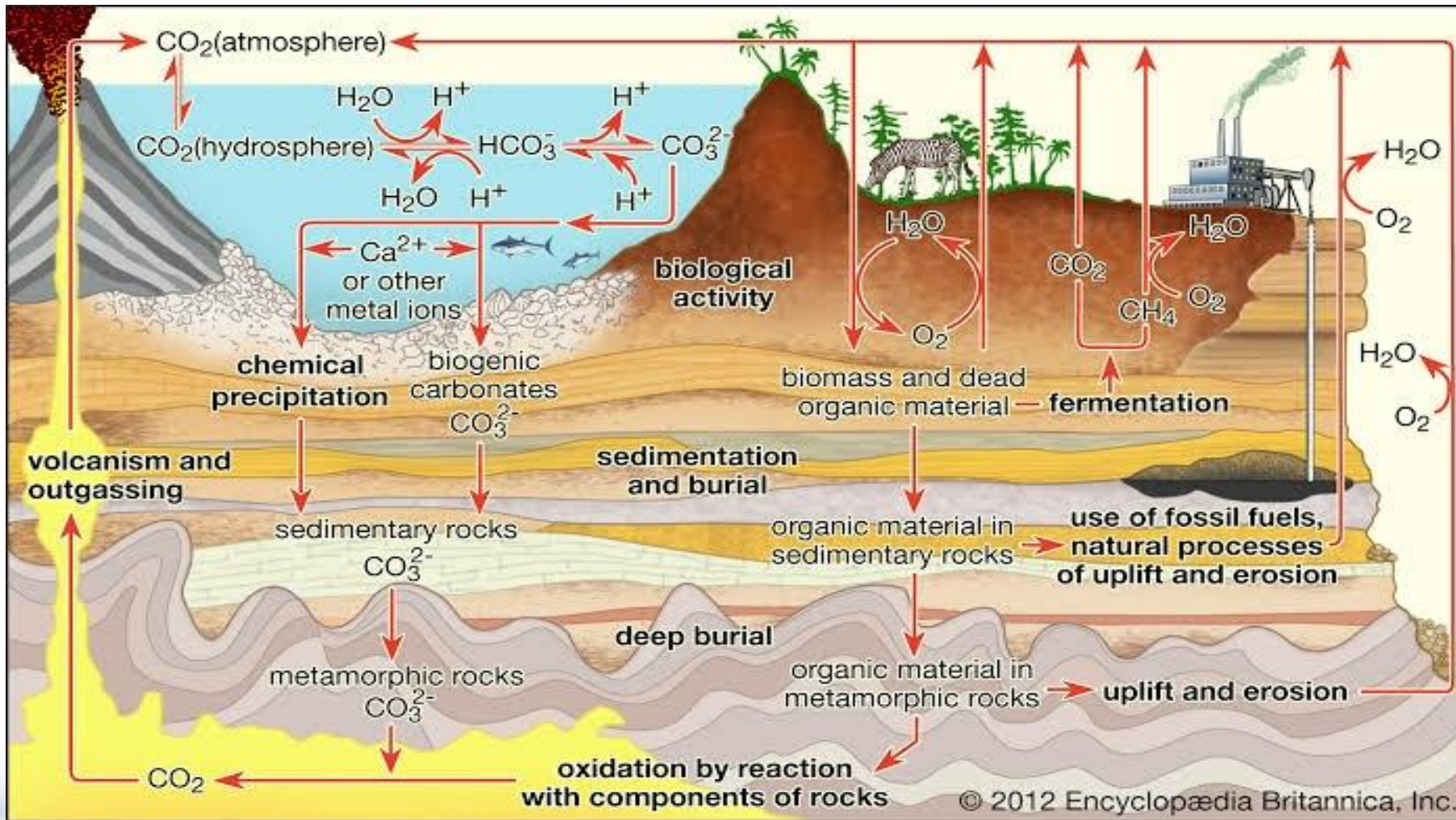
**IPA Convex 2023  
Jakarta , July 26<sup>th</sup>, 2023**

- ❑ **Background on CCS/CCUS**
- ❑ **CO<sub>2</sub> Utilization and Its Environmental Effects**
- ❑ **Analogs to CO<sub>2</sub> Injection into Subsurface**
- ❑ **Potential CO<sub>2</sub> Transboundary Hub: Learning from Northern Lights Project**
- ❑ **Potential CO<sub>2</sub> Transboundary Hub in Indonesia**
- ❑ **Readiness of Oil and Gas Industry for CCS/CCUS**
- ❑ **Center of Excellence CCS/CCUS ITB-Portfolio**

Carbon capture, utilization and storage (CCUS) prevents carbon dioxide (CO<sub>2</sub>) from being released into the atmosphere. The technology involves capturing CO<sub>2</sub> produced by industrial plants and then recycling the CO<sub>2</sub> for utilization (CCU) or compressing it for transportation and then injecting it deep into a rock formation at a carefully selected and safe site, where it is permanently stored (CCS) -- CO2CRC



# The Carbon Cycle



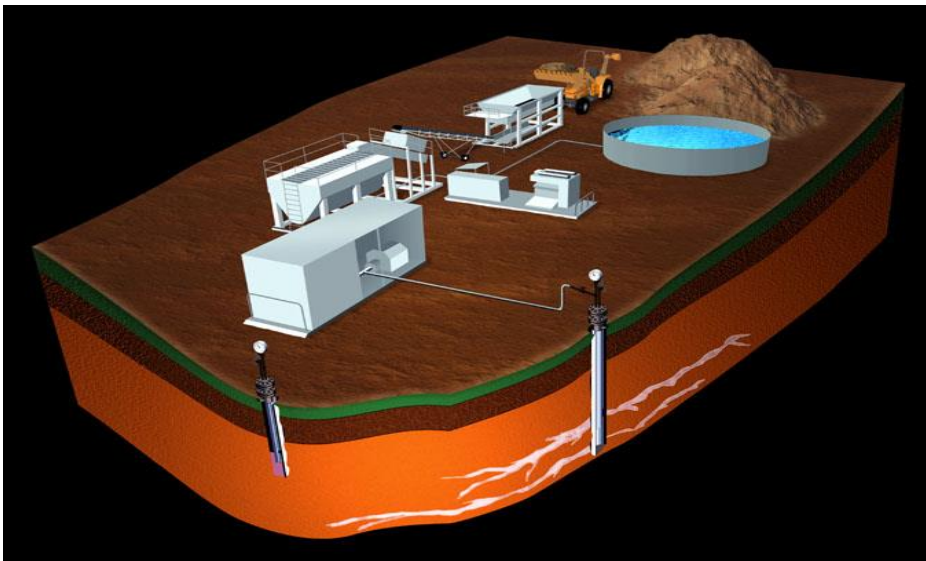
⑩ The carbon cycle is a biogeochemical cycle where different forms of carbon compounds are cycled through the Earth's various systems like the atmosphere, biosphere, hydrosphere, and geosphere.

- Underground storage of CO<sub>2</sub> can be analogous to **artificially accelerating Carbon Cycle**; hence it is a natural process and **CO<sub>2</sub> is not a waste**

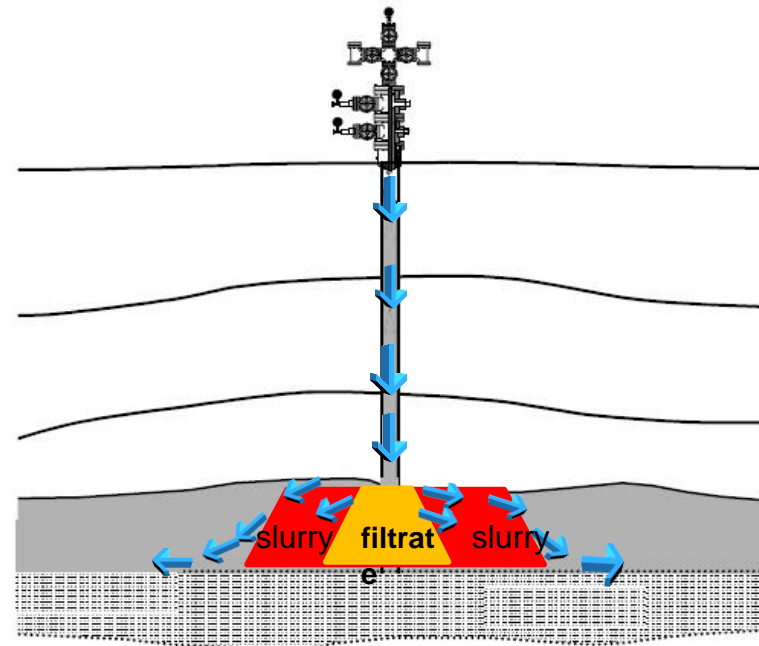
After Satyana, 2022



- ⑩ Indonesian Oil and Gas companies have experiences related to waste material injection (e.g. drill cuttings injection in BP Tangguh, slurry fracture reinjection in PHR) which requires technologically intensive methods, therefore the learning curve for CO<sub>2</sub> injection will not be steep.



**Slurry Fracture Injection in Duri Area**



**Drill Cuttings Injection in BP Tangguh Area**



## Northern Lights: a nucleus for further growth



Northern Lights is a partnership between Equinor, Shell and Total, and is a key component of Longship, the Norwegian Government's full-scale carbon capture and storage project, which aims to capture and store approximately 0.8 Mtpa of CO<sub>2</sub> by 2024 from a cement factory in Brevik and Fortum Oslo Varme, a waste-to-energy facility located in Oslo. Phase one of the project will be completed mid-2024 with a capacity of up to 1.5 million tonnes of CO<sub>2</sub> per year. The ambition is to expand capacity by an additional 3.5 million tonnes to a total of 5 million tonnes, dependent on market demand.



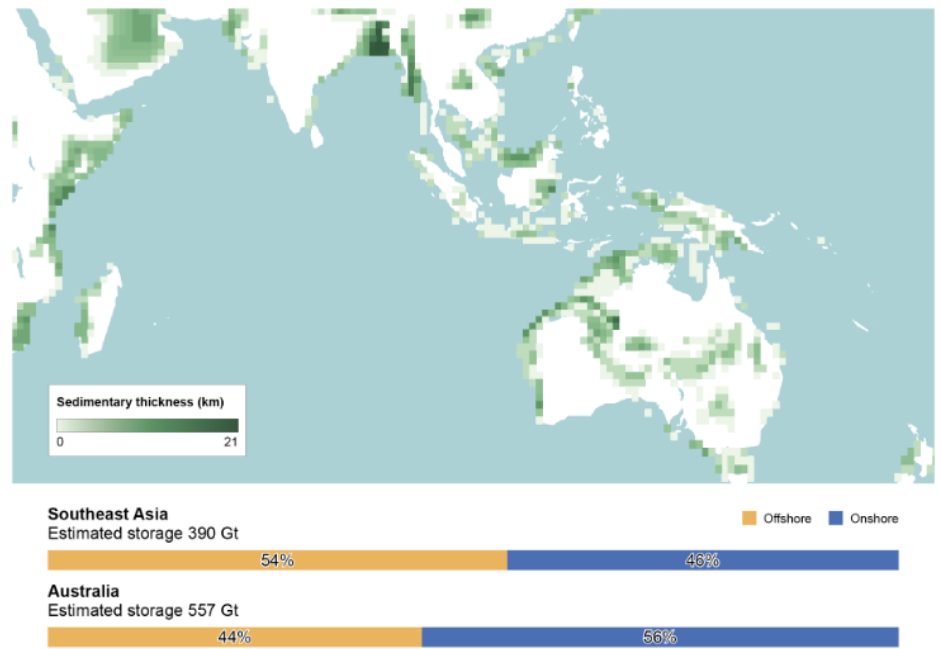
# Potential of Transboundary CO<sub>2</sub> Hub In Indonesia

Storage estimates for countries in Southeast Asia

| Country     | Type of storage  | Estimated volume        | Total volume            |
|-------------|--|-------------------------|-------------------------|
| Brunei      | Oil and gas fields   | 0.6 Gt CO <sub>2</sub>  | 0.6 Gt CO <sub>2</sub>  |
| Indonesia   | South Sumatra Basin  | 7.65 Gt CO <sub>2</sub> | 8.4 Gt CO <sub>2</sub>  |
|             | Java Basin (deep saline layers)                              | 386 Mt CO <sub>2</sub>  |                         |
|             | Tarakan Basin  | 130 Mt CO <sub>2</sub>  |                         |
|             | Central Sumatra Basin  | 229 Mt CO <sub>2</sub>  |                         |
| Malaysia    | Malay Basin  | 80 Gt CO <sub>2</sub>   | 80 Gt CO <sub>2</sub>   |
| Philippines | Saline Aquifers  | 22 Gt CO <sub>2</sub>   | 22.3 Gt CO <sub>2</sub> |
|             | Gas fields   | 0.3 Gt CO <sub>2</sub>  |                         |
| Thailand    | Saline formation in the Greater Thai Basin and Pattani Basin | 8.9 Gt CO <sub>2</sub>  | 10.3 Gt CO <sub>2</sub> |
|             | Gas and oil fields   | 1.4 Gt CO <sub>2</sub>  |                         |
| Viet Nam    | Deep saline reservoirs                                       | 10.4 Gt CO <sub>2</sub> | 11.8 Gt CO <sub>2</sub> |
|             | Depleted oil and gas fields                                  | 1.4 Gt CO <sub>2</sub>  |                         |

Sources: Based on [ADB \(2013\)](#); [METI \(2020b\)](#); [ERIA \(2021\)](#)

CO<sub>2</sub> storage potential in Southeast Asia and Australia



Indonesia has a significant potential to become one of the major players in Transboundary CO<sub>2</sub> Hub, armed with proper regulations and standards, ensuring CO<sub>2</sub> is safely transported and injected in depleted reservoirs (CCS) or producing reservoirs (CCUS/EGR/EOR).

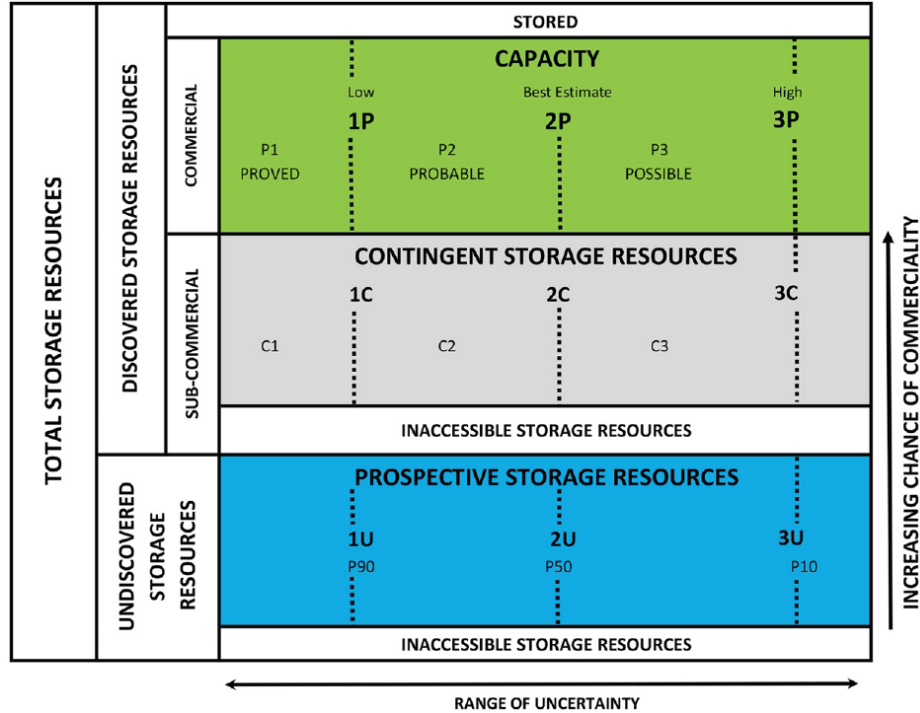
IEA 2021. All rights reserved.

Reproduced from IEA Report (2021)

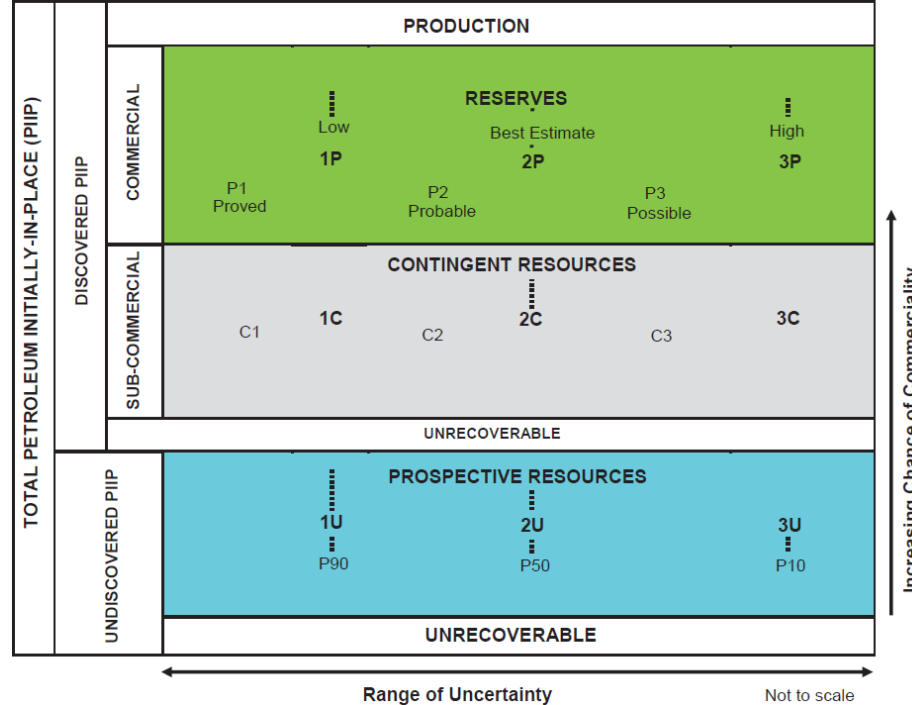


# Readiness of Oil and Gas Industry for CCS/CCUS

## SRMS

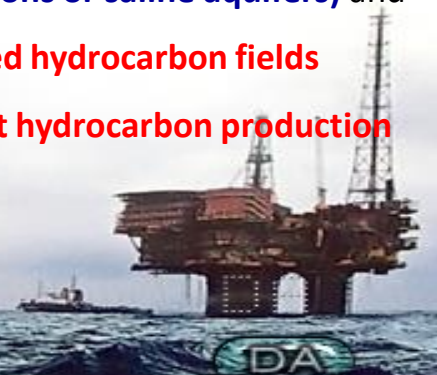


## PRMS



- The CO<sub>2</sub> – SRMS is being developed to create a **consistent set of definitions and a classification system for international usage.**
- The basic of the SRMS classification is the accessible pore volume in a geologic formation which CO<sub>2</sub> could be stored
- This document is **intended for use in geologic formations completely saturated with brine (i.e., saline formations or saline aquifers) and depleted hydrocarbon fields without hydrocarbon production**

| SRMS                           | PRMS                  |
|--------------------------------|-----------------------|
| Stored                         | Production            |
| Capacity                       | Reserves              |
| Contingent Storage Resources   | Contingent Resources  |
| Prospective Storage Resources  | Prospective Resources |
| Inaccessible Storage Resources | Unrecoverable         |







### Potential CO<sub>2</sub> Source in East Kalimantan

CO<sub>2</sub> Source from Oil & Gas

| No      | Field Name | Operator |
|---------|------------|----------|
| No Data |            |          |

CO<sub>2</sub> Source from Industry

| No  | Industry Category | Company  |
|-----|-------------------|--|
| A.1 | Petrochemicals    | PT Pupuk Kalimantan Timur, Ammonia Plants, etc |
| A.2 | LNG Plant         | PT Badak NGL                                   |
| A.3 | Refinery          | PT Pertamina (RU V)                            |

CO<sub>2</sub> Source from Power Plant

| No   | Coal Power Plant                 | Owner   |
|------|----------------------------------|---|
| C.1  | PLTU Senoni                      | PT Kalimantan Powerindo                                 |
| C.2  | PLTU CFK                         | PT PLN Cahaya Fajar Kaltim                              |
| C.3  | PLTU Teluk Balikpapan Kalimantan | PT PLN (Persero) Pembangkitan dan Penyaluran Kalimantan |
| C.4a | PT Kariangau Power               | PT Kariangau Power                                      |

New study cooperation between PT Kaltim Parna Industri (KPI) and ITB was established on 30 August 2021, study will be started from 1<sup>st</sup> Nov 2021

Potential Source of CO<sub>2</sub> in East Kalimantan  
Source Category: Gas Field, PLTU, Industry

### Decarbonization Study for GHG Emissions Reduction Program

Pelaksanaan Kajian Target Net Zero Carbon Emissions SP-002/648210/2020-20

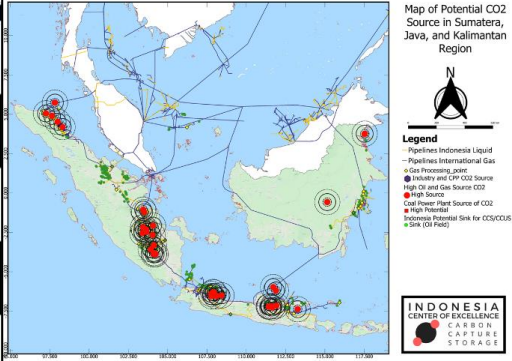
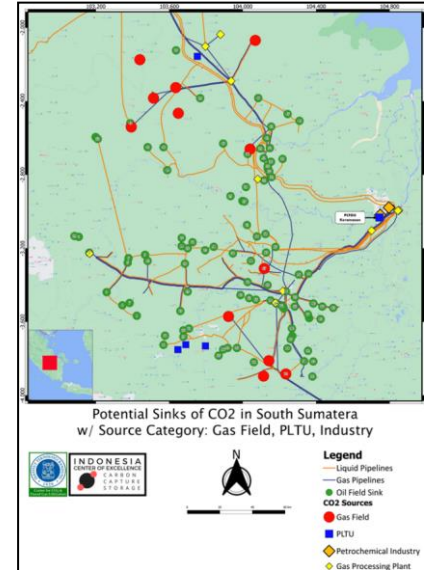
14 Oktober 2021

Pekerjaan I Kajian Target Net Zero Carbon Emissions

(1) Skenario CCS untuk Fabrik DME

(2) Analisis Risiko dari Skenario Terpilih

Risk Matrix



## Indonesia CO<sub>2</sub> Source – Sinks Mapping and Spatial Database

### New Study Cooperation

Signing of MoU regarding CCS Joint Study for Clean Fuel Ammonia Production in Central Sulawesi

PT Panca Amara Utama, JOGMEC, Mitsubishi Corp. & ITB: 19 March 2021

Study is started from 29 October 2021

Sink from Oil and Gas Fields Around Banggai Ammonia Plant Central Sulawesi

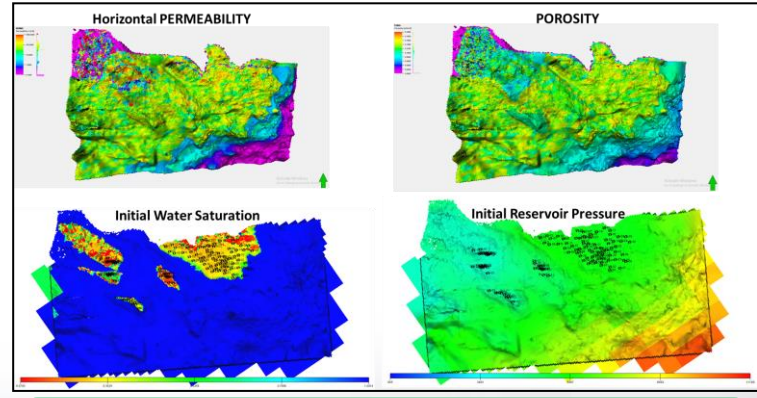
| NO | FIELD NAME | DKP CURR   | PROD. STAT          | GN. HC TYPE      | R/D SKORNA |
|----|------------|--|---------------------|------------------|------------|
| 1  | Senoro     | JOB Pertamina-Medco E&P Tomori Sulawesi (JOB PMTS) | Producing           | Oil & Gas Fields | 56,9       |
| 2  | Tiaka      | JOB Pertamina-Medco E&P Tomori Sulawesi (JOB PMTS) | Temporarily shut-in | Oil & Gas Fields | 6,9        |
| 3  | Donagi     | PT Pertamina EP                                    | Producing           | Gas Fields       | 14,1       |
| 4  | Matindok   | PT Pertamina EP                                    | Producing           | Gas Fields       | 5,92       |

## Decarbonization Study For Greenhouse Gases Emission Reduction Program

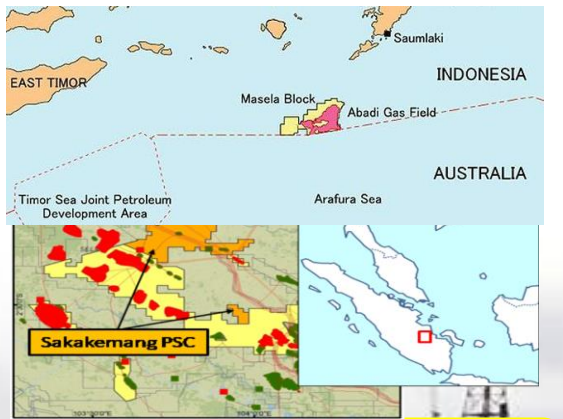
### CCUS/EGR FEASIBILITY STUDY AT TANGGUH FIELD: G&G EVALUATION, RESERVOIR SIMULATION, SURFACE FACILITY AND ECONOMIC STUDY FINAL REPORT

Prepared for: bp PT. BP BERAU LTD.

MARCH 2021

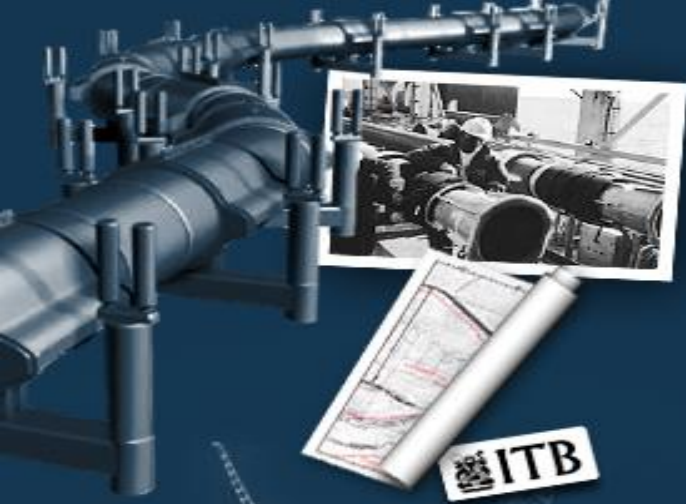


## CCUS/EGR Feasibility Study At Tangguh Field: G&G Evaluation, Reservoir Simulation, Surface Facility and Economic Studies



## Abadi & Sakakemang CCS Feasibility Study

## CCS Joint Study for Clean Fuel Ammonia in East Kalimantan and Central Sulawesi



 **ITB**

**Thank You**

