CCS/CCUS PROGRAM AND ACTIVITIES IN INDONESIA

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Directorate General of Oil and Gas Indonesia

Deep Dive Workshop CCS Way Forward in Asia
Manila, 6 Juni 2016
OUTLINE

I. Background
II. INDONESIA CCS/CCCUS COE
III. CCS/CCUS Program
IV. Challenges/Opportunities
BACKGROUND: MINISTRY OF ENERGY AND MINERAL RESOURCES

Ministry of Energy and Mineral Resources

Directorate General of Oil and Gas

Directorate of Oil and Gas Program Development
Directorate of Oil and Gas Upstream Business Dev.
Directorate of Oil and Gas Downstream Business Dev.
Directorate of Oil and Gas Engineering and Environment
INDONESIA’s Commitment on Climate Change
November 30th 2015

• 29% emissions reduction from BAU by 2030 and 41% with international support scenario

Related to Energy:

**CCS and CCUS**

- Contributions can be given by
  
  Introducing **CCS and CO2-EOR (CCUS)** to the community and implementing those approaches in Indonesian HC fields
ROLE OF CCS IN OIL AND GAS INDUSTRY

GREEN OIL AND GAS INDUSTRY INITIATIVE (GOGII)

ENERGY UTILIZATION

OIL & GAS FUELS

OIL & GAS UPSTREAM & DOWNSTREAM ACTIVITIES

CO₂

EOR

INDUSTRY

CCS

Source: Ministry of E&MR (2012)
EOR Potential

Reserves Distribution:
(Billion Barrel)

Original OIL In Place (OOIP):
74 BSTB

Cumulative Production:
23.93 (32%)

Remaining Reserves:
3.25

Remaining Oil In Place
46.89 (63%)

Unrecoverable Reserves

EOR POTENTIAL

Source: SKK Migas Indonesia Oil Reserves Data (1/1/2014)
## CO₂ Contents of Some Gas Fields in Indonesia

<table>
<thead>
<tr>
<th>No</th>
<th>Field</th>
<th>Contractor</th>
<th>Gas Reserves (TSCF)</th>
<th>CO₂ Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subang</td>
<td>PT Pertamina EP</td>
<td>0.76</td>
<td>± 20%</td>
</tr>
<tr>
<td>2</td>
<td>Cilamaya</td>
<td>PT Pertamina EP</td>
<td>0.14</td>
<td>± 30%</td>
</tr>
<tr>
<td>3</td>
<td>Jatibarang</td>
<td>PT Pertamina EP</td>
<td>0.09</td>
<td>± 23% * (for EOR)*</td>
</tr>
<tr>
<td>4</td>
<td>Merbau</td>
<td>PT Pertamina EP</td>
<td>0.18</td>
<td>± 7%</td>
</tr>
<tr>
<td>5</td>
<td>Gundih</td>
<td>PT Pertamina EP</td>
<td>0.32</td>
<td>± 21%</td>
</tr>
<tr>
<td>6</td>
<td>Jambaran Tiung Biru</td>
<td>Mobil Cepu Ltd</td>
<td>0.03</td>
<td>± 35%</td>
</tr>
<tr>
<td>7</td>
<td>East Natuna</td>
<td>PT Pertamina EP</td>
<td>46</td>
<td>± 72%</td>
</tr>
<tr>
<td>8</td>
<td>Tangguh</td>
<td>BP (Berau) Ltd.</td>
<td>6.93</td>
<td>± 12%</td>
</tr>
</tbody>
</table>
Natuna D Alpha Field

Gas Reserves: 46 TSCF
CO₂ Content: 72%
Discovery Year: 1973
Water Depth: 143 m
Simulation of Monetization of Natuna D Alpha Field

Assumed conditions with CCUS:
1. Calorie Heating Value: 1100 BTU/CF (based on data for a nearby field)
2. Gas Price: 7 – 13 USD/MMBTU

<table>
<thead>
<tr>
<th>Case</th>
<th>Gas in Place (TSCF)</th>
<th>Recov Reserve (TSCF)</th>
<th>Monetization (billion USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gas Price: 7 USD/MMBTU</td>
</tr>
<tr>
<td>Low Case</td>
<td>138</td>
<td>29</td>
<td>233.3</td>
</tr>
<tr>
<td>Medium Case</td>
<td>222</td>
<td>46</td>
<td>354.2</td>
</tr>
<tr>
<td>High Case</td>
<td>272</td>
<td>57</td>
<td>438.9</td>
</tr>
</tbody>
</table>
CCS Program in Indonesia

CURRENT STATUS
Chronology of LEMIGAS’s CCS/CCUS activity since 2003

- **2003 - 2008**: Sojitz & Mitsubishi: Investigating CO2 storage potential combined with EOR
- **2009 - 2011**: Joint study with UK government: a first comprehensive study to identify CCS potential deployment in Indonesia
- **2011 - 2012**: ADB: Identify a promising demonstration project in specific site
- **2014 - 2015**: The World Bank: EOR market and CO2 storage capacity study
- **2012 - 2013**: JCOAL: Schedule for CO2 injection to oil fields; Economical study for CO2 EOR
- **2016 - 2018**: Center of Excellence CCS - ESDM: (1) CCS EOR Pilot Project; (2) Regulatory Framework

- **2010 - 2011**: Total Indonesia: Multiyears joint research at TOTAL field
### Status of CCS & CCUS in Indonesia

<table>
<thead>
<tr>
<th>Field</th>
<th>Stakeholders</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tiung Biru Field, Mid Java</strong></td>
<td>ASCOPE, Petrad, CCOP, DNV-Statoil</td>
<td>The field was not applicable</td>
</tr>
<tr>
<td><strong>Jatibarang Field, West Jawa</strong></td>
<td>Pertamina, Marubeni/AOC, UPN</td>
<td>CO₂ EOR Feasibility Study</td>
</tr>
<tr>
<td><strong>(2011 – 2013)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Merbau Field, South Sumatera</strong></td>
<td>Pertamina EP, ADB, MIGAS LEMIGAS</td>
<td>CCS/CO₂ EOR Joint Feasibility Study</td>
</tr>
<tr>
<td><strong>(2011 – 2012)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gundih Field, Jawa Tengah</strong></td>
<td>Pertamina, Bandung Institute of Technology, Kyoto University, ADB, MIGAS</td>
<td>• Joint FS for Carbon Sequestration &amp; Monitoring</td>
</tr>
<tr>
<td><strong>(2012 – 2015)</strong></td>
<td></td>
<td>• Current Status: Preparation for pilot project</td>
</tr>
</tbody>
</table>
CCS/CCUS COE

Centre of Excellence

- Institutional Set Up
- Cross Cutting Research
- Institutional & Regional Collaboration
CENTRE OF EXCELLENCE FOR CCS/CCUS, INDONESIA

- Coordinating Ministry for Maritime and Resources
- Coordinating Ministry for Economic
- SKKMIGAS
- Pertamina EP and UTC (Implementing agency)
- Ministry of Energy and Mineral Resources (Directorate of General for Oil and Gas)
- DG of Research strengthen and Development (MRTHE)
- Ministry of Environmental
- State Ministry of National Development and Planning
- Institute Technology Bandung, Oil and Gas Institute, UGM, etc
ROLE OF INDONESIA CCS/CCUS CoE

LEARNING FACILITIES
- Porous Space Mapping
- Incentives and Cost Recovery
- Technology Deployment
- Policy Integration and Standards
- Reporting and Lessons Learnt
- Value-chain Development
- Science and Society
- Research

FUNDING FACILITATION
- Funding
- Project Facilitation
- Manufacture & Processing

KNOWLEDGE SUPPORT
- Porous Space Mapping
- Technical Information
- Monitoring and Evaluation
- Technology Innovation
Ministry of Energy & Mineral Resources, Republic of Indonesia

CCS/CCUS COE PROGRAM

1. Pilot Plant CCS Gundih (ADB, JICA SATREP)

- 300,000 t-CO₂/year

Schedule

- 2016: EPC Perio d
- 2017: Construction
- 2019: Injection Test
- 2020: Monitoring & Verification
- 2022: End of Pilot Project

Project activity:
1. Purification
2. Liquefaction
3. Transportation
4. Injection
5. Storage

Monitoring & Verification

CO₂

Project activity

1. Purification
2. Liquefaction
3. Transportation
4. Injection
5. Storage
2. Planned CCUS pilot project in Merbau Field, South Sumatra

Extra facilities need to be built for:
- drying: glycol contactor
- compressing: compressor
- power generation: gas turbines
- transport: pipeline or truck
3. SUPPORTING GOI TO DEVELOP CCS/CCUS Regulation

*Each activity should be covered by law to enable sustainable CCS & CCUS.*

2. CO₂ Transportation and storage requirement
3. CO₂ Monitoring
4. Liability
5. CO₂ EOR Implementation
4. Low Carbon Smart City With Coal Bed Methane
UGM Project Location
5. CO₂ SEPARATION TECHNOLOGY and EOR Pilot Project

- Jatibarang Field, West Java
- CO₂ sources:
  - Subang & Cilamaya CO2 Removal Plant, and
  - Balongan Refinery Unit

JATIBARANG FIELD

- Located in NW Java basin
- Approx. 170 km East of Jakarta
- Discovered in 1970
- Commenced production 1975
- Average reservoir depth 1140 m SS
- Volcanic, naturally fractured reservoir
- 17 reservoirs / layers defined
- Approx. 207 wells (27 active)
- Oil Remaining Reserve 49.3 MMSTB (from 58.7 MMSTB OOIP)
CHALLENGES/OPPORTUNITY

1. Limited funding, need project sponsors
2. Access to cross cutting technology related to CCS/CCUS
3. Qualified researchers need exposure to International forum
4. Regional and International Collaboration
Thank You

www.migas.esdm.go.id