



**Deep Dive Workshop**  
Friday, 19 June 2020  
10:30 p.m. – 12:00 p.m. (Manila time, GMT +8)

## Clean Energy Fossil Initiatives in Indonesia

**Dr. Mohammad Rachmat Sule**

**\*Center Manager of National Center of Excellence for CCS/CCUS and ZRF**



# National CoE for CCS - CCUS and ZRF

--- First activity was stated in 2009 ---

--- Established based on DG Oil and Gas Appointed Letter (May 2017) ---

## The purposes of establishment:

- Realization of National commitment to reduce GHG of 29% in 2030 by national effort and could increase up to 41% if International support is available.
- Promoting the reduction of GHG emission efforts from Energy Sector in Indonesia
  1. Developing technology related to CCS/CCUS and it can be used for future EOR activity (CCUS) in order to maintain and increase oil & gas production.
  2. Develop real projects related to CCS and CCUS, such as: Gundih CCS Pilot project, development of CO<sub>2</sub> separation technology, CCS/CCUS SOP, Regulation, etc.
  3. Extended to other oil & gas fields with high CO<sub>2</sub> content, such as Natuna D alpha, some fields in South Sumatera and East Java, etc.

# Government of Indonesia released several regulations related to GHG emission reductions

- Presidential Decree 61/2011 on Reducing Greenhouse Gas Emission
- MEMR Decree 31/ 2012 on Gas Flaring for Oil and Gas Industries (in the form of limitation, permit, and reporting)
- MEMR Decree 32/2017 on Monetization of Flare Gas from Upstream Oil and Gas Industries
- Responding several offers from international institutions related to the reduction of GHG emission from energy sector

Draft of regulation for promoting CCS and CCUS in Indonesia was produced by the CoE CCS-CCUS in 2019 (supported by ADB)



THE PRESIDENT OF THE REPUBLIC OF INDONESIA

REGULATION OF THE PRESIDENT OF THE REPUBLIC OF INDONESIA NUMBER \_\_ YEAR 20 \_\_ ON CARBON CAPTURE AND SEQUESTRATION

BY THE GRACE OF THE ALMIGHTY GOD

THE PRESIDENT OF THE REPUBLIC OF INDONESIA,

Considering : that in order to encourage the efficient utilization of Indonesia's natural resources as well as to develop carbon capture and sequestration technologies as a possible option to advance Indonesian government policies seeking to reduce greenhouse gas emissions within the context of sustainable development,

that in order to provide a legal basis for carbon capture and sequestration projects, including for addressing long-term liability for sequestered carbon dioxide, and thereby provide greater certainty to support the development of efficient and effective projects,

that in order to assure the integrity of carbon capture and sequestration projects in terms of their health, safety and environmental aspects through existing and new regulations, policies and standards,

that in order to provide a system for permitting carbon capture and sequestration projects that is performance-based according to the underlying degree of risk of such activities, with the objective of mitigating the risks associated therewith,

that in order to coordinate the efforts of government agencies at the national and local levels in developing regulations, policies and standards; evaluating applications for permits for carbon capture and sequestration projects; and overseeing these projects,

that in order to ensure that Indonesia serves as a positive example in the development of carbon capture and sequestration through adherence to best international practices, including though public engagement initiatives,

it is necessary to stipulate Regulation of the President on Carbon Capture and Sequestration;

In View of : 1. Article 4 paragraph (1) of the 1945 Constitution of the Republic of Indonesia;

MINISTER OF ENERGY AND MINERAL RESOURCES  
REPUBLIC OF INDONESIA

Our Ref. No. 1554/04/IRM.S/2017 20 February 2017

Mr. Rodrigo A. Chaves  
World Bank Country Director, Indonesia  
ISEB Tower 2, 12th Floor  
Jln. Jend. Sudirman Kav. 52-53  
Jakarta 12190

Dear Mr. Chaves,

Subject : Initiative to Reduce Global Gas Flaring "Zero Routine Flaring by 2030"

With reference to your letter, November 28, 2016, first of all, I would like to appreciate the World Bank effort in reducing global emission of greenhouse gases by introducing Initiative to Reduce Global Gas Flaring: "Zero Routine Flaring by 2030".

The World Bank initiatives is in line with Indonesia interest to promote more efficient and sustainable oil and gas industry. Under Indonesia technical regulation, routine flaring is not an acceptable practice except for the on very strict consideration.

On behalf of Indonesia, it is my pleasure to confirm an endorsement of the "zero routine flaring by 2030" initiative. We look forward to working with the World Bank in this initiative.

Sincerely,  
*Ignasius Jonan*  
Ignasius Jonan  
Minister of Energy and Mineral Resources

CARBON CAPTURE AND STORAGE (CCS) PILOT PROJECT AT GUNDIRI

Memorandum of Cooperation (the "MoC")

between

MINISTRY OF ENERGY AND MINERAL RESOURCES  
DIRECTORATE GENERAL OF OIL AND GAS (DG OIL & GAS)

and

ASIAN DEVELOPMENT BANK ("ADB")

and

JAPAN INTERNATIONAL COOPERATION AGENCY ("JICA")

and

PT PERTAMINA (PERSERO) ("PERTAMINA")

19 March 2016

I. INTRODUCTION

1. Indonesia's current energy mix is highly dominated by coal, gas, and oil. Indonesia has set plans to reduce its reliance on oil by 2030 by increasing the share of coal and gas in the country's energy supply mix to around 51% and 20.4%, respectively. According to data from the National Greenhouse Gas Inventory System of the Ministry of Environment and Forestry (SIGEN-SMART), CO<sub>2</sub> emissions from coal have risen from 444,738 tons in 2000 to 2,2290,082 tons in 2013. This number will continue to increase as coal gains an ever larger share in the national power generation mix.
2. At the same time, Indonesia has also set high targets to reduce its greenhouse gas emissions by 29% in 2030. It is thus necessary to implement new strategies in order to reduce carbon emissions from the energy sector. One strategy that has yet to be implemented in Indonesia is carbon capture and storage (CCS). CCS may be particularly viable in Indonesia since many of the country's gas fields have high levels of associated CO<sub>2</sub>, and enhanced oil recovery using CO<sub>2</sub> may be a way to halt the decline in the country's oil production.
3. On June 18, 2013, PERTAMINA, the national oil and gas company, ADB, and JICA entered into a Memorandum of Understanding (MoU) regarding CCS Pilot Activities in Indonesia. The MoU was intended to formalize a non-exclusive framework of cooperation and to record the additional support to

REPUBLIC INDONESIA

MEMORANDUM OF COOPERATION

BETWEEN

THE MINISTRY OF ENERGY AND MINERAL RESOURCES OF THE REPUBLIC OF INDONESIA

AND

THE MINISTRY OF ECONOMY, TRADE, AND INDUSTRY OF JAPAN

ON THE ENERGY SECTOR

The Ministry of Energy and Mineral Resources of the Republic of Indonesia and the Ministry of Economy, Trade, and Industry of Japan (hereinafter referred to individually as a "Participant" and collectively as the "Participants"):

DESIRING to strengthen cooperation between the two countries in the field of energy in the light of the needs for all possible options for global energy transitions;

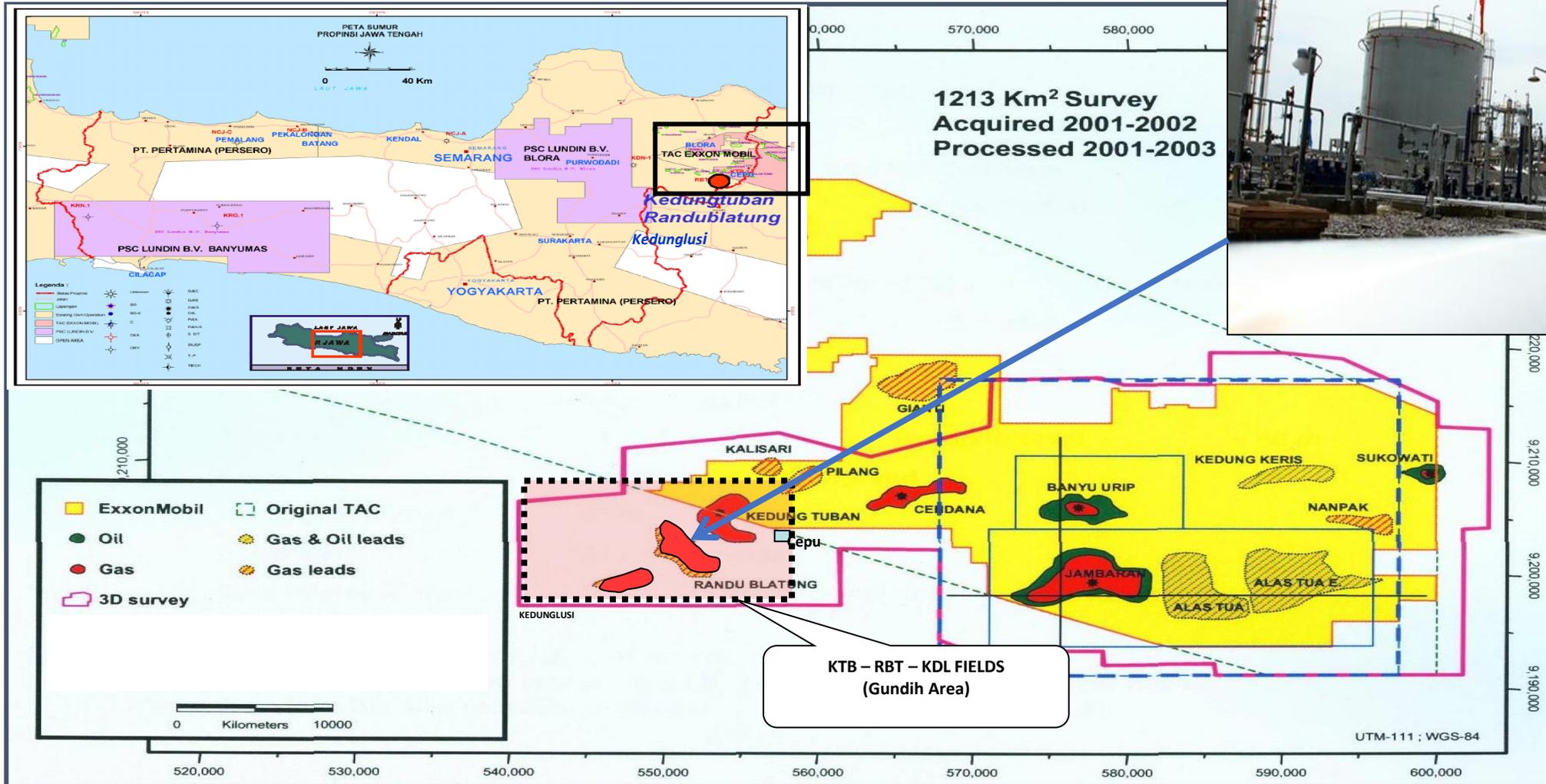
CONSIDERING the mutual interests of the Participants in developing cooperation in the field of energy based on the principles of equality and mutual benefits;

NOTING the opportunities to enhance economic and commercial cooperation, especially in the East Indonesia region, as well as to contribute to the national energy security of both countries; and

REFERRING to the "Indonesia-Japan Joint Statement on Strengthening Strategic Partnership" on January 15, 2017 in Jakarta;

# Latest Status of Gundih Project: Shifting from CCS Pilot Project to CO<sub>2</sub>-EGR Project

## Map of Gundih area and its surrounding areas

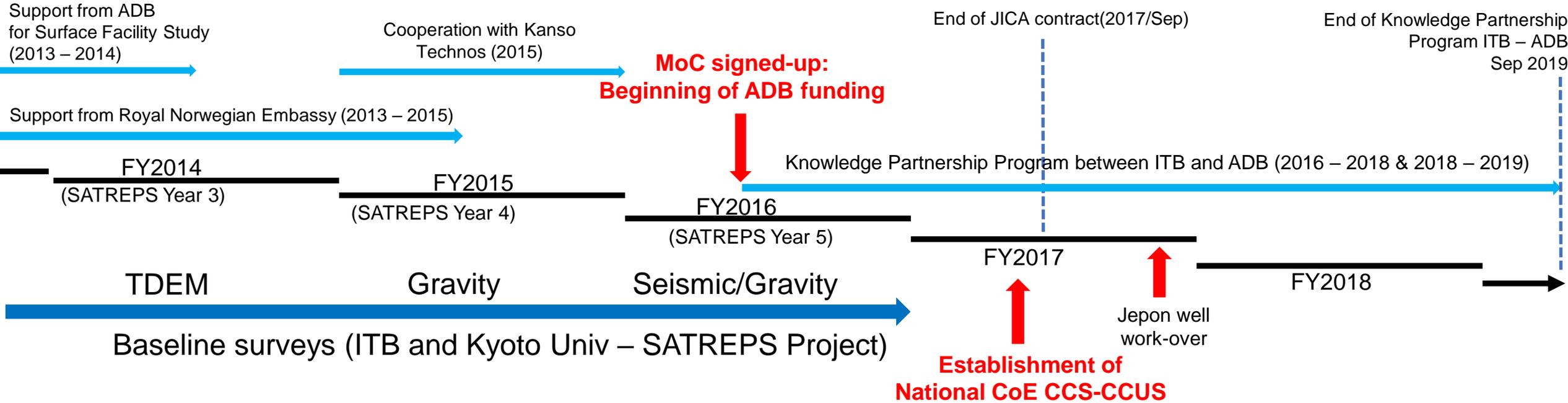


# Historical Gundih CCS Pilot Project (2012 – 2019)



## Contributors:

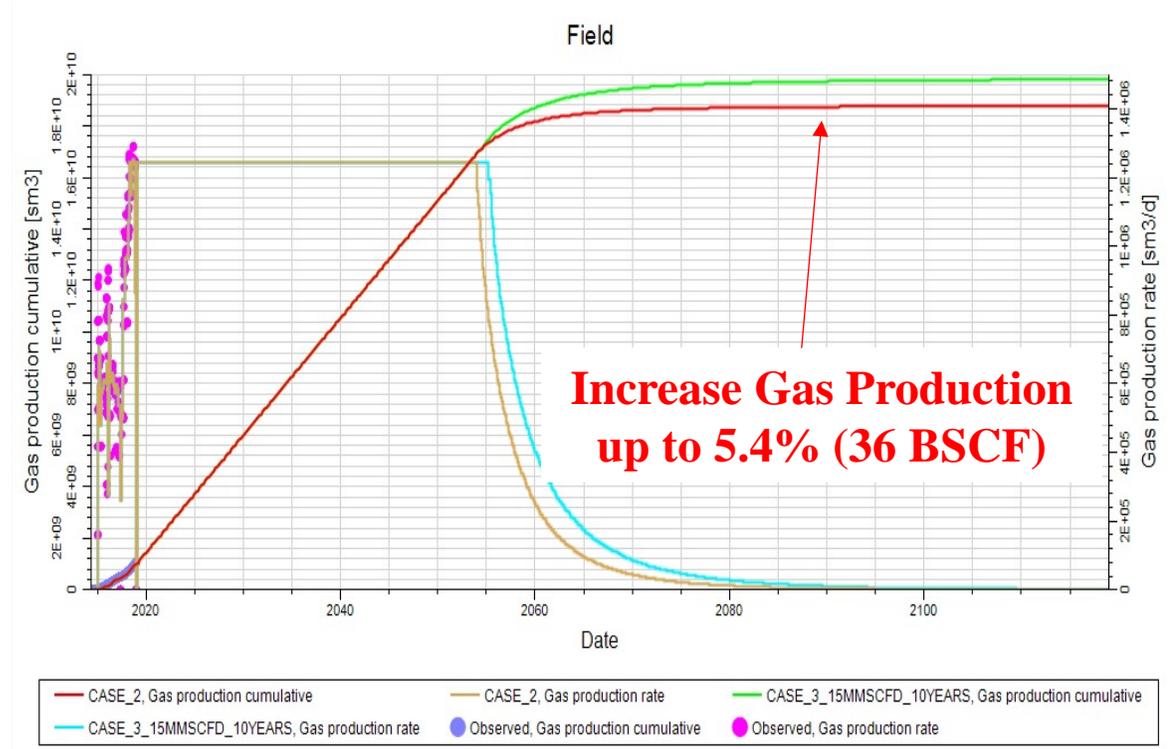
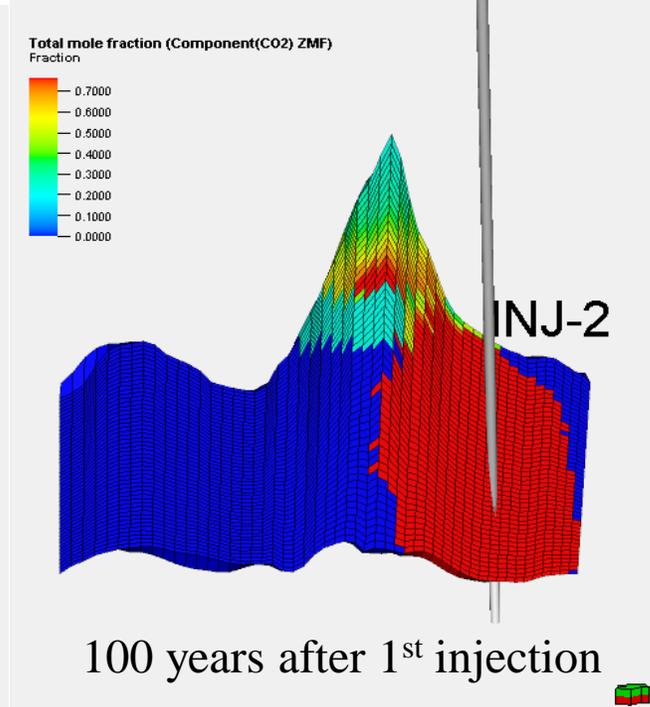
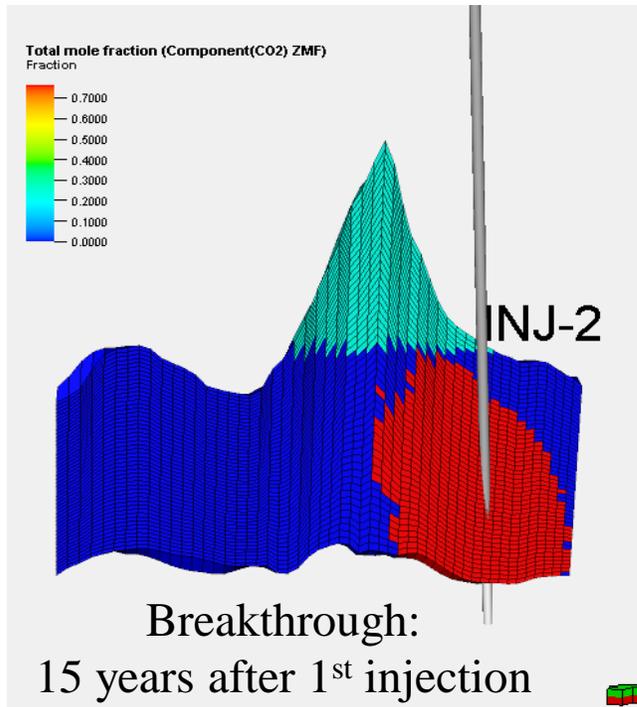
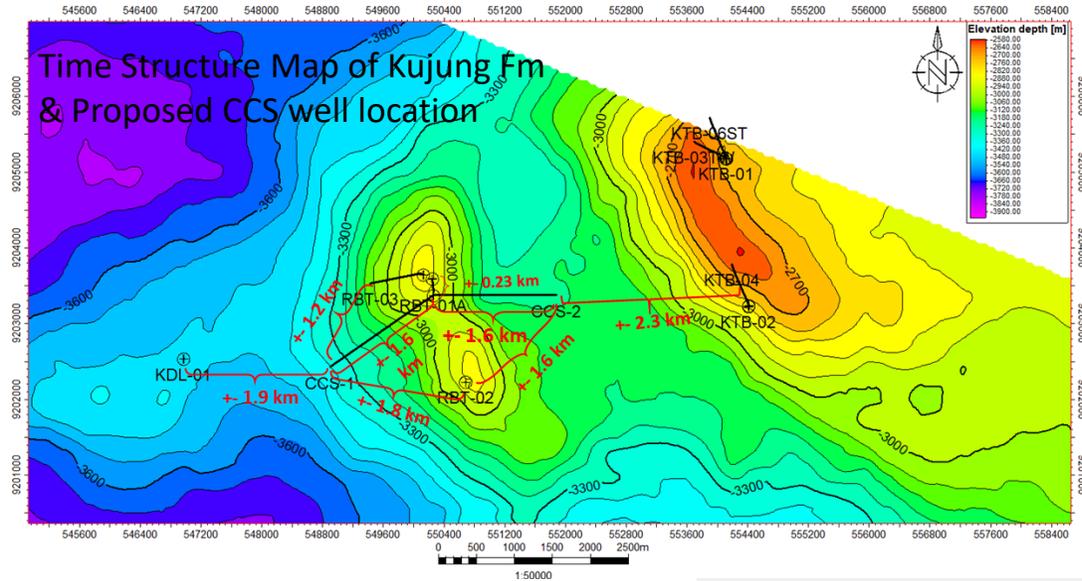
SATREPS project (2012-2017), ADB TA (2013 – 2014), Royal Norwegian Embassy (2013 – 2015), Kanso Technos (2015) and Knowledge Partnership Program ITB and ADB (2016 – 2019)



# NEW Scenario of CO<sub>2</sub>-EGR Project in GUNDIH AREA

Currently Gundih CPP releases 800 tpd of CO<sub>2</sub>. If all of available CO<sub>2</sub> is injected to Kedungtuban structure:

- 3 mio of CO<sub>2</sub> will be reduced for 10 years injection time.
- Incremental gas production of 30 BSCF for 10 years, equivalent to USD 120 mio. Gundih CCUS = Enhance gas Recovery.
- The Opex and Capex for 10 years CO<sub>2</sub> injection = UD 35 mio.
- Offering participation of foreign institutions for injecting CO<sub>2</sub>, e.g. using JCM scheme.



# Newest Good News that received May 2020:

## Approved FS Joint Crediting Mechanism: Proposing MRV Methodology for Gundih Enhance Gas Recovery (Jun 2020 – Feb 2021, funded by METI)

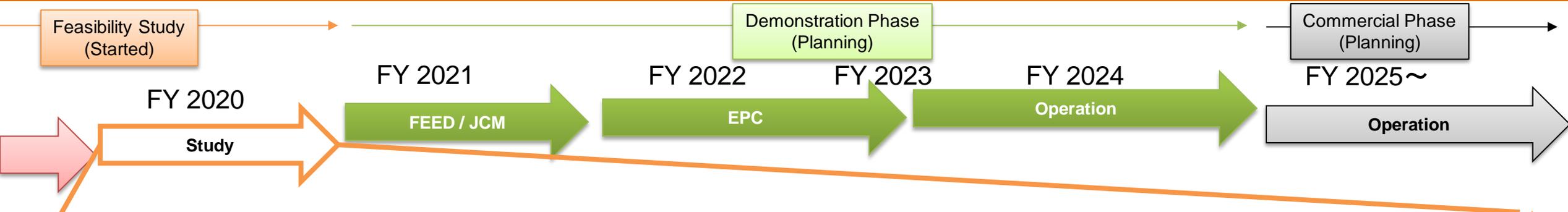
Tasks and Roles 2020 (Just an idea)	ITB/CoE	JN/FG/JP
<b>Subsurface Study</b>		
- Discussion on the Current Study	✓ ✓	✓ ✓
- Further Discussion	✓	✓ ✓ ✓
- Model Modification	✓	✓ ✓ ✓
- New Simulation	✓	✓ ✓ ✓
<b>CO<sub>2</sub> Transport / Injection /Well Systems</b>		
- Discussion on Current Study	✓ ✓	✓ ✓
- Concept Design	✓ ✓ ✓	✓
- Cost Estimation	✓ ✓ ✓	✓
- Study for Permit/License/Approval	✓ ✓ ✓ ✓	
<b>Monitoring Plan</b>		
- Discussion on the Current Study	✓ ✓	✓ ✓
- CO <sub>2</sub> Monitoring	✓	✓ ✓ ✓
- Monitoring Plan after Closure	✓	✓ ✓ ✓
<b>Standards/Regulation</b>		
- Planning compliant to Std./Reg.	✓	✓ ✓ ✓
<b>Social Acceptability</b>		
- Outreach Planning	✓ ✓ ✓	✓
<b>Technology Applicability</b>		
- Micro-bubbling CO <sub>2</sub> Injection (RITE)		✓ ✓ ✓ ✓
- Monitoring with Optic Fiber (RITE)		✓ ✓ ✓ ✓
- Impact by Impurity Injection (JPWR)		✓ ✓ ✓ ✓
<b>Symposium for Dissemination of Outcome</b>	✓ ✓ ✓	✓



**METI**  
Ministry of Economy, Trade and Industry

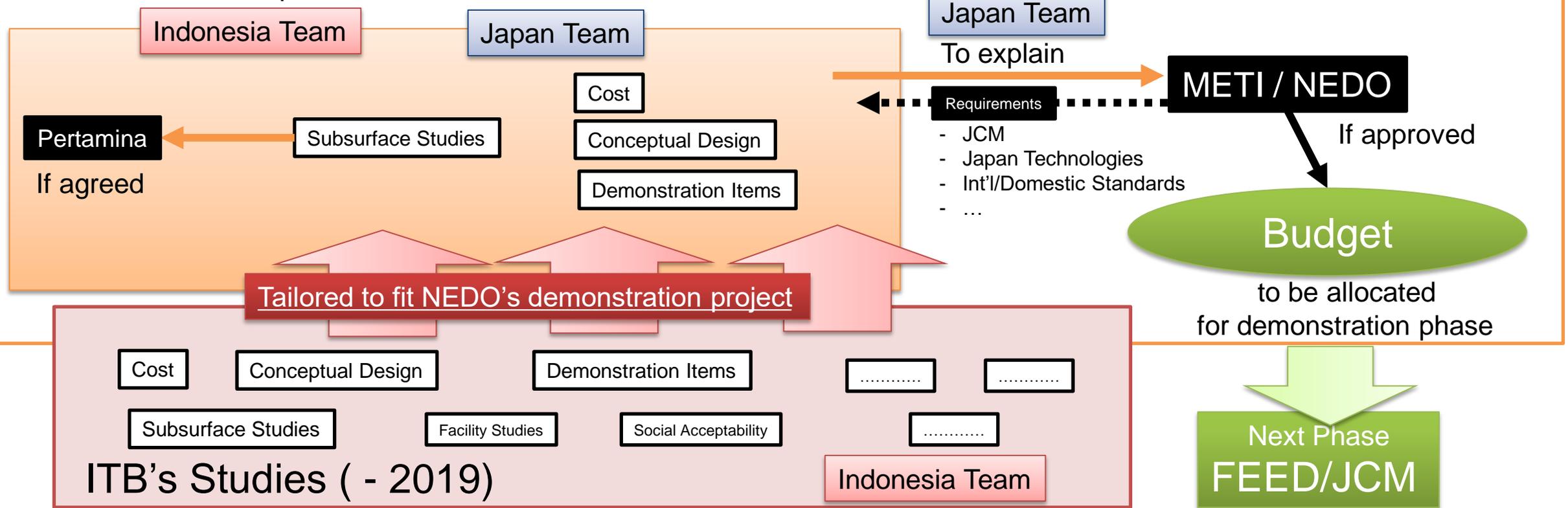


# Road Map of New Gundih CCUS (CO2-EGR) Implementation (2020 - ~)



## Study (2020)

To move into the next phase;



# Activities starting from 2020:

**Development of GIS Database for CO<sub>2</sub>-Source-Sink Matches**

→ Current cooperation with Japan NUS Co. Ltd. and supported by METI - Japan

**Opportunity for Installation of CCUS in Coal Fired Power Plant**

**The role of Bioenergy coupled with Carbon Capture and Storage (BECCS) in Indonesia's Deep-Decarbonization Pathway**

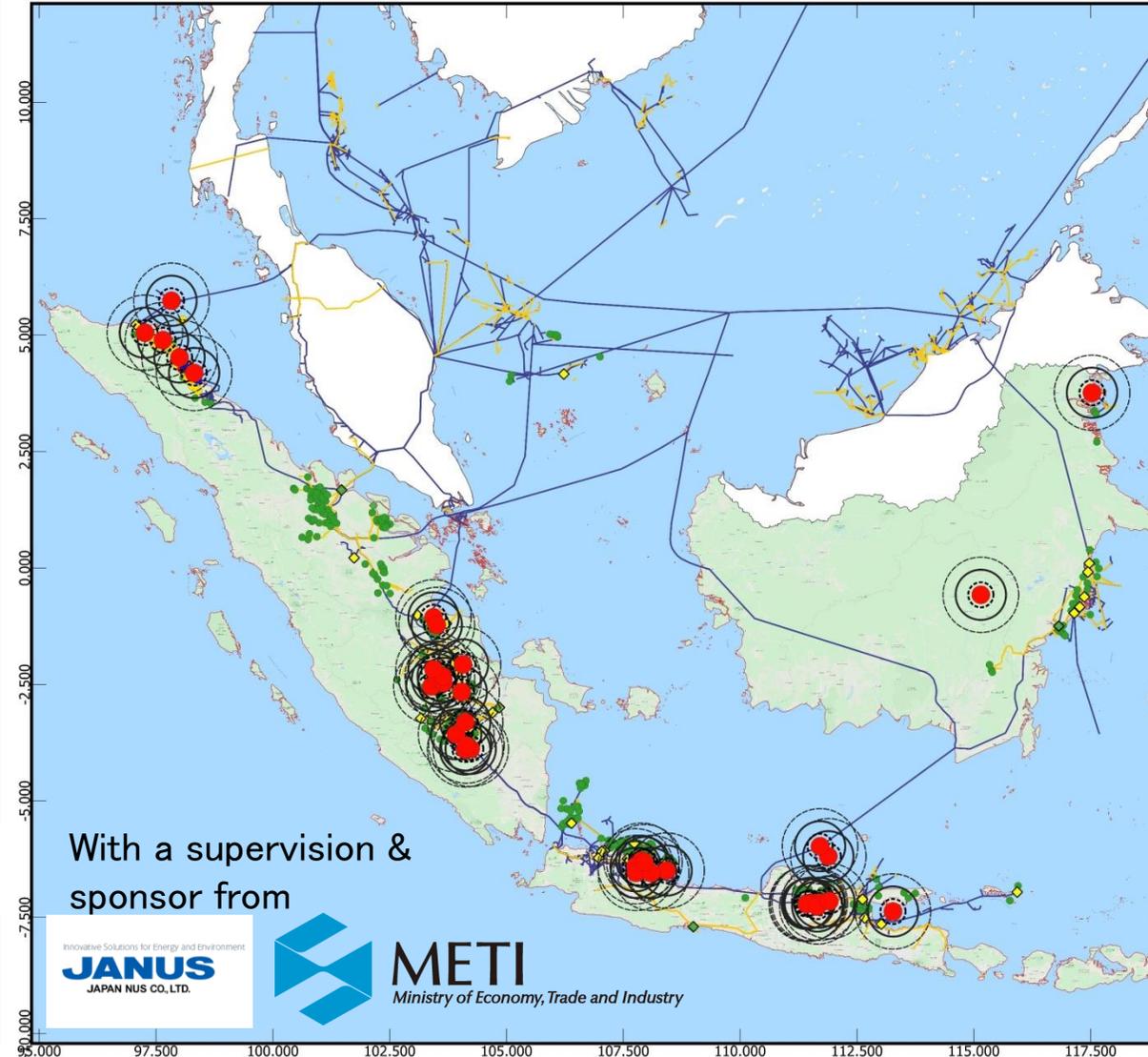
**Zero Routine Flaring (ZRF) and Reduction of Methane Emission**

# Overview of Potential CO<sub>2</sub> Source Map (Sumatera, Java, Kalimantan)

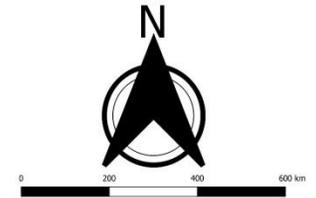
## CO<sub>2</sub> Source (subject to be discussed)

- The Oil-Gas CO<sub>2</sub> is calculated by CO<sub>2</sub> content (%) x remaining gas reserve (mmscf)
  - Low Co<sub>2</sub>: < 5,000 mmscf
  - Medium CO<sub>2</sub>: 5,000 – 20,000 mmscf
  - High CO<sub>2</sub>: > 20,000 mmscf
- Industrial CO<sub>2</sub>: from Cement Industry, Petrochemical, Coal Mining, Pulp Industries (>1,500 TCO<sub>2</sub>/day)
- Power Plant (coal) CO<sub>2</sub> is classified as:
  - Low: <1,000,000 TCO<sub>2</sub>e
  - Medium: 1 - 2 mio TCO<sub>2</sub>e
  - High: > 2 mio TCO<sub>2</sub>e

Hub-Clustering have been done in Gas Fields, Industry, and Coal Power Plant



Map of Potential CO<sub>2</sub> Source in Sumatera, Java, and Kalimantan Region



## Legend

- Pipelines Indonesia Liquid
- Pipelines International Gas
- ◇ Gas Processing\_point
- ⬢ Industry and CPP CO<sub>2</sub> Source
- High Oil and Gas Source CO<sub>2</sub>
- High Source
- Coal Power Plant Source of CO<sub>2</sub>
- High Potential
- Indonesia Potential Sink for CCS/CCUS
- Sink (Oil Field)



- Note that the CO<sub>2</sub> unit available from oil&gas in database is volume (mmscf gas) not flowrate (mmscfd or mmscfy)
- Blue hexagon = CO<sub>2</sub>-rich industry, Red Squares = high CO<sub>2</sub> produced from Power Plant.

# Potential CO<sub>2</sub> Source in South Sumatera

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

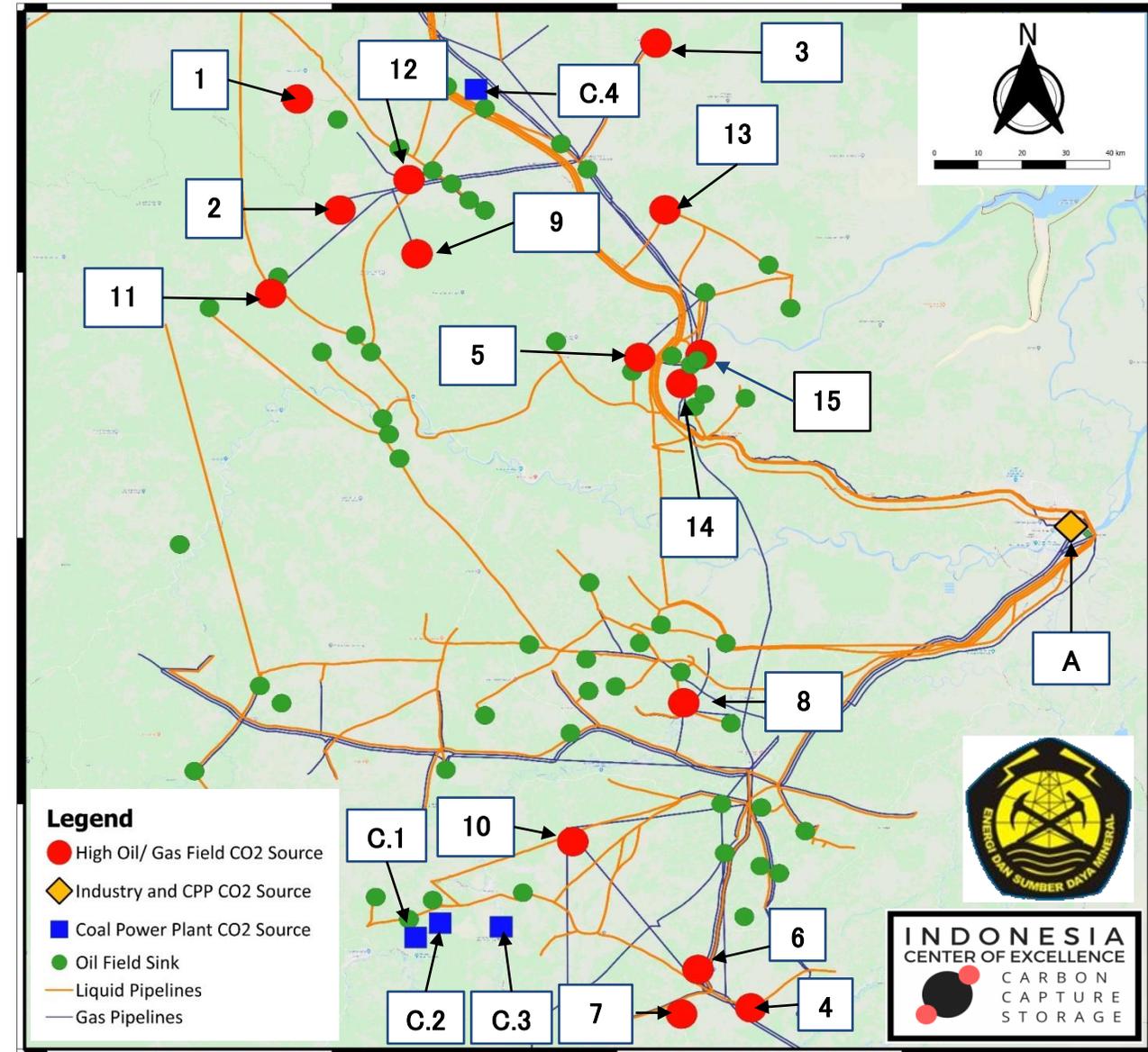
No	Field Name	Operator
1	Bungin 1	ConocoPhillips (South Jambi) Ltd
2	Dayung	ConocoPhillips (Grissik) Ltd
3	Gelam	ConocoPhillips (Grissik) Ltd~PT Pertamina/Talisman (Jambi Merang) Ltd
4	Kuang	PT Pertamina EP
5	Letang	ConocoPhillips (Grissik) Ltd
6	Pagardewa	PT Pertamina EP
7	Prabumenang	PT Pertamina EP
8	Raja	PT Pertamina EP
9	Sambar 1	ConocoPhillips (Grissik) Ltd
10	Singa (Medco)	PT Medco E&P Lematang
11	Suban	ConocoPhillips (Grissik) Ltd
12	Sumpal	ConocoPhillips (Grissik) Ltd
13	Bentayan	PT Pertamina EP
14	Tanjung Laban	PT Pertamina EP
15	Ramba	PT Pertamina EP

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

No	Industry Category	Company
A	Petrochemical	PT Pupuk Sriwidjaja

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

No	Coal Power Plant	Owner
C.1	Keban Agung	PT Priamanaya Energi
C.2	PLTU Banjarsari	PT Bukit Pembangkit Innovative
C.3	Bukit Asam #2	PT PLN (Persero) Pembangkitan Sumatera Bagian Selatan
C.4	Sumsel-5	PT DSSP Power



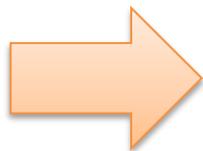
Map of Potential CO<sub>2</sub> Source in South Sumatera Region  
Category: Oil and Gas Field; Industry; Power Plant

# ZERO ROUTINE FLARING (ZRF) PROGRAM – 2030

Source of Flaring → It should be minimized by monetisation of Flared Gas



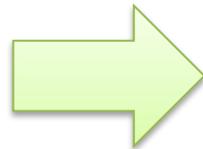
Oil and Gas Field



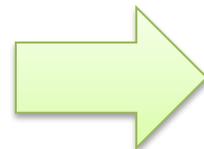
- Natural Gas (90% methane)
- CO<sub>2</sub>
- Inert Gas: N<sub>2</sub>



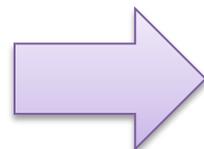
Oil Refinery



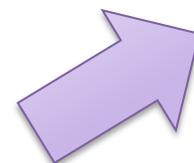
- Mixture of Hydrocarbon
- H<sub>2</sub> (occasionally)



LNG Facilities

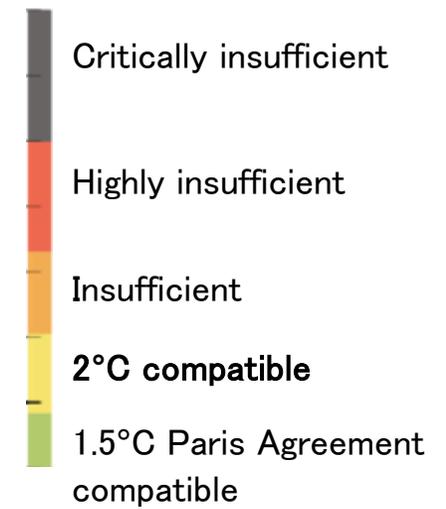
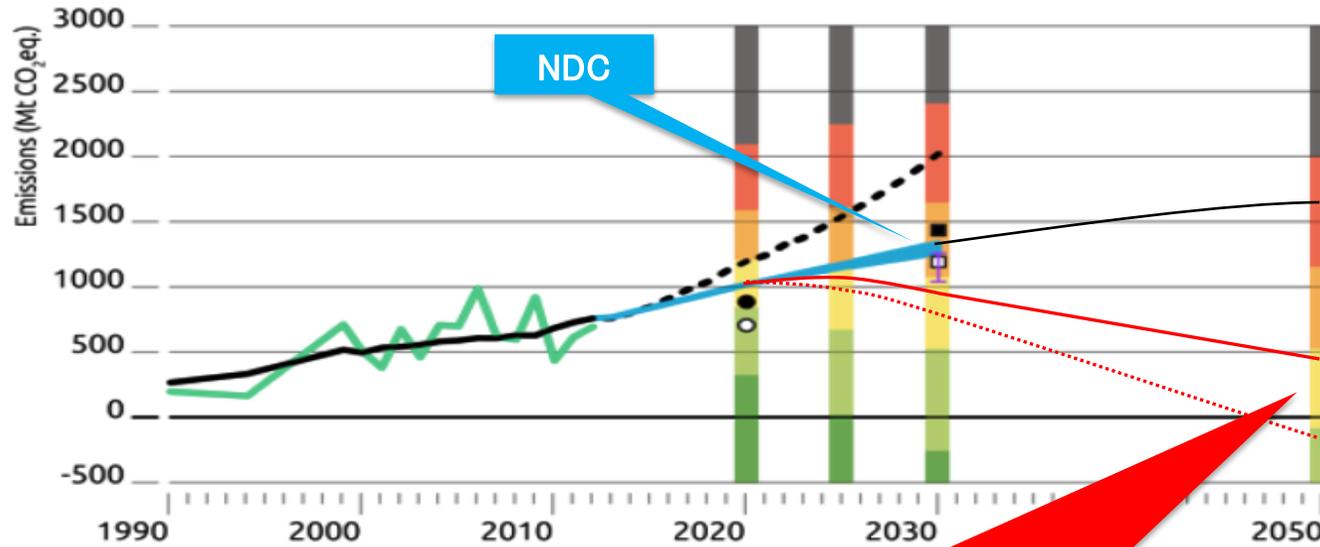


- Natural Gas

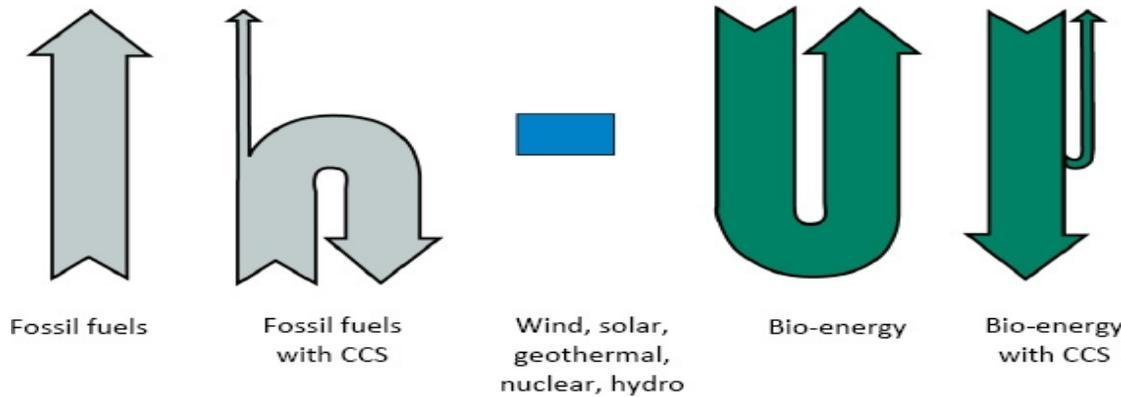


Flaring

# NEEDS FOR BECCS & DDPP BECCS INDONESIA



## Needs for Negative Emissions

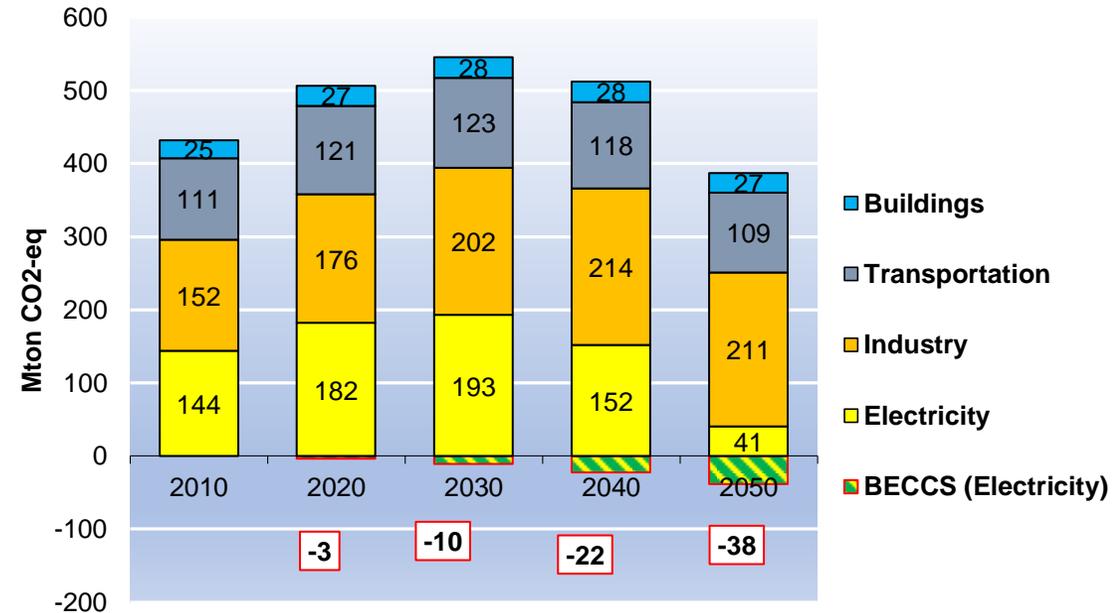


By 2050, 1.14 ton CO<sub>2</sub>/cap is compatible with world 2DS (2.2 ton CO<sub>2</sub>/cap\*) under BECCS scenario

\*world average DDPP

Some source: Climate Action Tracker (2017), Global CCS Institute (2016)

## CO2 Emissions Development Scenario



# THANK YOU

**Email: [coe-ccs@fttm.itb.ac.id](mailto:coe-ccs@fttm.itb.ac.id) & [rachmat@gf.itb.ac.id](mailto:rachmat@gf.itb.ac.id)**

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**<http://ccs-gundih.fttm.itb.ac.id/>**

