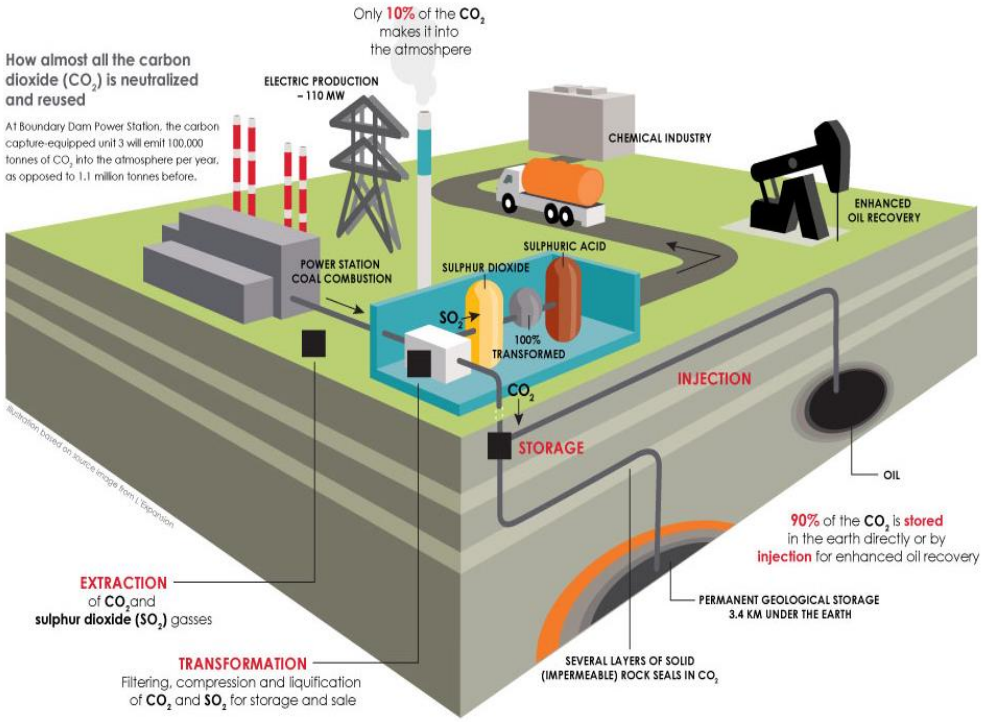
R&D CENTER FOR OIL AND GAS TECHNOLOGY "LEMIGAS"

MINISTRY OF ENERGY AND MINERAL RESOURCES, REPUBLIC OF INDONESIA



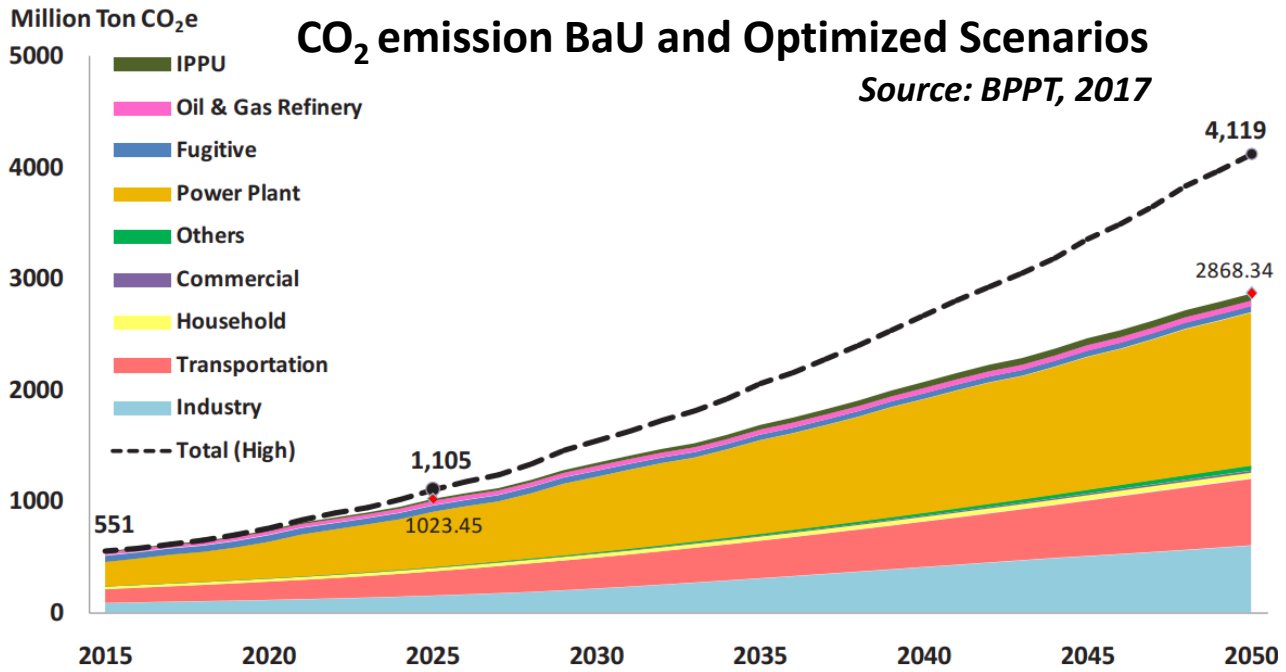

# CURRENT STATUS AND FUTURE PATH OF DEVELOPMENTS FOR CCUS IN INDONESIA

**JUNE 08, 2018**

# Outline

# Background

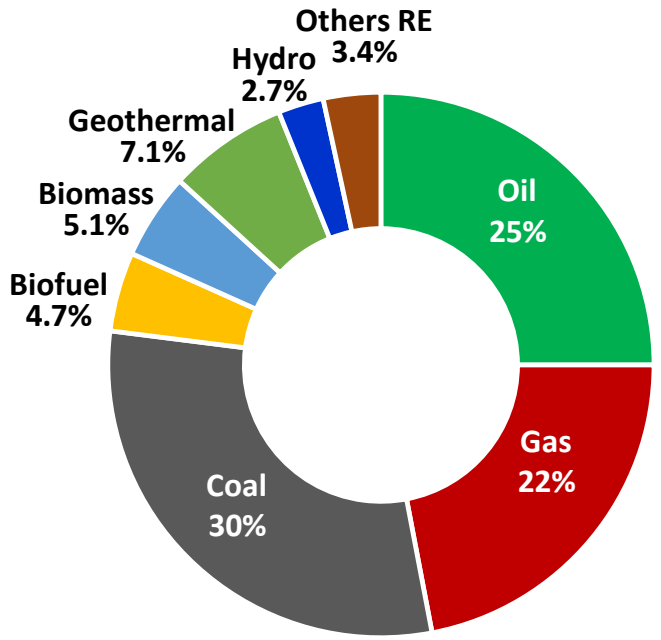
- In 2015, $CO_2$ emissions from the energy sector 551 Mt with average growth of 4.8% per-year.
- GoI's has set unconditional emission reduction target of 29% and conditional reductional target up to 41% of the BAU scenario by 2030,
- Current efforts are considered still insufficient to achieve $CO_2$ emissions abatement target in 2030.
- It is imperative for Indonesia to investigate options for CCUS.
- CCUS includes the use of $CO_2$ in enhanced oil recovery (EOR) operations, but also includes other potential beneficial uses of captured $CO_2$.




**$CO_2$ emission BaU and Optimized Scenarios**

***Source: BPPT, 2017***

**Government Regulation No 79/2014**
**Optimizing Energy Mix 2025**

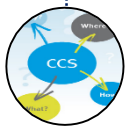



- Energy Mix improvement for 2025 is still dominated by fossil fuel
- As a result of objective function of Energy Mix improvement:

  The energy sector can achieve 1023 Mt $CO_2$ reduction in 2025 from 1105 Mt in BaU

# CCUS Milestones in Indonesia

**2012**



**ADB TA: Determining CCS Potential *South-east Asia***

Conducted by LEMIGAS, supported by BAPPENAS, DJMIGAS, SKK MIGAS, PERTAMINA, GCCSI

**2013**

**Study of EOR and CCS Opportunity of CO2 byproduct SNG Plant**

**2015**

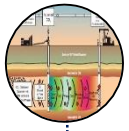
**CCS for Coal-Fired Power Plants in Indonesia**

**To provide** PT. PLN with technical, economic, operational, and environmental analysis of the CCSR for selected coal-power plants

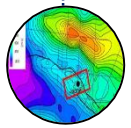
**To explore** the EOR market as cost-offsetting mechanism for CCS projects at the selected site

**2016**

**FS of $CO_2$ EOR Pilot Project in Beringin Depleted Oil Field**



**2017**



**FEED of $CO_2$ EOR Pilot Project in Beringin Depleted Oil Field**

## WHY CCS WITH $CO_2$ EOR

- **The use of $CO_2$ for EOR provides** a driver and early mover for deploying CCS particularly for Indonesia
- **Rationale the selected South Sumatera**: Large presence of the industrial and power sector in South Sumatera, Large and various $CO_2$ sinks, South Sumatera has low density population, Existing infrastructure, Relatively stable geological setting from seismic and tectonic activity
- **LEMIGAS** study shown that additional potential oil reserves from $CO_2$ EOR application in South Sumatera is ±480 MMstb. Potential of $CO_2$ storage ± 75 million tonne. At national level, additional potential oil reserves ±2 miliar barel. Potential of $CO_2$ storage ± 300 million tonne.

# CCUS Deployment Strategy in Indonesia

**STAGE 1**

## Pilot

- 50-100 tonnes per day of $CO_2$ over several months
- Knowledge of reservoir performance to support financing and designing a Demo project.

**STAGE 2**

## Demonstration

- Larger quantities of $CO_2$ injected into many wells continuously over many years
- 500-1,000 tonnes per day or more of $CO_2$ injected over 10 + years.
- Confirmation of long-term successful $CO_2$ storage to support financing and construction of at least one full scale commercial operation

**STAGE 3**

## Commercial

- Very large quantities of $CO_2$ captured from one or more sources injected into one or more locations for a very long time period
- 2,500 -5,000 tonnes per day $CO_2$ captured and injected over 20+ years.
- Capture and store sufficient quantities of $CO_2$ to substantially reduce Indonesia's $CO_2$ emissions

# A roadmap for CCUS pilot project

## Emphasis to improve energy security in conjunction with EOR / CTL / CTG / Biomass

### Roadmapping

Five stage gates for the pilot

**GATE 1**
Pilot $CO_2$ source and storage site have been identified and the owners/ operators are supportive

**GATE 2**
Pilot funding has been secured and permitting has been completed

**GATE 3**
The construction of the pilot has been completed

**GATE 4**
Injection of 50–100 tons of $CO_2$/day has been successful

**GATE 5**
Case for a storage demonstration is approved based on a successful pilot assessment

# Proposed CCUS pilot project


## Merbau Gas Gathering Station Site

75 ton $CO_2$/hari
1,85 bar, 50°C

Amine regenerator

20 bar,
35°C

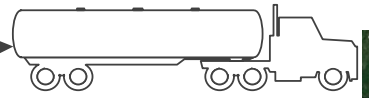
CO2 Compressor

Dryer package

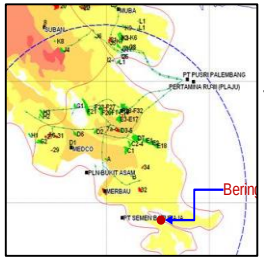
20 bar,
-20°C

CO2 Liquefaction

75 ton $CO_2$/hari




*Note:*
*Land road (20 km)*
*National road (45 km)*



To Injection Well
75 ton $CO_2$/day

Injection Pump

Heater

Liquid $CO_2$ Pump

## Beringin Field Site

**MERBAU GAS GATHERING STATION:**

- As $CO_2$ Source
- $CO_2$ production: 1,5 MMscfd ≈ 79 ton/day ≈ 28.800 ton / year (2016)
- Has 1 processing train.
- The removal of $CO_2$ takes place absorber column by using a multi-stage proprietary A-MDEA process.
- The pure $CO_2$ (99.9%) is vented to the atmosphere.

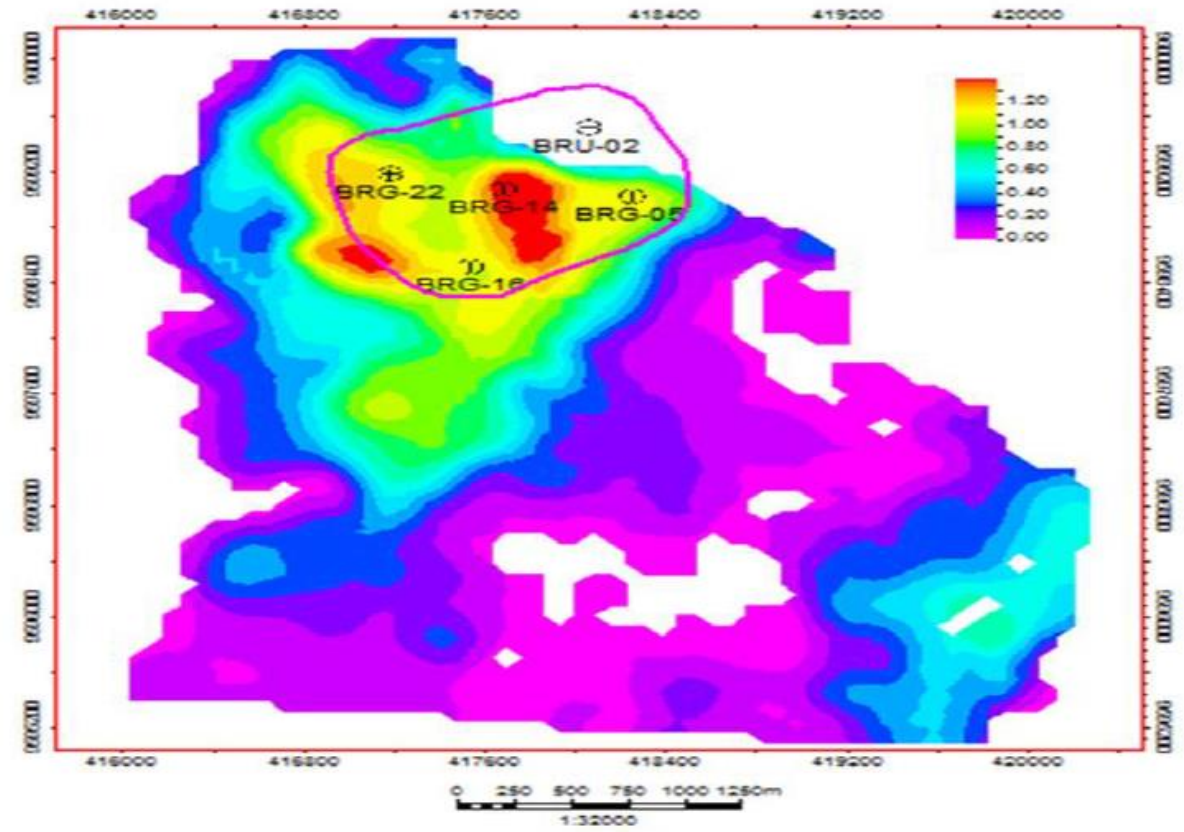
**BERINGIN FIELD:**

- $CO_2$ Storage capacity = 180,000 ton of $CO_2$
- For five years, oil recovery gain will be at 1.4 % RF by immiscible $CO_2$ injection
- For pilot project, one injection well and four producing wells will be applied
- Total amount of $CO_2$ injected is 75 ton per day

| Component Facility | Merbau | Beringin |
|---|---|---|
| Process and Mechanical | 6,792 | 196 |
| Electrical | 375 | 134 |
| Instrument | 145 | 17 |
| Piping | 219 | 40 |
| HSE | 79 | 79 |
| Civil | 73 | 142 |
| Well conversion | | 1860 |
| Monitoring | | 157 |
| **Subtotal** | **7,683** | **2,626** |
| **TOTAL CAPEX (U$. 000)** | | **10,309** |
| **TOTAL OPEX 1st year** | | **1,760** |

# Deep review of the pilot project candidate

- $CO_2$ EOR and storage pilot planned in Beringin field using inverted 5-spot
- Simulation studies to establish expected pilot performance
- Design for $CO_2$ transport from Merbau gas processing plant + other surface facilities
- Monitoring plan with active and passive technologies



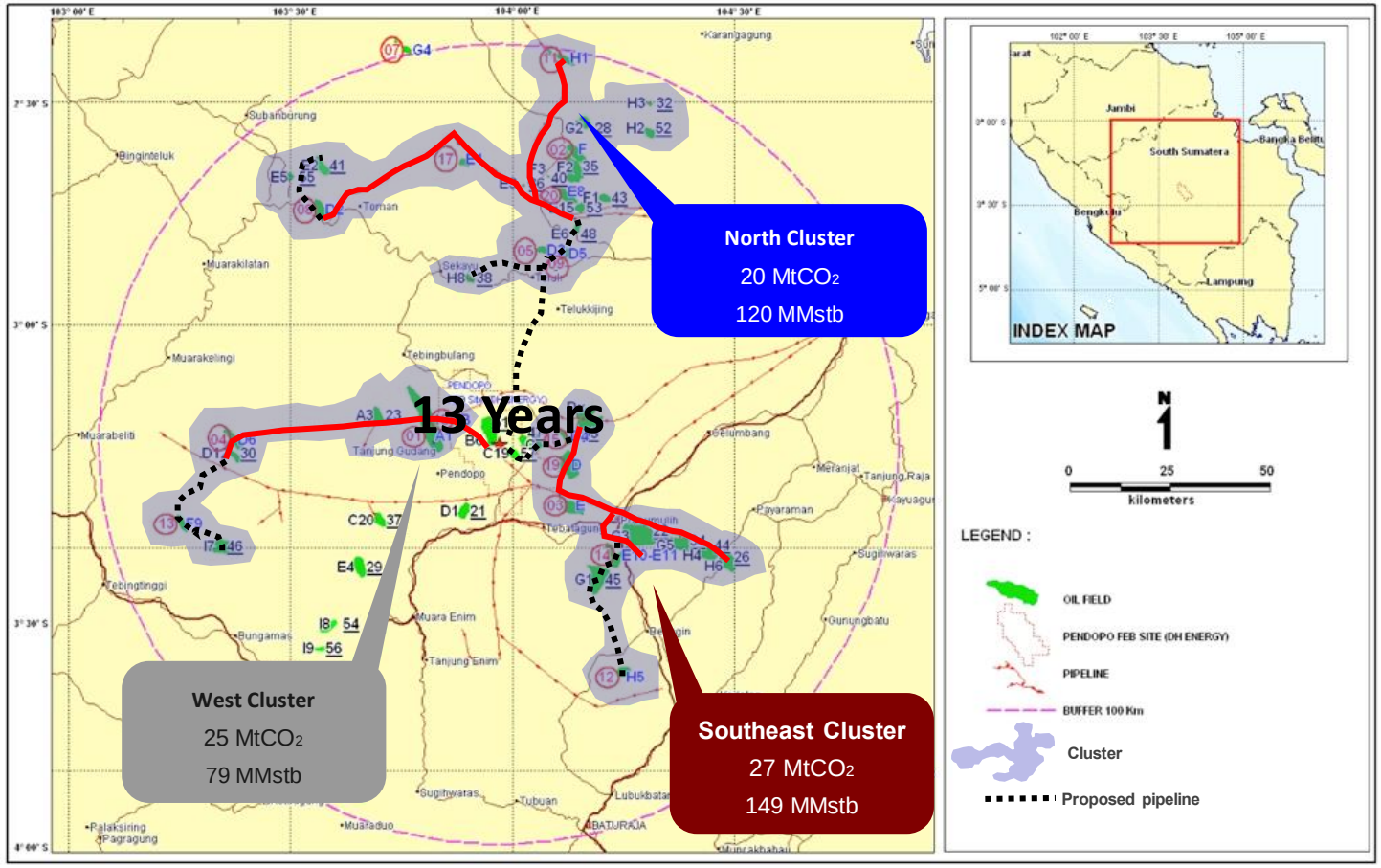
# Why we need a CCUS pilot project

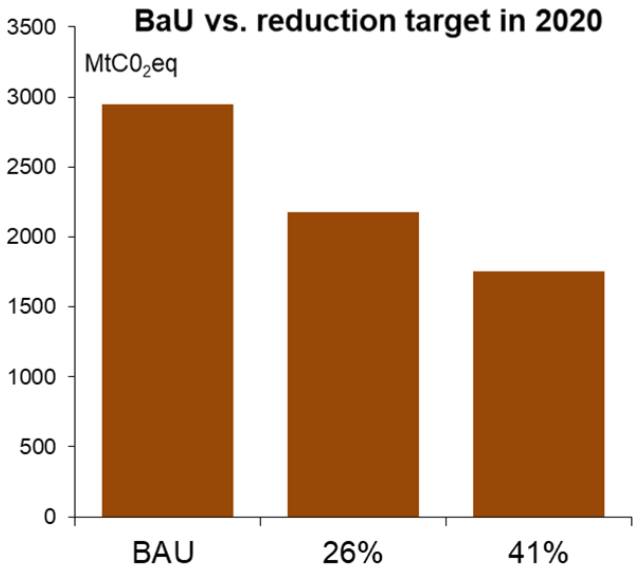
**This pilot project generates support of Indonesian stakeholders in the following areas:**

- Confirm feasibility of $CO_2$ EOR sequestration in a South Sumateran reservoir;
- Understanding $CO_2$ EOR processes when applied in conjunction with $CO_2$ sequestration;
- To increase the level understanding of and confidence in $CO_2$ EOR sequestration;
- Gain valuable experience and expertise in operating a $CO_2$ EOR sequestration project;
- To synthesize the information collected from the pilot project as the basis to seek the possibility for deployment of CO2 EOR sequestration;
- To support capacity building in $CO_2$ EOR sequestration nationally; and
- To obtain information for the development of appropriate legal and regulatory frameworks for $CO_2$ EOR sequestration.

# Expected outcome of this pilot project

## Prime mover for $CO_2$ EOR and Sequestration in the region




| Sectors | 26% | 41% |
|---|---|---|
| | Giga Ton | |
| Forestry + Land Peat | 0.672 | 1.039 |
| Agriculture | 0.008 | 0.011 |
| Energy and Transport | 0.038 | 0.056 |
| Industry | 0.001 | 0.005 |
| Waste | 0.048 | 0.078 |

***Presidential Regulation No 61/2011***

# Concluding remarks

- Deployment of CCUS in Indonesia is aligned with national energy policy and GoI's commitment to achieve unconditional emission reduction target of 29% and conditional reductional target up to 41% of the BAU scenario by 2030
- The utilization of $CO_2$ in petroleum industry particularly for EOR is highly encouraged in achieving both emission reduction and national oil production targets.
- Enabling the development of highly contaminated gas fields e.g. East Natuna

# Thank you

***www.lemigas.esdm.go.id***