



40th JCCP International Symposium

Energy Transition and Reducing GHG Emission in Indonesia through CCUS Implementation on Oil & Gas Field: *Progress and Opportunity*

Thursday, 27 January 2022

Background & Motivation



PRESIDENCY'S FRAMEWORK, G20 INDONESIA 2022

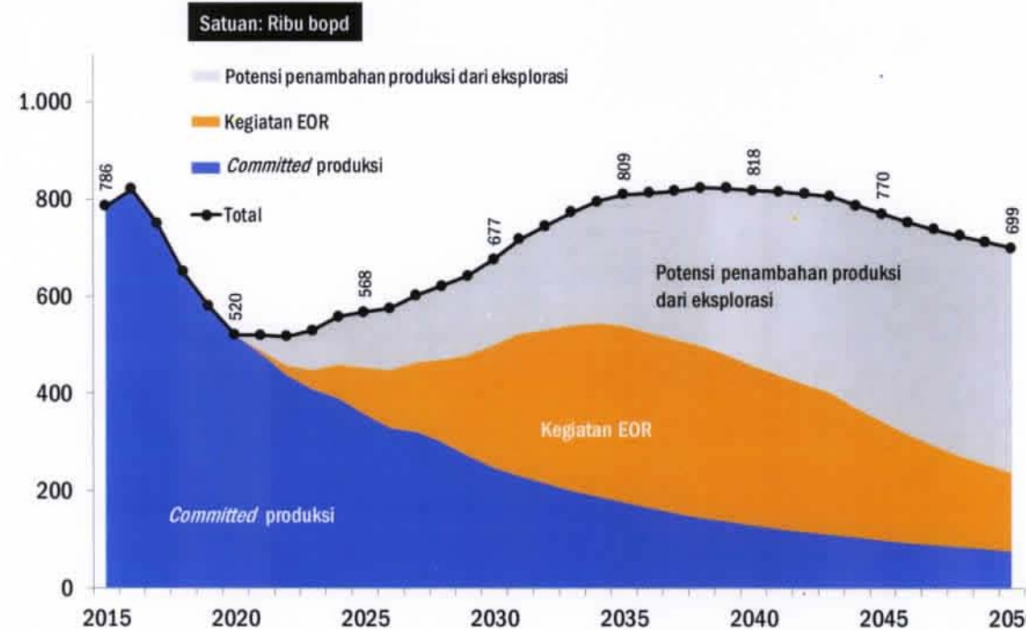


Background

1. National Energy Plan (RUEN) of Indonesia

Enhanced Oil Recovery (EOR) technology is one of the solutions to increase oil and gas production in Indonesia.

2. Commitment of Gol to Reduce Green House Gas (GHG) Emission in COP 21 - Paris.



Reduction Scenario
GHG Emission by 2030

29 % business as usual

41 % with international support

Widodo spoke at United States President Joe Biden's Climate Leadership Summit in April, he made three key comments consistent with other coal producing and consuming nations, and the direction of the World Coal Association.

Firstly, he underscored Indonesia's commitment to tackling climate change as an issue which is in the "national interest". Secondly, he invited global leaders to support developing countries in realizing their climate ambitions in a "credible way". Thirdly, he said the Paris Agreement partnership had to be "strengthened" around a better understanding of the strategies which can accelerate net zero emissions.



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Reducing GHG Emission from Energy Sector and its opportunity for CCS-CCUS

Indonesia is committed to reduce GHG Emission by 29% in 2030 and could be up to 41% if there is international support

No	Sector	GHG Emission Level 2010 (MTon CO2e)	GHG Emission Level 2030 (MTon CO2e)			GHG Emission Reduction (MTon CO2e)	
			BaU	CM1	CM2	CM1	CM2
1	Energy*	453.2	1,669	1,335	1,271	334	398
2	Waste	88	296	285	270	11	26
3	IPPU	36	69.6	66.85	66.35	2.75	3.25
4	Agriculture	110.5	119.66	110.39	115.86	9	4
5	Forestry**	647	714	217	64	497	650
	TOTAL	1,334	2,869	2,034	1,787	834	1,081



38% of emission reductions come from the energy sector

* Including fugitive

**Including Peat fire

Notes: **CM1** = Counter Measure (*unconditional mitigation scenario*)

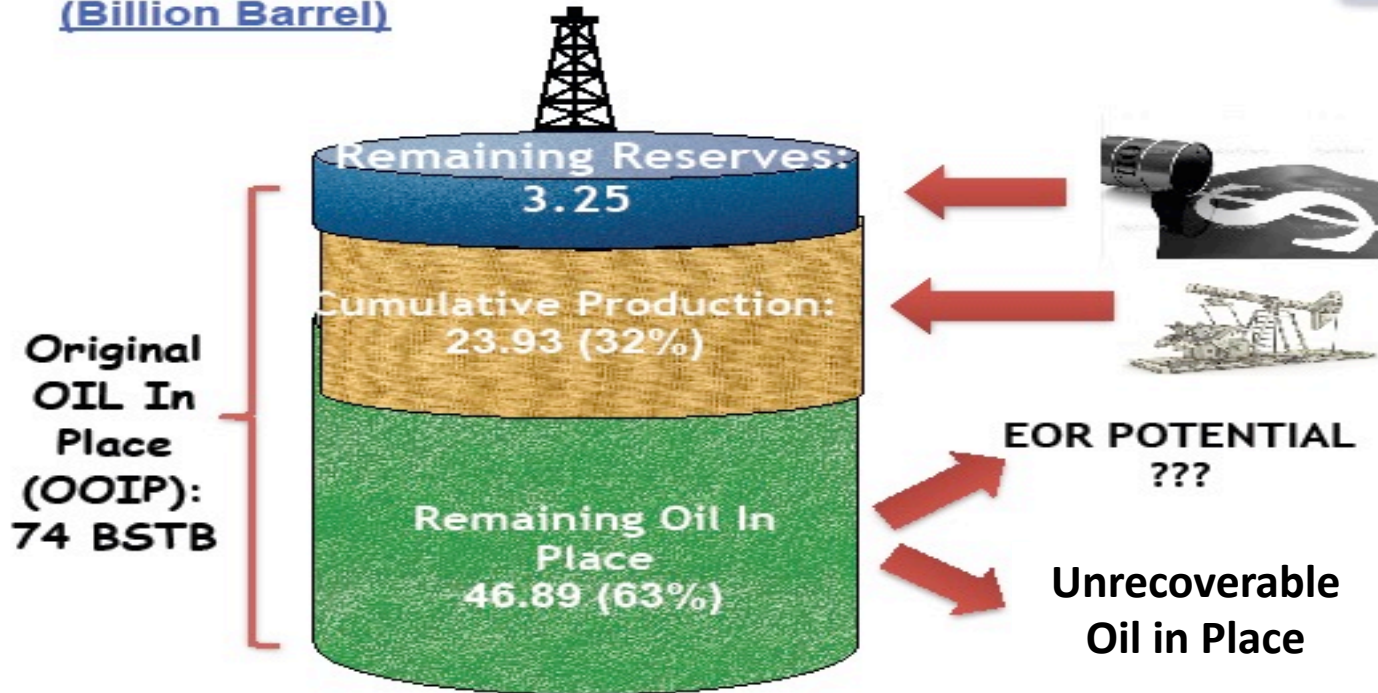
CM2 = Counter Measure (*conditional mitigation scenario*)

IPPU = Industrial Processes and Production Use

EOR Potential



Reserves Distribution:
(Billion Barrel)



→ To get 2⁰C compatible should be NDC + CCS&CCUS and while for 1.5⁰C compatible needs NDC + BECCS (Bioenergy with CCS&CCUS)

→ CCS and CCUS implementations are not included in Indonesian NDC as the tool that could reduce the GHG emissions, because it was predicted that these kinds of technologies are too expensive.

Source: SKK Migas Indonesia Oil Reserves Data (1/1/2014)

→ The concept of CO₂-injection implementation in the form of CO₂-EOR or CO₂-EGR are introduced by National CoE for CCS/CCUS since the end of 2019, when the preparation of the Gundih CCS project is revised to become the Gundih CCUS project

CO₂ Sources from Main Energy Sectors in Indonesia and its plan and opportunity for CCS-CCUS implementation

Our target for GHG emission reduction **from energy sector** from 2020 – 2030 (10 years): ~ 400 Mton of CO₂.

Some facts about CO₂ from some sites in Indonesia:

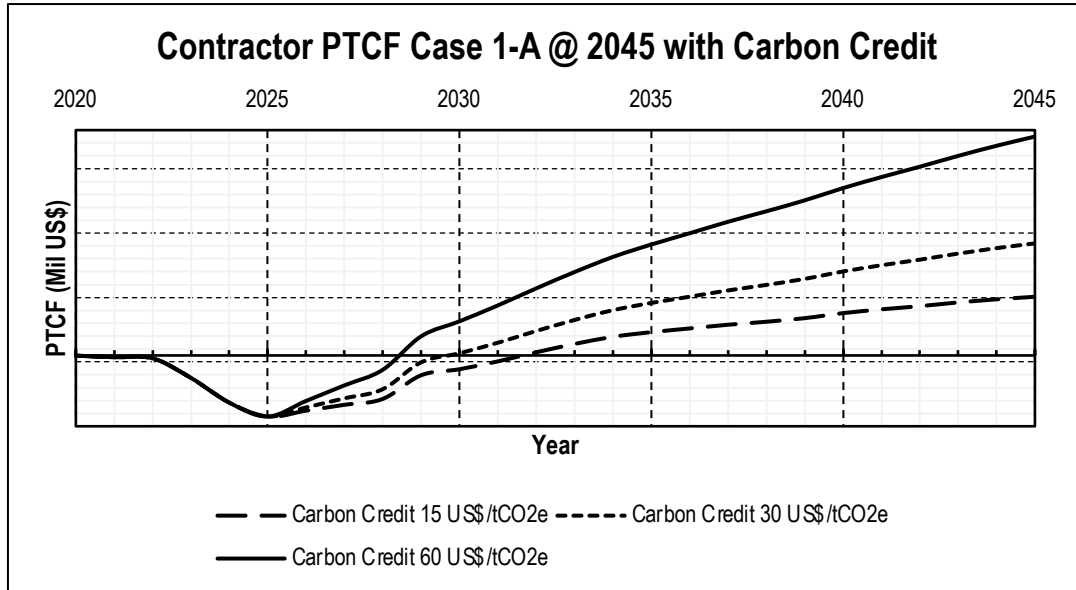
- Total CO₂ that could be injected in Gundih field for 10 years ~ 3 Mton of CO₂
- Total CO₂ that could be injected in Tangguh field for 10 years ~ 32 Mton of CO₂
- Total CO₂ that could be produced from all main fields in Eastern Java (Gundih, Banyu Urip, Sukowati, and JTB) for 10 years ~35 Mton
- Potency of CO₂ to be injected from Banggai Ammonia Plant (Central Sulawesi) for 10 years ~ 9 Mton of CO₂
- Potency of pure CO₂ injection from DME Project in Tanjung Enim – South Sumatra for 10 years (from coal gasification) ~ 40 Mton of CO₂ (there will be another 25 Mton of CO₂ for 10 years from boiler incl impurities)
- Released of CO₂ from PLTU Cirebon (650 MW, 80% capacity factor) for 10 years ~ 45 Mton of CO₂ (Note: 1 MWh ~ 1 ton of CO₂)
- CO₂ released from all Coal-fired power plants in Indonesia (totally 35 GW, 80% capacity factor) ~455 Mton of CO₂

→ **Thus, CCUS can play an important role in Indonesia, since there are a lot of CO₂ sources from energy sector, but their locations are close to depleted oil reservoirs and coal mining, so that CO₂-EOR, CO₂-EGR and CO₂-CBM can perhaps be carried out economically in Indonesia.**

Economical Motivation of CCUS Implementation in Indonesia:

Make oil and gas fields more environmental friendly & they give economic benefit e.g. from incremental production

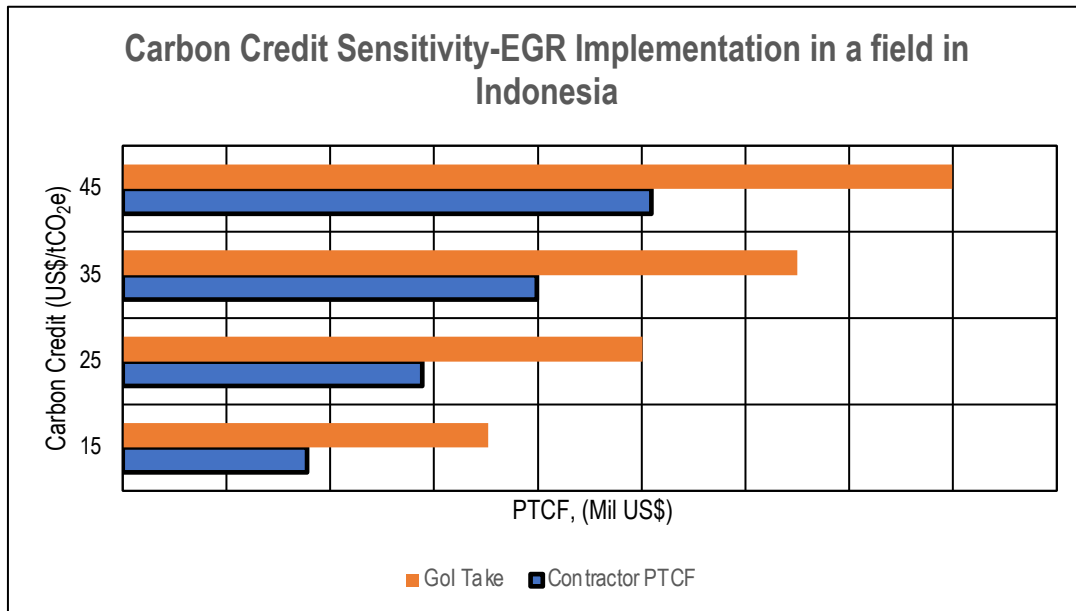
--- A Study from an Indonesian EGR Project Plant: Analysis on Carbon Credit Sensitivity for Project Economics ---



Assumptions: Injection of CO₂ starts in 2026 & all CO₂- credit could be sold

Estimated Project pay out time for

- Carbon Credit 15 US\$/tCO₂e : Q1 2032
- Carbon Credit 25 US\$/tCO₂e : Q4 2030
- Carbon Credit 35 US\$/tCO₂e : Q2 2029
- PTCF Comparison for project 35 US\$ carbon credit is **1.6 times as profitable** as the project with 25 US\$ carbon credit and **2.4 times more profitable** compared to the project with 15 US\$ carbon credit.
- Based on the calculation, carbon credit is able to reduce operating expenditure to **zero**, therefore increasing profit for both contractor and the Government of Indonesia.



References of Carbon Pricing Around the World:

- EU ETS : 25 US\$/tCO₂e (50-60 US\$/tCO₂e in 2022)
- Hitachi: 46.7 US\$/tCO₂e
- Iceland Carbon Tax: 31.3 US\$/tCO₂e
- Beijing Pilot ETS: 10.4 US\$/tCO₂e

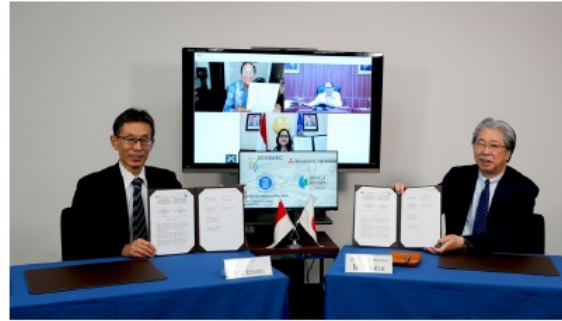
CCUS is also needed for downstream oil and gas industries

March 19, 2021

Japan Oil, Gas and Metals National Corporation

Mitsubishi Corporation

Signing of Memorandum of Understanding regarding CCS Joint Study for Clean Fuel Ammonia Production in Indonesia



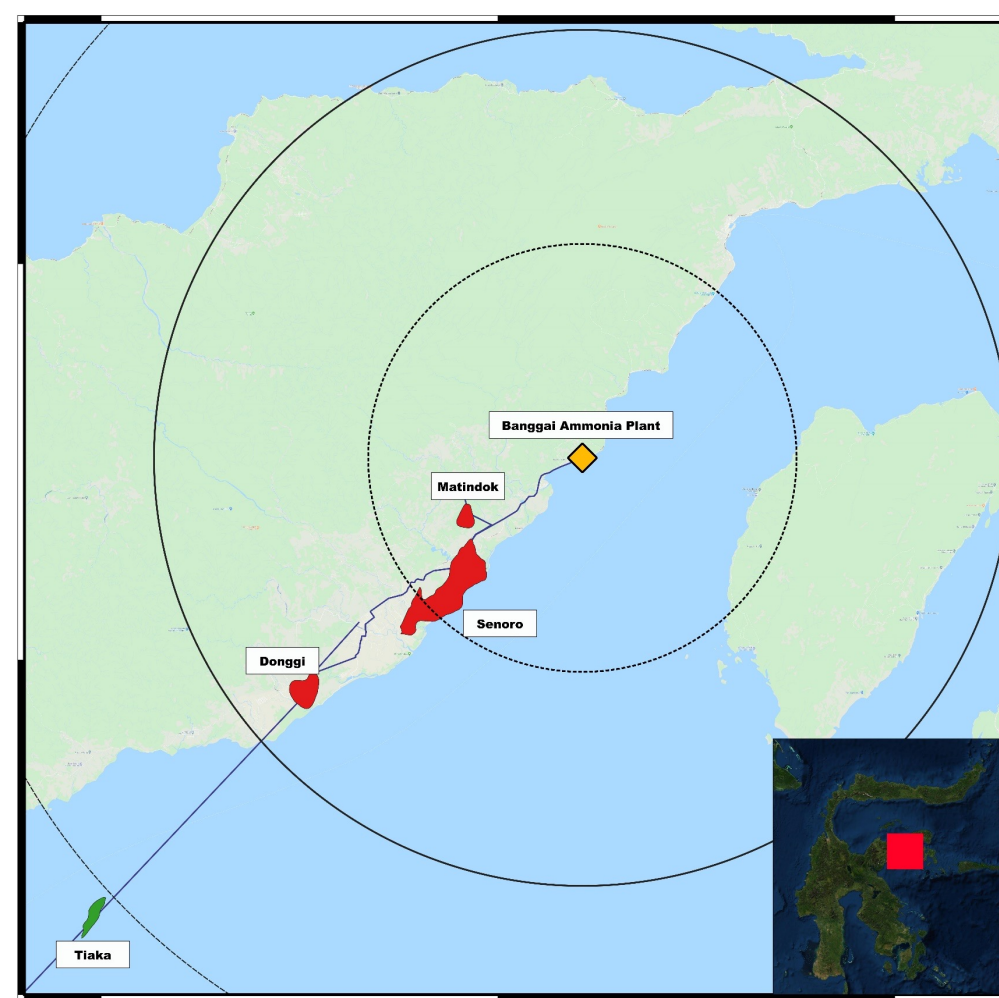
Signing ceremony

Japan Oil, Gas and Metals National Corporation (JOGMEC), Mitsubishi Corporation (MC), Bandung Institute of Technology (ITB), a national university in the Republic of Indonesia, and PT Panca Amara Utama (PAU) have agreed to conduct a joint study on carbon capture and storage (CCS) and carbon dioxide utilization for clean fuel ammonia production in Central Sulawesi, the Republic of Indonesia. The four parties have signed a Memorandum of Understanding (MOU).

Ammonia is being used worldwide as raw material for fertilizers/plastics/chemicals. Expectation for ammonia to become a next generation clean energy source is growing because ammonia does not emit carbon dioxide when burnt; transportation methods have been established with existing infrastructure; and due to its high hydrogen content.

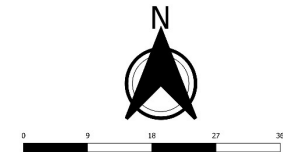
Under the MOU, the four parties will jointly conduct a CCS feasibility study near PAU's ammonia plant in Luwuk, Central Sulawesi, and the Donggi-Senoro LNG plant in the same province which is being led by MC as the largest shareholder. Mitsubishi Gas Chemical Company, Inc., which also indirectly invests in PAU together with Mitsubishi Corporation, has expressed its interests to cooperate in this joint study. Going forward, the companies concerned will formulate the necessary work processes including project composition; data accumulation of candidate storage formations; simulations; analysis and evaluations.

Through this joint study, we will make effort to contribute towards realizing a decarbonized society and securing stable energy supply for Japan by pursuing the feasibility of clean fuel ammonia production from utilization of existing ammonia plant and CCS treatment of carbon dioxide generated during the production phase.



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

No ID	FIELD_NAME	OPR_CURR	PROD_STAT	GN_HC_TYPE	FLD_SQKM
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	Donggi	PT Pertamina EP	Producing	Gas Fields	14.1
4	Matindok	PT Pertamina EP	Producing	Gas Fields	5.92

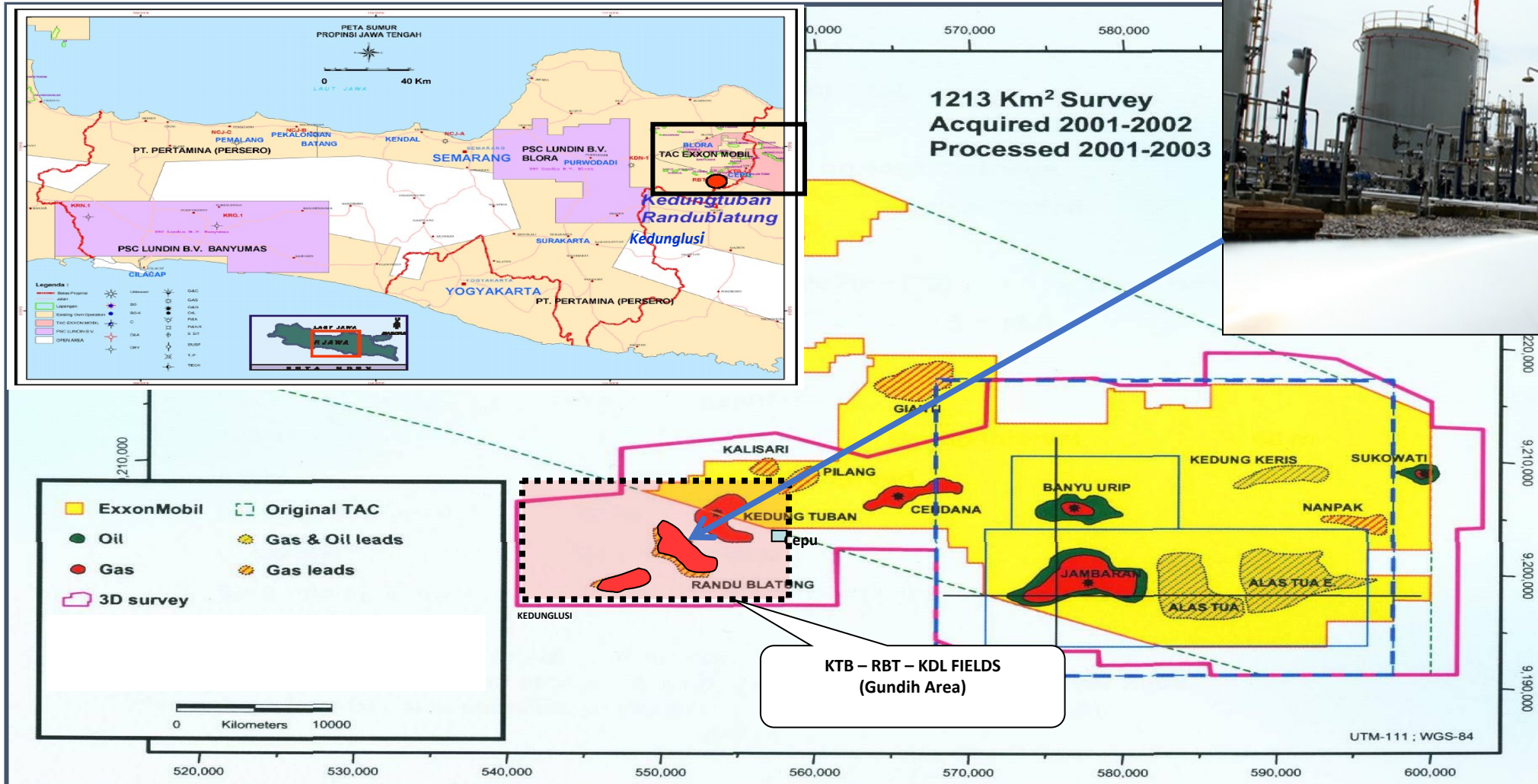


Legend

- ◆ Banggai Ammonia Plant
- Liquid Pipelines
- Gas Pipelines
- Fields_Structure**
- Gas
- Oil
- Cluster C (90 km)
- Cluster A (30 km)
- Cluster B (60 km)

Latest Status of Gundih Project as an example: Shifting from CCS Pilot Project to CCUS (CO₂-EGR) Project

Map of Gundih area and its surrounding areas

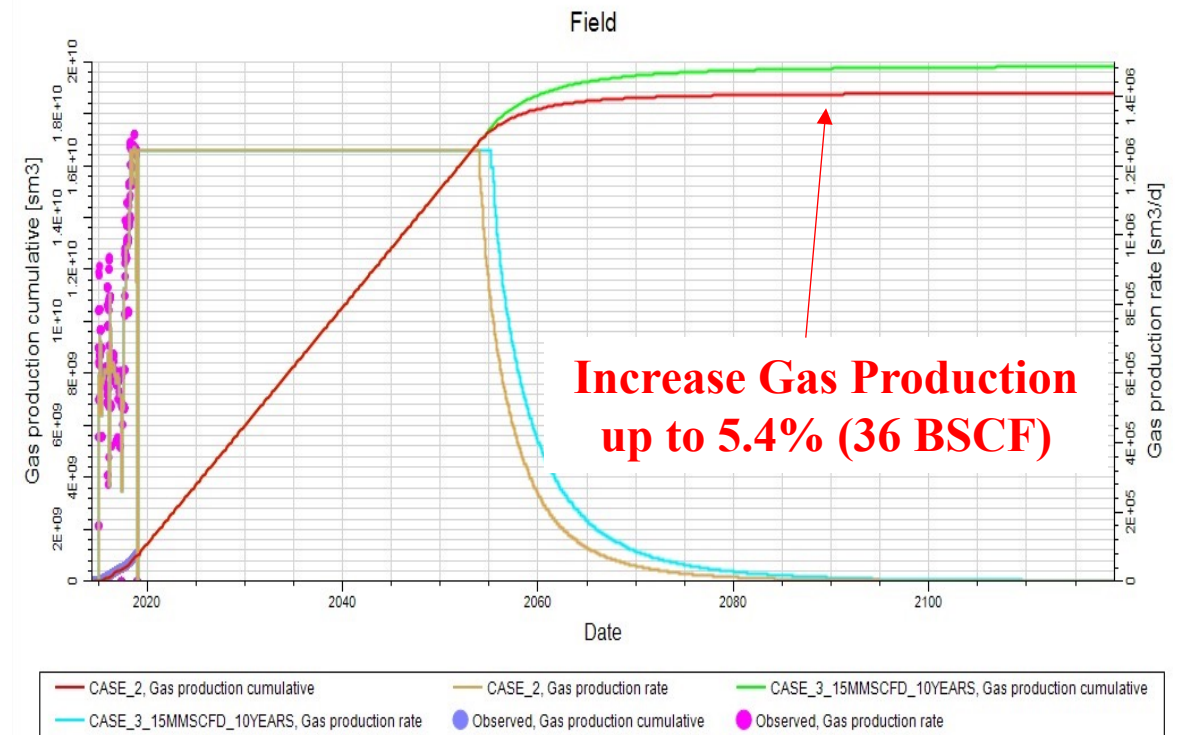
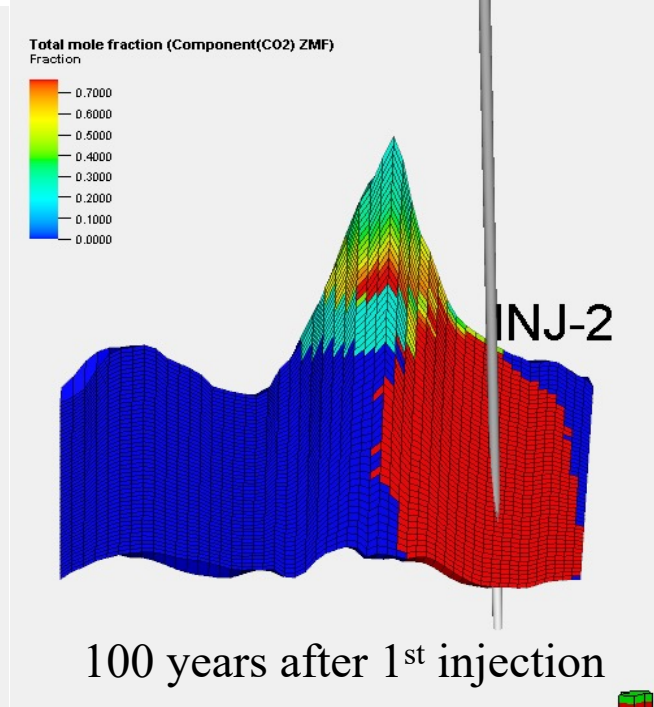
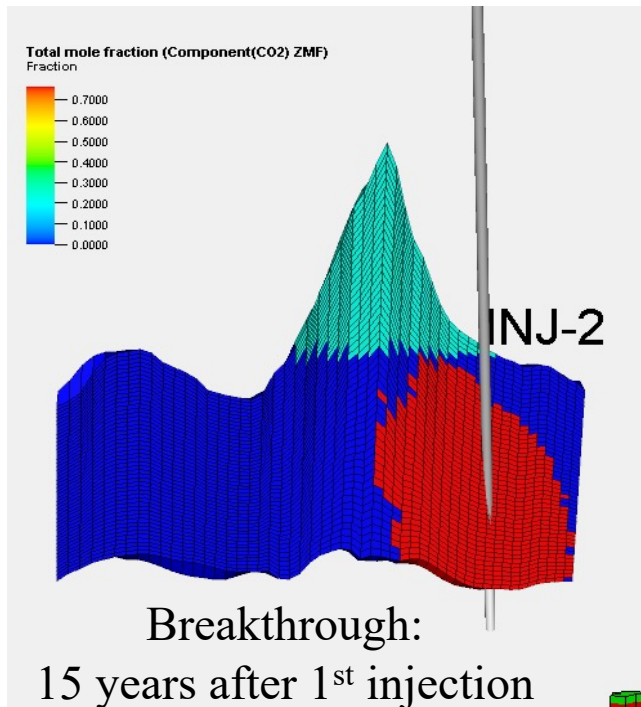
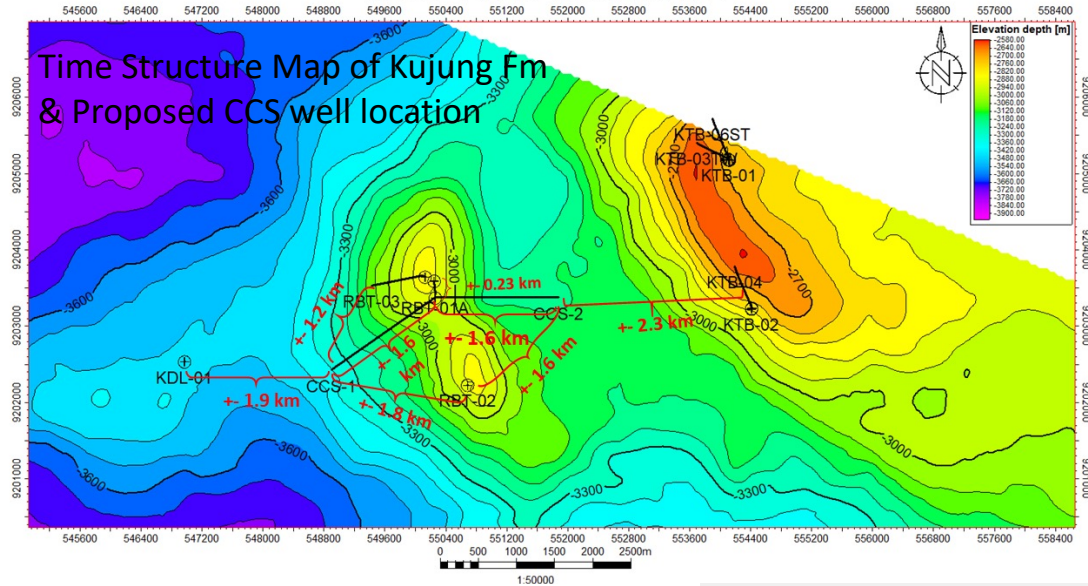


- 70 MMSCFD for 12 years
- CO₂ = 21%, equivalent to 800 tpd

NEW Scenario of CCUS Project in GUNDIH AREA (Starting from 2019)

Currently Gundih CPP releases 800 tpd of CO₂. If all of available CO₂ is injected to Kedungtuban structure:

- 3 mio of CO₂ will be reduced for 10 years injection time.
- Incremental gas production (80% CH₄) of 36 BSCF for 10 years, equivalent to approx. USD 100 - 120 mio.
- The Capex for 10 years CO₂ injection = USD 49 mio, total OPEX = USD 20 mio
- Offering participation of foreign institutions for injecting CO₂, e.g. using JCM scheme (Initial CO₂ injection will be 2025)



Regulation to support CCS–CCUS activity in Indonesia

Regulation will cover some points such as :

- Revision to existing regulation in oil and gas
- The need to provide regulations that support CCUS activities in Indonesia including a system that account CO₂
- To build an agency/board/entity that will certify the MRV methodologies in a specific CCUS project in Indonesia
- The need to prepare and form an attractive carbon market in Indonesia
- Supporting projects related to monetization of Associated Gas Recovery and Fuel Producing Facility e.g. with JCM Scheme toward Zero Flaring



INDONESIA CENTER OF EXCELLENCE FOR CCS AND CCUS



THANK YOU

