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The Climate Chronicle

EMBRACING THE FUTURE WITH CCS & CCUS TECHNOLOGIES

The Climate Chronicle:

Embracing the Future with CCS and CCUS Technologies

In the ongoing battle against climate change, the spotlight is now firmly fixed on Carbon Capture and Storage (CCS) and Carbon Capture, Utilization, and Storage (CCUS) technologies. Discussed fervently at the 2023 UN Climate Change Conference (COP 28), these innovations have captured the imagination of stakeholders worldwide, offering a promising path towards a sustainable future.

COP 28 Insights: Shaping the Future of Climate Action

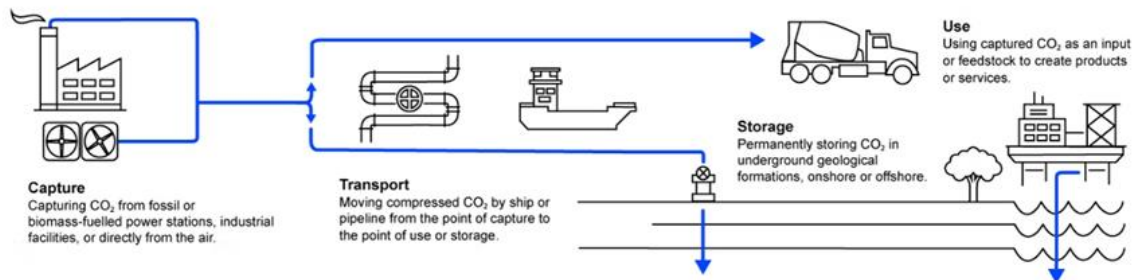
COP 28 served as a catalyst for advancing CCS/CCUS technologies, with key outcomes including:

1. **Global Endorsement:** Renewed commitment to scaling carbon management technologies.
2. **Policy Integration:** Integration of CCUS into the Paris Agreement's Global Stocktake.
3. **Strategic Focus:** CCUS emerged as a central theme in the Mitigation Action and Implementation Work Programme (MWP).
4. **Industry Spotlight:** Recognition of CCS applications across diverse sectors by the Global Decarbonization Accelerator (GDA).
5. **Innovative Solutions:** The Cement and Concrete Breakthrough initiative underscored the pivotal role of CCS in emissions reduction.
6. **Youth Engagement:** New avenues for youth involvement as CCS technologies evolve.

Demystifying CCS & CCUS: A Primer

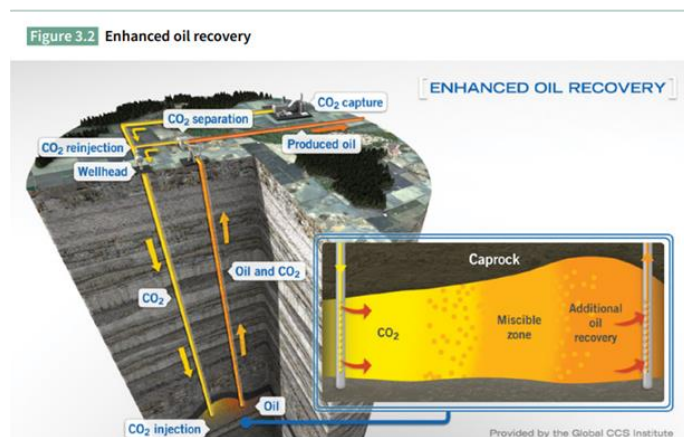
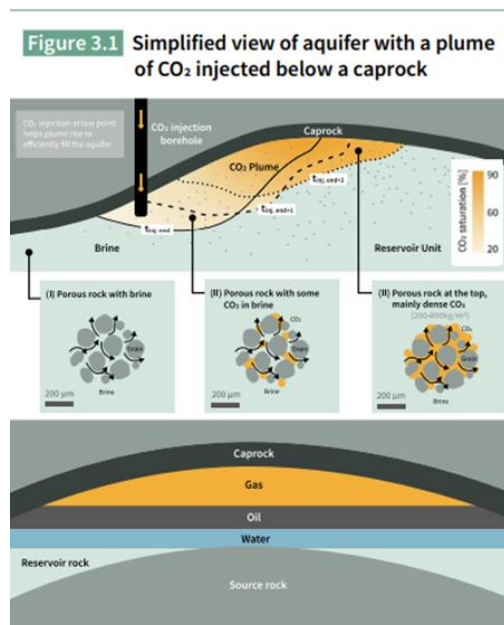
CCS and CCUS are not just buzzwords; they are the technologies that allow us to capture CO₂ emissions from significant sources and either store them or convert them into useful products, thus reducing our carbon footprint. The point of capture is usually from a large emission source such as power generation or industrial facilities. The CO₂ captures is then

compressed and transported by pipeline, ship, rail or truck to be used in a range of applications or to be stored in underground geological formations.



- Storage Solutions

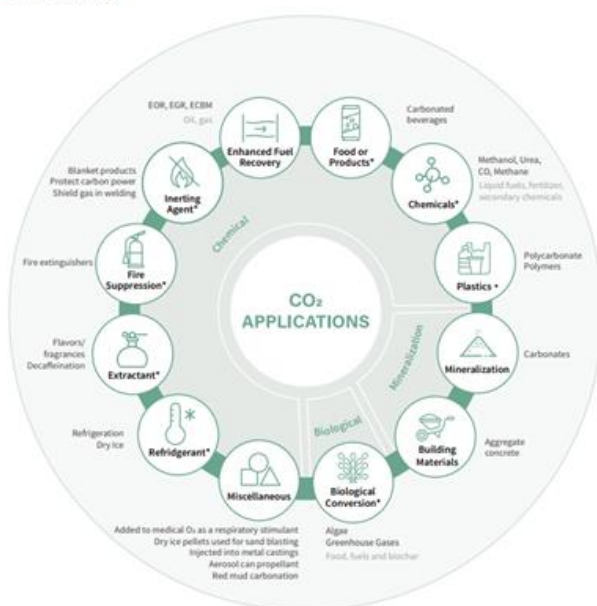
CO₂ is sequestered in aquifers or used in Enhanced Oil Recovery (EOR), preventing its release into the atmosphere. Aquifers are geological formations containing brine/salt water in porous rock and are available all over the world at depths over 1km. The CO₂ injected into the brine will form to a solid carbonate mineral. By binding the CO₂ into aquifer, the CO₂ is trapped in the rocks, which minimized the CO₂ in the atmosphere. Meanwhile, enhanced oil recovery (EOR) is a family of techniques to increase the recovery of oil and gas, one of them is by injecting CO₂ into the well at pressure.



- Utilization Pathways

CO₂ is transformed into valuable products through mineralization (Ex: concrete and cement), biological processes (Ex: biochar), or chemical applications (Ex: polymer products), offering economic and environmental benefits.

Figure 5.1 CO₂ applications



Spotlight on Global CCS/CCUS Projects

- The Sleipner CCS Project, Norway

A pioneering initiative operational since 1996, demonstrating the viability of CCS technology by injecting millions of tons of CO₂ into porous sandstone formations. This initiative marks the inception of the world's inaugural large-scale industrial CCS project aimed at mitigating carbon emissions. CO₂ injection commenced on September 15, 1996, and achieved a significant milestone by surpassing two decades of continuous operation in 2016. During this period, a remarkable total of 16 million tons of CO₂ were effectively injected into the Utsira Sandstone reservoir. Situated within the vast and highly permeable sandstone layers, enriched with saltwater (aquifer), this location serves as a natural repository for CO₂. The injected CO₂ is securely confined beneath an extensive 800-meter-thick layer of overhead rock, ensuring its retention and preventing its release into the atmosphere.



- The Gorgon CCS Project, Australia

Despite challenges, such as water ingress and corrosion risks, the Gorgon project exemplifies the complexities of large-scale CCS implementation, striving to meet ambitious CO2 injection targets. The Gorgon CCS Project in Australia, led by Chevron and The Gorgon Project capturing CO2 emissions from offshore fields, separating them at the Gorgon Liquefied Natural Gas Plant, and subsequently injecting them more than 2 kilometers underground beneath Barrow Island.

However, the project has encountered challenges in meeting its targets. Despite injecting 2.7 million tonnes of CO2 in 2019-2020, followed by 2.2 million tonnes in 2020-2021, and 1.6 million tonnes in 2021-2022, the project has fallen short of its annual target of 4 million tonnes. Several issues contribute to this underperformance, including excess water infiltration into pipeline and injection well facilities, posing corrosion risks that could potentially delay the project by three years.

Furthermore, the disposal of water pumped to the surface, which contains solids, gas, and oil, presents a significant challenge. Chevron has announced plans to address these issues by undertaking substantial drilling work to enhance the project's efficiency and mitigate operational challenges. This is a setback and further endangers biodiversity around the island.



CCS/CCUS in Indonesia

Indonesia's Director of Ministry of Energy and Mineral Source revealed that there are currently 15 projects in development in Indonesia. These projects have a total capacity of 4.31 giga tonne CO₂. Pertamina, Indonesia's state-owned oil and natural gas corporation, states its readiness to become Indonesia's main player in the CCS/CCUS technology. Oki Muraza as the Senior VP of Research and Technology Innovation at Pertamina, during COP 28 stated: "There are 400 giga tonnes potential CCS capacity and 60 million tonnes (Mtpa) business capacity in Indonesia ". He also stated there are two locations in Borneo, four in Java, and two in Sulawesi currently in its feasibility phase.

- **Ministry of Energy and Natural Resources Regulation No.2/2023: Oil and Gas Sector Innovations**

This regulation is specific for companies in the Oil and Gas Sector. It emphasized the importance of environmental safety, economic viability, technological and operational aspects. This regulation also provides a clear set of guidelines for capturing carbon emissions, transportation, and storage within geological formations, ensuring the safe and permanent reduction of greenhouse gasses. Through CCUS, the regulation facilitates increased recovery rates in oil and gas extraction, merging environmental initiatives with production efficiency.

- **Presidential Regulation No. 14/2024: Setting a National CCS Framework**

Unlike the Ministry Regulation, this regulation expands the focus beyond the oil and gas sector, setting a national framework for CCS activities across various industries. This regulation recognizes the role that CCS can do to reduce carbon emissions, especially across all sectors, aligned with the NDC under the Paris Agreement. It also aims to attract both domestic and international funding and expertise in CCS Projects.



Looking Ahead: A Call to Action

The advancements in CCS/CCUS technologies, coupled with the outcomes of COP 28, provide a roadmap for accelerating climate action. By learning from existing projects and fostering international cooperation, we can harness the full potential of these technologies to combat climate change.

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