

CARBON CAPTURE UTILIZATION & STORAGE (CCUS), MEMPERKUAT KOMITMEN ESG PERTAMINA

CARBON CAPTURE UTILIZATION & STORAGE (CCUS), STRENGTHENING PERTAMINA'S ESG COMMITMENT

Sejalan dengan komitmen keberlanjutan/ESG Pertamina dan dalam rangka mendukung target Indonesia menurunkan emisi GHG sebesar minimal 29% pada 2030 yang dinyatakan dalam Intended Nationally Determined Contribution (INDCs) untuk Perjanjian Paris, Pertamina melakukan berbagai penelitian dan inovasi seperti EBT, Solar PV, Electric Vehicle (EV), Biofuel, Green Hydrogen dan pemanfaatan emisi CO₂ melalui pengembangan Carbon Capture, Utilization & Storage (CCUS).

CCUS merupakan teknologi penangkapan, penyimpanan dan pemanfaatan emisi karbon untuk peningkatan produksi minyak dan gas yang menjanjikan untuk mengurangi emisi karbon sehingga perlu diterapkan di setiap negara termasuk di Indonesia. Metode ini merupakan bagian dari *Circular Carbon Economy* sebuah inisiatif meliputi aktivitas 4R (*reuse, recycle, reduce, and remove carbon emission*).

In line with Pertamina's ESG/ sustainable commitment and to support Indonesia's GHG emission reduction target min

29% by 2030 which stated in the Intended Nationally Determined Contribution (INDCs) for the Paris Agreement, Pertamina conducted various researches and innovations such as NRE, Solar PV, Electric Vehicle, Biofuel, Green Hydrogen, utilization CO₂ emission within development of CCUS (Carbon Capture Utilization & Storage).

*CCUS is a carbon emission capture, storage and utilization technology to increase oil and gas production that promises to reduce carbon emissions so that it needs to be applied in every country including in Indonesia. This method is part of circular carbon economy initiative covering 4R activities (*reuse, recycle, reduce, and remove carbon emission*).*



CCUS di Pertamina

Emisi CO₂ yang dihasilkan dari lapangan migas dikumpulkan dan diinjeksi ke dalam lapisan subsurface sumur-sumur Pertamina untuk meningkatkan kembali produktivitasnya.

Saat ini Pertamina telah menginisiasi dua proyek CCUS dengan potensi reduksi CO₂ mencapai 18 juta ton, yang pertama CCUS Enhanced Gas Recovery (EGR) lapangan Gundih yang berpotensi mengurangi ± 3 juta tCO₂ dalam 10 tahun, direncanakan akan beroperasi pada Q4 2026. Kedua, CCUS Enhanced Oil Recovery (EOR) lapangan Sukowati yang berpotensi mengurangi sebesar ± 15 juta tCO₂ dalam 25 tahun yang direncanakan akan beroperasi pada Q4 2030.

Kedua proyek CCUS tersebut direncanakan akan bermitra dengan pihak Jepang melalui skema *Joint Crediting Mechanism* (JCM) yang merupakan kerja sama strategis penurunan emisi antara pemerintah Indonesia dan pemerintah Jepang.

DIVERSIFIKASI PRODUK

Pertamina telah menginisiasi riset & pengembangan untuk menciptakan produk bernilai tambah berbasis CO₂.

- **Konversi CO₂ menjadi Metanol**
Menggunakan metode elektrolisis langsung antara CO₂ dan air menjadi metanol dengan sumber listrik panel surya dan katalis berbasis tembaga pada Membrane Electrode Assembly (MEA).
- **Konversi CO₂ menjadi Bahan Bakar Sintetis**
Pengembangan Katalis berbasis kobalt-nikel dan tembaga untuk mengubah CO₂ menjadi syngas dan sintesis DME langsung.



CCUS in Pertamina

CO₂ emissions generated from oil and gas fields are collected and injected into the subsurface layer of Pertamina's wells to increase productivity.

Currently Pertamina has initiated two CCUS projects with the potential for CO₂ reduction reaching 18 million tons, the first CCUS Enhanced Gas Recovery (EGR) Gundih field which has the potential to reduce ± 3 million tCO₂ in 10 years, is planned to be operational in Q4 2026. Second, CCUS Enhanced Oil Recovery (EOR) Sukowati field which has the potential to reduce by ± 15 million tCO₂ in 25 years is planned to operate in Q4 2030.

The two CCUS projects are planned to partner with the Japanese through the *Joint Crediting Mechanism* (JCM) scheme which is a strategic cooperation on reducing emissions between the Indonesian government and the Japanese government.

PRODUCT DIVERSIFICATION

Pertamina has initiated basic research & development to create CO₂-based value-added products.

- **Conversion of CO₂ to Methanol**
Using electrolysis method direct CO₂ into methanol using platinum, palladium and copper-zinc based catalysts with Membrane Electrode Assembly (MEA).
- **Conversion of CO₂ into Synthetic Fuels**
Development of cobalt-nickel and copper based catalysts to convert CO₂ into syngas and direct DME synthesis.

- **Karbonasi Mineral Menggunakan CO₂ menjadi PCC**

Konversi CO₂ menjadi produksi Precipitated Calcium Carbonate (PCC) dengan kapasitas 2 kg/jam yang saat ini telah memperoleh 4 paten proses dan sedang dalam tahap pilot plant untuk persiapan uji lapangan dan uji coba pasar.

- **Fiksasi CO₂ Menggunakan Mikroalga**

Pengembangan strain mikroalga dengan metode fiksasi CO₂ menggunakan injeksi langsung dan penangkapan karbon menjadi bikarbonat sebagai nutrisi untuk diolah menghasilkan produk biofuel, foodgrade ataupun feedgrade.

- **Konversi CO₂ menjadi Produk Polimer**

Pengembangan Katalis untuk konversi CO₂ menjadi poliuretan melalui proses non isosianat menggunakan katalis berbasis cerium.

Sebagai wujud kontribusi terhadap perusahaan dalam menjalankan riset strategis pemanfaatan emisi CO₂. Atas inisiatif tersebut, Pertamina mendapatkan super tax deduction dari kementerian keuangan RI sehingga biaya riset tersebut berpotensi sebagai pengurang pajak perusahaan. Selain itu, pemanfaatan CO₂ ini berpotensi mendapatkan benefit pengurangan karbon melalui beberapa skema seperti Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) dan Joint Crediting Mechanism (JCM). Untuk selanjutnya skema ini akan diatur dalam bentuk Nilai Ekonomi Karbon (NEK) yang dituangkan dalam Peraturan Presiden RI.

**informasi terkait CCUS lainnya dapat dibaca di Buletin PEI edisi 2 Tahun 2021.*

- **Mineral Carbonation Using CO₂ to PCC**

Conversion of CO₂ into precipitated Calcium Carbonate (PCC) production with a capacity of 2 kg /h, currently under field test and market trials.

- **Fixation of CO₂ Using Microalgae**

Development of Algae Strains with CO₂ fixation method by direct injection and carbon capture into bicarbonate as nutrients to be processed to produce biofuel, food-grade or feed-grade products.

- **Conversion of CO₂ into Polymer Products**

Development of Catalysts for the conversion of CO₂ into polyurethane through a non-isocyanate process using the development of cerium-based catalysts.

As a form of contribution to the company in carrying out strategic research on the utilization of CO₂ emissions. For this initiative, Pertamina obtained a super tax deduction from the Ministry of Finance of the Republic of Indonesia so that the research costs have the potential to reduce corporate taxes.

The utilization of CO₂ has the potential to benefit carbon reduction through several schemes such as Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) and Joint Crediting Mechanism (JCM). Furthermore, this scheme will be regulated in the form of Carbon Economy Value (NEK) as stated in the Presidential Regulation of the Republic of Indonesia.

**Other CCUS-related information can be read in the PEI Bulletin 2nd Edition of 2021.*

CARBON CAPTURE UTILIZATION & STORAGE (CCUS), STRENGTHENING PERTAMINA'S ESG COMMITMENT

CARBON CAPTURE, UTILISATION AND STORAGE (CCUS) IN PERTAMINA OPERATING AREA

CO₂ emissions generated in oil and gas fields are collected and injected into the subsurface layer of Pertamina's wells to increase productivity.

POTENTIAL OF CO₂ REDUCTION FROM CCUS PROCESS IN UPSTREAM FIELD:

CCUS EGR Gundih
± 3 Million tCO₂
in 10 years

18 Million tCO₂

CCUS EOR Sukowati
± 15 Million tCO₂
in 25 years

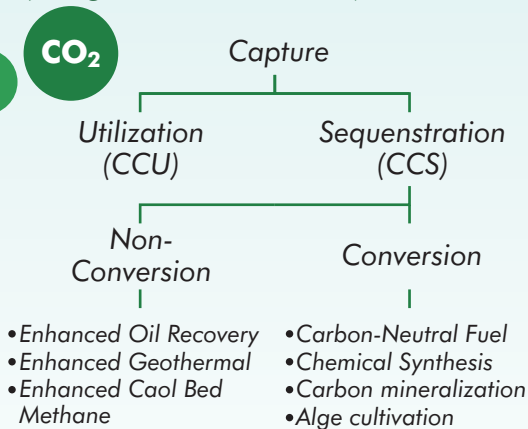
Enhanced Gas Recovery in Gundih Field

Enhanced Oil Recovery in Sukowati Field



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CCUS CONCEPT (Integrated CO₂ Network)



PRODUCT DIVERSIFICATION USING CO₂ AS FEEDSTOCK

Pertamina has initiated basic research & development to create value-added products based on CO₂.

