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Response to 'Request for Information California Carbon Management Hub (25-ERDD-01)'

To whom it may concern,

We, CARBONCO Pte Ltd, hereby submit our response to the Request for Information California Carbon Management Hub (25-ERDD-01)

Additional submitted attachment is included below.

CARBONCO

Response to Carbon Management Hub Request for Information

1. Interest in Partnerships and Contribution to a Carbon Management Hub

CARBONCO, as a reputable carbon capture technology provider based on its proprietary post combustion carbon capture system as well as its proprietary amine solvent, is dedicated to collaborating with the California Energy Commission (CEC) and other entities to secure DOE funding and establish a carbon management hub in California. Our strength lies in our accumulated expertise in post-combustion carbon capture, which has led to the development of proprietary amine-based solvent and the successful deployment of a commercial-scale carbon capture system that has been operating for over a decade.

Drawing on this extensive experience, CARBONCO can deliver optimized carbon capture solutions and process designs tailored to the unique requirements of potential point source emitters utilizing the carbon management hub. By offering cost-effective and highly competitive solutions, we aim to alleviate the financial burden on regional emitters, promote broader adoption of CCS initiatives, and serve as an aggregator for diverse stakeholders.

Currently, CARBONCO plans to apply for the 'Point Source Carbon Capture Large-Scale Pilots, Commercial Demonstrations, and Networked Demonstration Commercialization' funding opportunity (DE-FOA-0003473) focusing on the Topic Area (TA) 1b, CCUS Demonstration at an Industrial Facility not Purposed for Electric Generation. In collaboration with a California-based emitter, we intend to capture over 95% of CO2 emissions from steam generators at their facilities, with permanent storage in nearby depleted oil wells. This initiative aligns with California's objectives of maintaining stable energy production while reducing carbon emissions.

CARBONCO's expertise in developing tailored solvent technology and designing efficient capture systems uniquely positions us to contribute significantly to the establishment of a robust carbon management hub in California.

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2. Preferred State-Level Support

We believe the following state-level support measures will significantly enhance the success of carbon management efforts:

- **Facilitation of Networking Opportunities**: Supported by California's unique decarbonization policies, such as the Cap-and-Trade Program, the state boasts

numerous stakeholders with exceptional technical expertise and capabilities. Identifying contact points within this pool or organizing networking events would enable CARBONCO and other entities to establish valuable partnerships and drive CCS initiatives forward.

- **State-Level Grants Supporting Carbon Capture Projects Across the Project Lifecycle**: For our ongoing project, which aims to capture CO2 emissions and store it permanently in the same location in California, state-level financial support is essential. Providing non-federal cost sharing, such as tax credits or cash grants, would complement DOE funding and significantly enhance the feasibility of the project. This type of support is particularly viable for California-based initiatives, given the state's commitment to carbon neutrality and its robust policy framework. By reducing upfront financial risks, these grants would accelerate project development and ensure alignment with state and federal carbon management objectives.

These support measures would enable CARBONCO and other stakeholders to overcome early-stage challenges, foster collaboration within the state, and enhance the viability of carbon management hubs in California.

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3. Technology Readiness and Project Details

CARBONCO's post-combustion carbon capture technology has achieved TRL 9+, with successful commercial applications worldwide. Key project details include:

- **Annual Carbon Capture Capacity**: Up to 700,000 tonnes of CO2 per year from steam generators at Bakersfield sites.
- **Development Stage**: The project is in the pre-FEED (Preliminary Front-End Engineering and Design) stage.
- **Co-Benefits**: The initiative will significantly reduce the carbon footprint of the entire region, contributing to California's carbon neutrality goals.
- **Permanent Storage**: High-purity CO2 will be stored in depleted oil wells, enhancing California's carbon sequestration infrastructure.

These outcomes demonstrate the scalability and practicality of CARBONCO's technology within a carbon management hub framework.

4. Current and Anticipated Challenges

CARBONCO has identified the following challenges in scaling CCS technologies within a hub-based approach:

- **Funding**: Addressing construction and operational cost barriers through incentives and public-private partnerships.
- **Infrastructure Development**: Overcoming the resource-intensive nature of CO2 transportation and storage infrastructure.
- **Regulatory Navigation**: Streamlining compliance with California's rigorous regulatory frameworks.
- **Community Acceptance**: Building public trust and awareness of CCS benefits to ensure smooth project implementation.

Anticipated challenges include securing long-term offtake agreements for CO2 storage and addressing coordination among multiple stakeholders within the hub.

Conclusion

CARBONCO is eager to collaborate with the CEC and other stakeholders to advance this transformative initiative. By integrating advanced carbon capture technology, robust state support, and active community engagement, CARBONCO aims to contribute significantly to California's ambitious carbon neutrality goals. Through our expertise in solvent development and process optimization, we seek to act as an aggregator, enabling regional emitters to adopt CCS solutions effectively and cost-efficiently.

Contact Point

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CARBONCO

Your trusted partner in carbon capture technology

Global developer
creating a better future

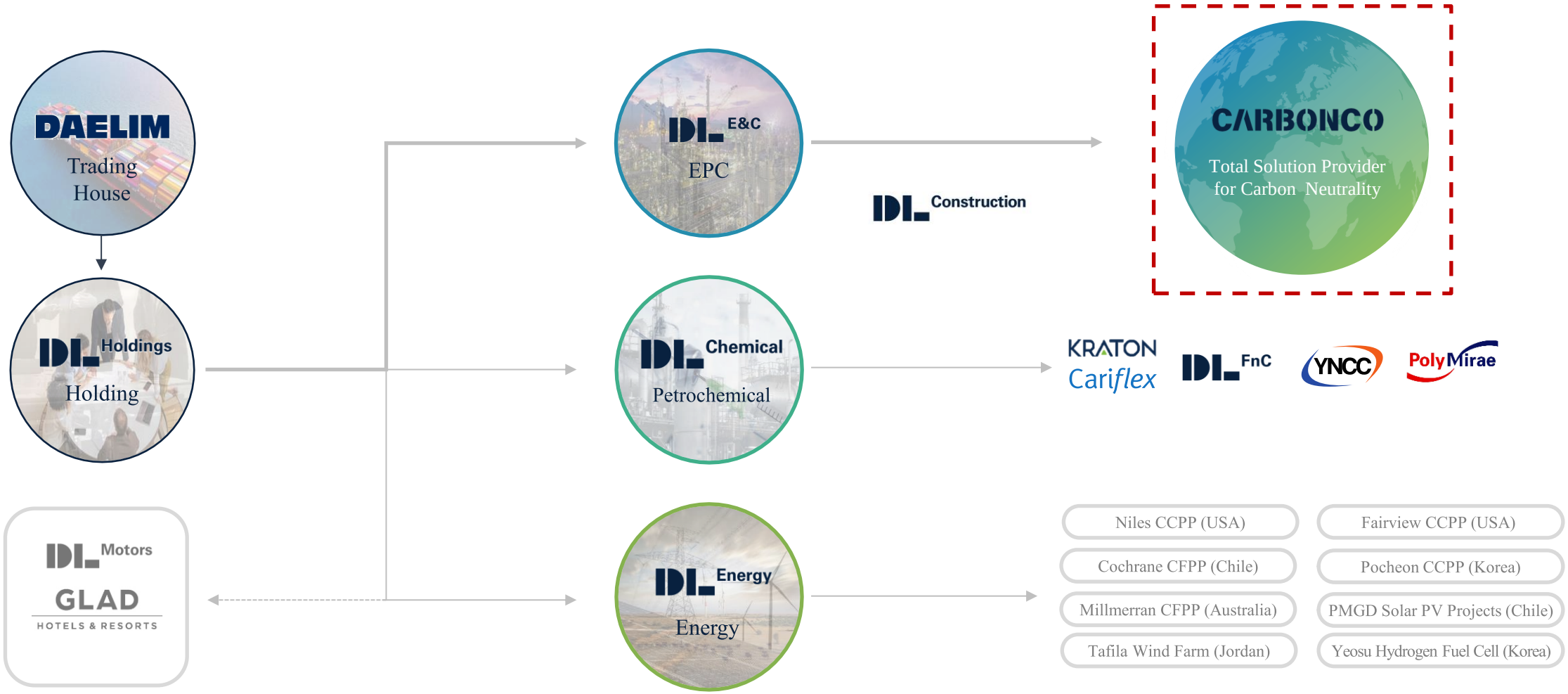
- **Since its inception in 1939, DL Group has stacked up its knowledge, capabilities and technologies in Oil & Gas, Petrochemical, and Power Generation Industry, laying the new foundation of CARBONCO for its dedication to eco-friendly/green business.**

Revenue
18 Bil. USD

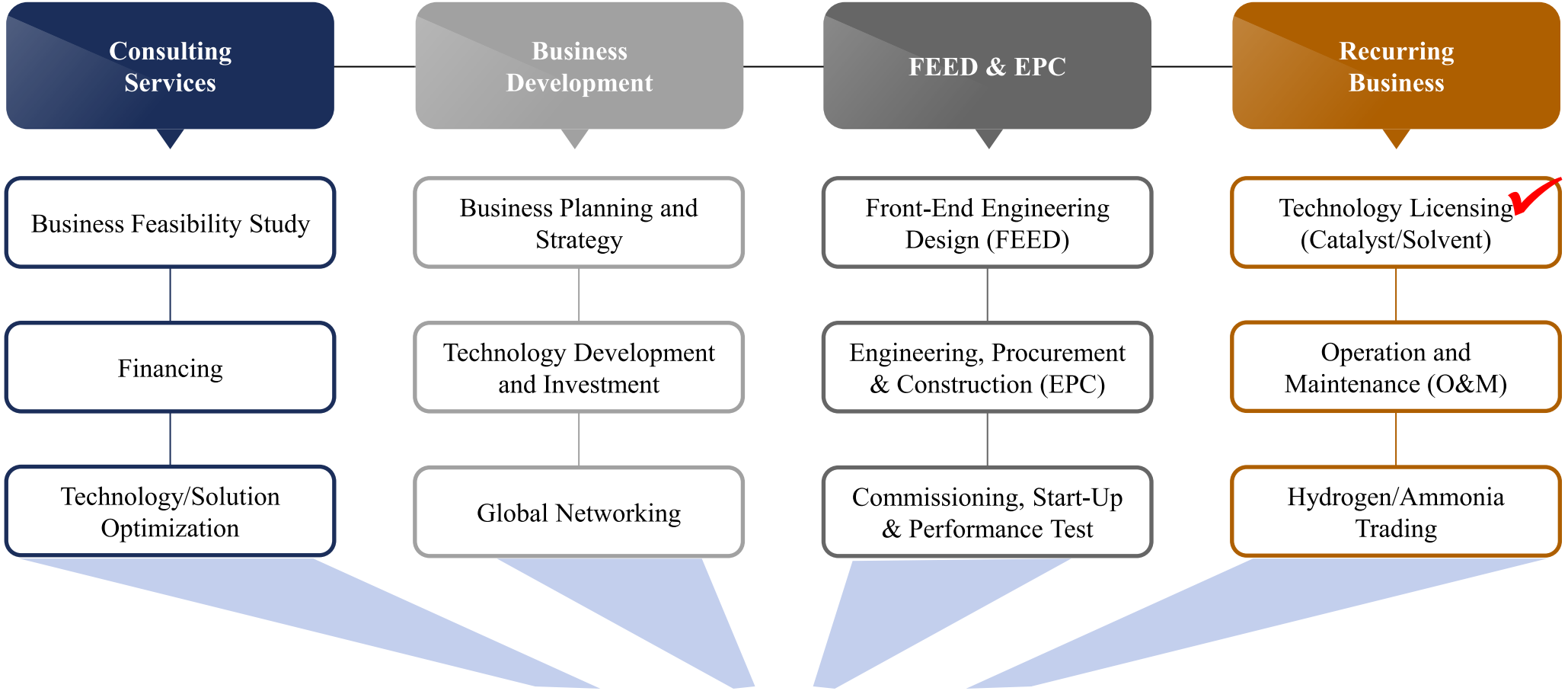
Total Employees
15,000 nos.

Asset
25 Bil. USD

[As of 2023]



- **CARBONCO provides customers with the optimal solution across the entire spectrum of Consulting, Licensing, FEED/EPC, Off-Taking, O&M, and Financing based on DL group's accumulated experience in its proprietary carbon capture technology.**

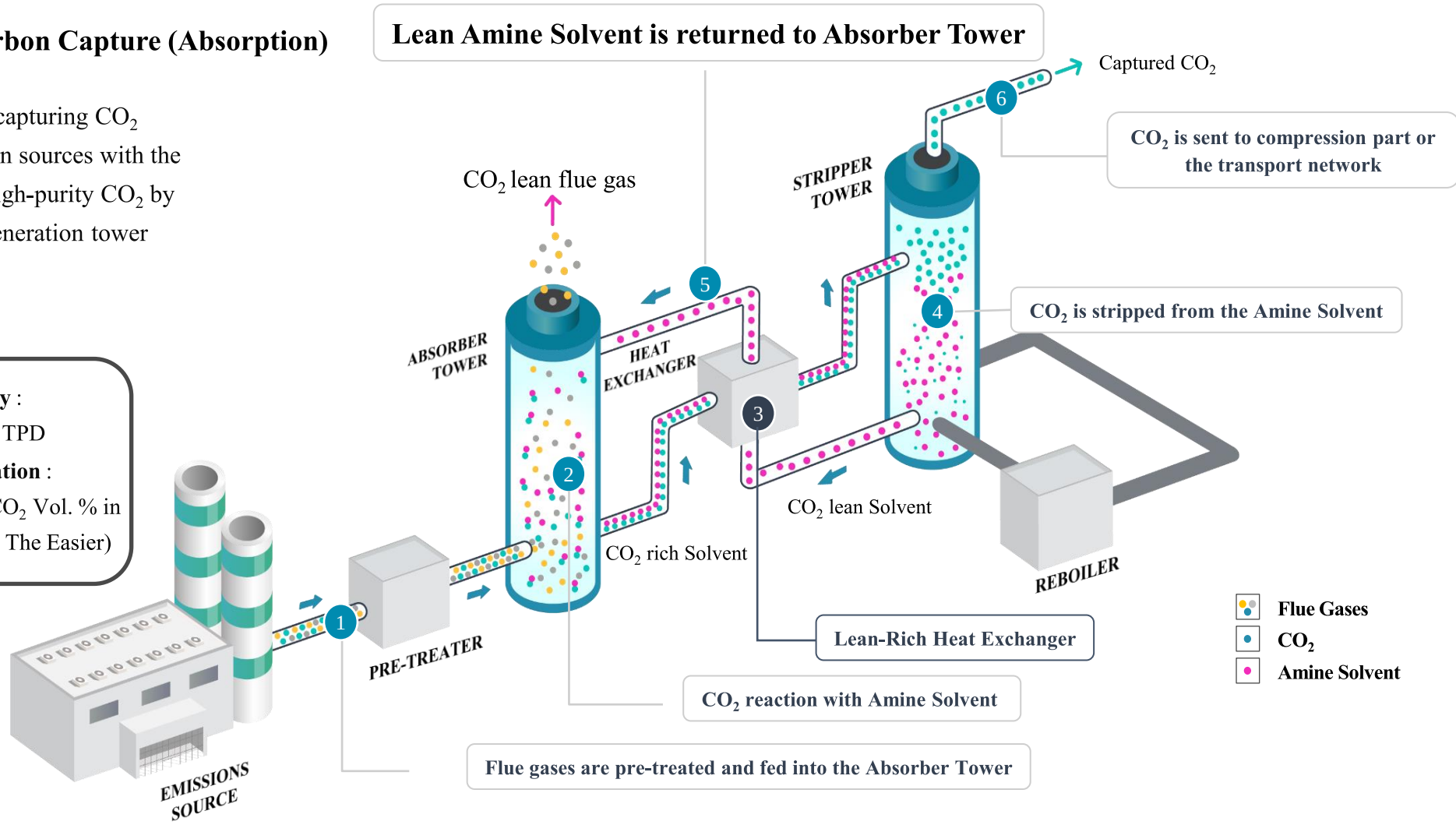


- **As compared to the other technologies, absorption-based carbon capture is an available option to apply to meet various conditions and demands in terms of capture capacities and CO_2 Concentration. It fits into the large-scale of carbon capture, of which contains a low concentration of carbon dioxide.**

Post-combustion Carbon Capture (Absorption)

- Technology for selectively capturing CO_2 in the flue gas from emission sources with the absorbents and collecting high-purity CO_2 by heating with steam in a regeneration tower

- By capacity :
2 TPD ~ 4,000 TPD
- By Concentration :
3% ~ Composition of CO_2 Vol. % in Flue Gas (The Higher, The Easier)



- **With project achievements and scale-up experiences, CARBONCO consistently optimizes its engineering. Customers can benefit from cost-effectiveness solutions provided by CARBONCO's optimized model.**

2002

Dangin-ri Power Plant

Korea's First CO_2 Capture Pilot Plant

- Capacity: 2 t-CO_2/d
- Source: LNG Combustion Gas
- **CARBONCO Role:** **EPC + Commissioning**

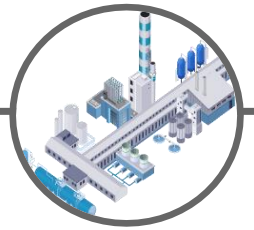
2013

Boryeong Power Plant

- Capacity: 200 t-CO_2/d
- Source: Coal Combustion Gas
- **CARBONCO Role :** **Basic Design**

2014 / 2017 /2023

Large Scale Standard Model



- Capacity: 3000 t-CO_2/d
- Source: Coal Combustion Gas
- Continuous Operation Time of Boryeng Power Plant : 30,000+ hours
- **CARBONCO Role :** **Basic Design / FEED / Detailed Engineering**

Present

Levelized Cost of Carbon Capture (LCOCC)

Development of Next Generation Solvent

Reducing steam consumption

Design Optimization According to Requirements + Minimization of Design Errors + **OPEX Savings Based on New Generation of Solvent**

- **CARBONCO has been co-developing Carbon Capture process utilizing KoSol with Korean government institute, KEPCO for commercialization. It has been representatively applied to Boryong CCU Plant in South Korea which is being operated over a decade since 2013.**

  - **Amine-Based CO_2 Capture Facility**

Project	Boryeong CCU Plant (2013)
Operation	10+ years in operation
Solvent	KoSol (Korea Solvent)
Capacity	200 TPD (70,000TPA)
Commercial	The First and Largest Size of Amine-Based Carbon Capture Facility in Korea
Participants	DL E&C, CARBONCO, KEPCO, KOMIPO 한국중부발전

Process Development

Development of optimized process
Basic design and process improvements
Research on large scale-up

+

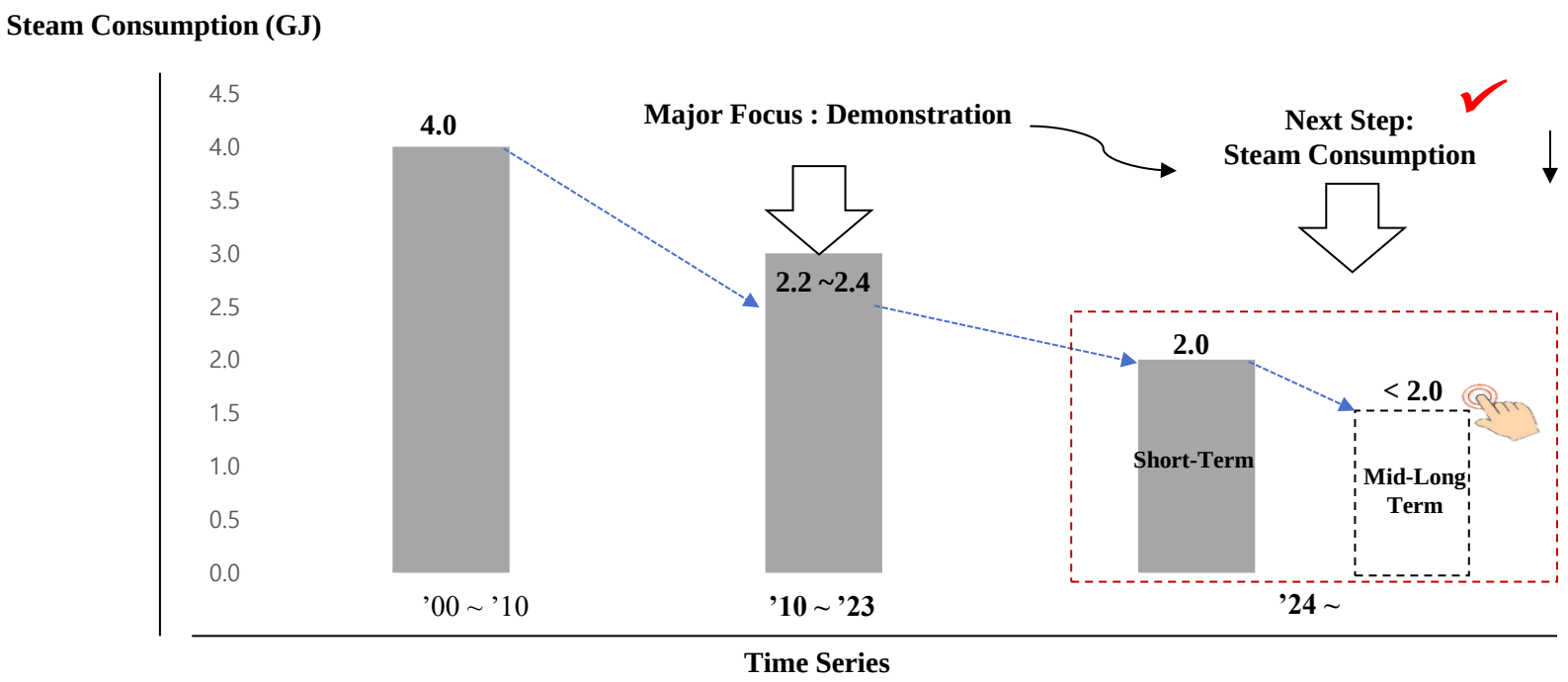
Optimized Operation

Long-term operational data for KoSol
Performance and flexibility on scenario
Compilation of Lessons Learned

- **As compared to the conventional MEA solvent, the current generation of technology consumes less steam and electricity, both of which significantly impact the final levelized cost.**
- **To enable and entice the CCS business in the industry, development of next generation is now inevitable and critical to survive.**

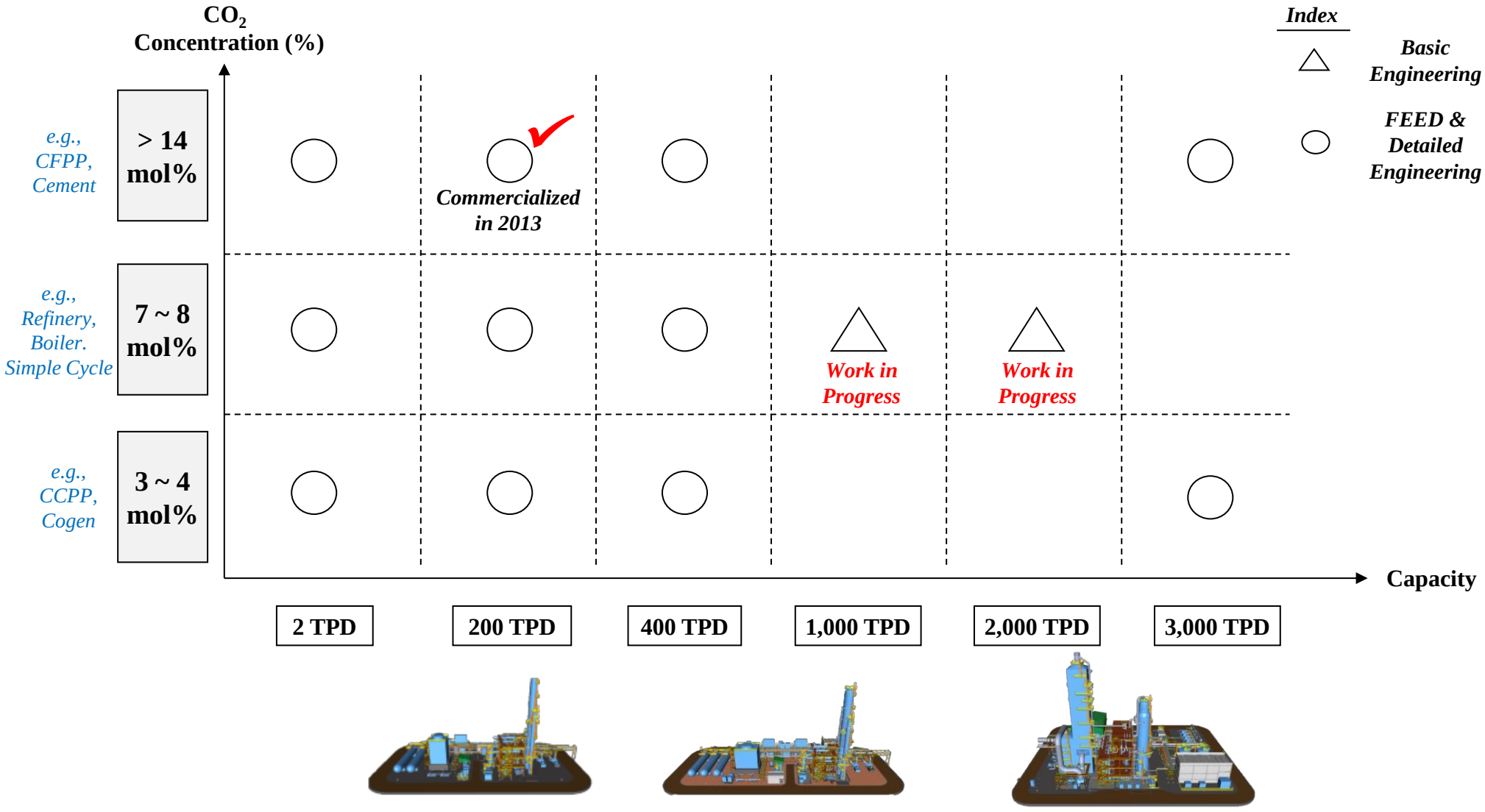
Technology Development Trend Chart

- Since the inception of solvent development, post-combustion carbon capture (PCCC) is majorly focused on its demonstration. **However, competitive figures in terms of energy consumption is now a critical to ignite the CCS market to push forward.**

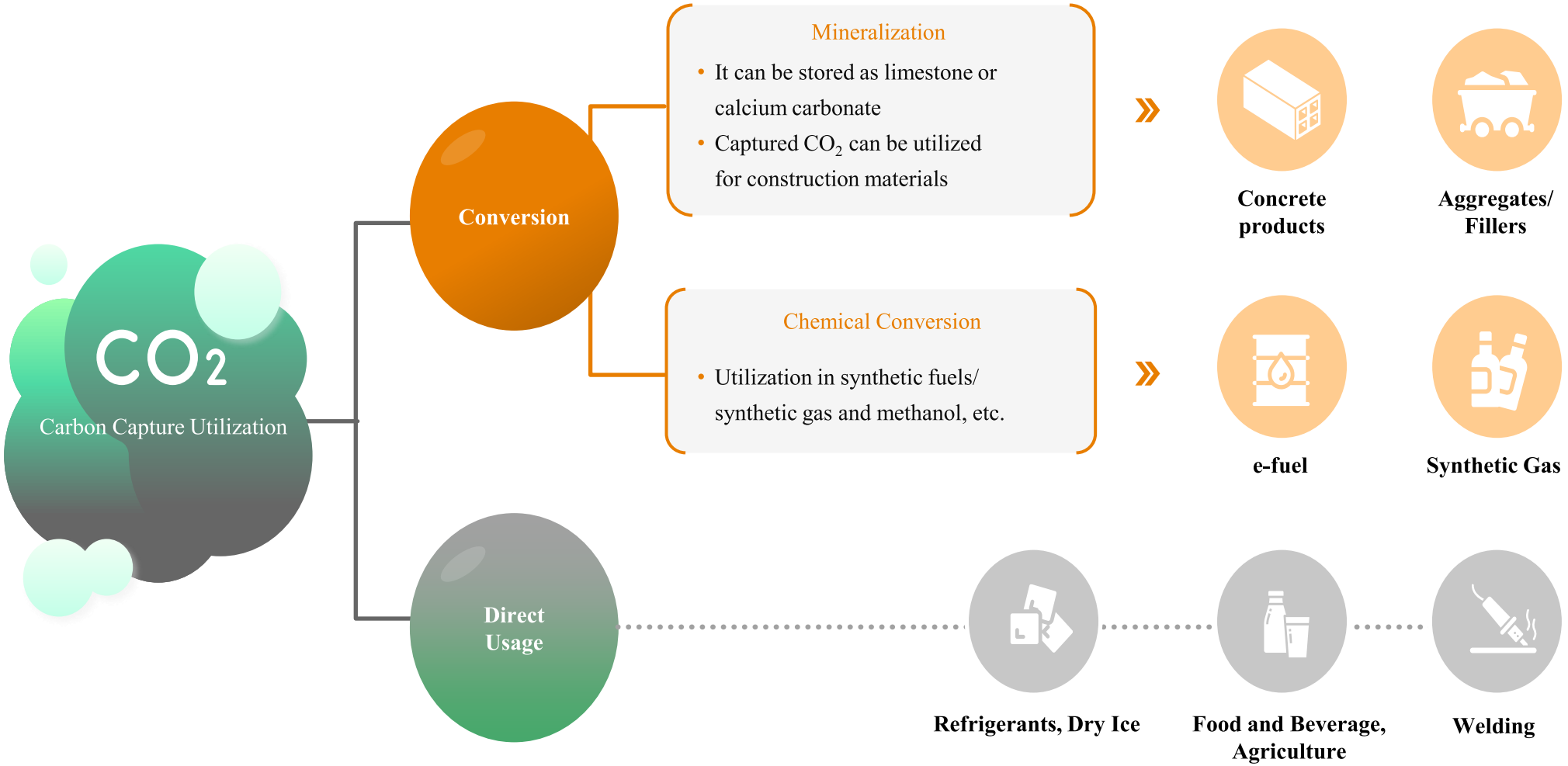


※ *Steam Consumption Analysis is based on the test of Coal-Fired Power Plant of which has 14% of CO_2 concentration*

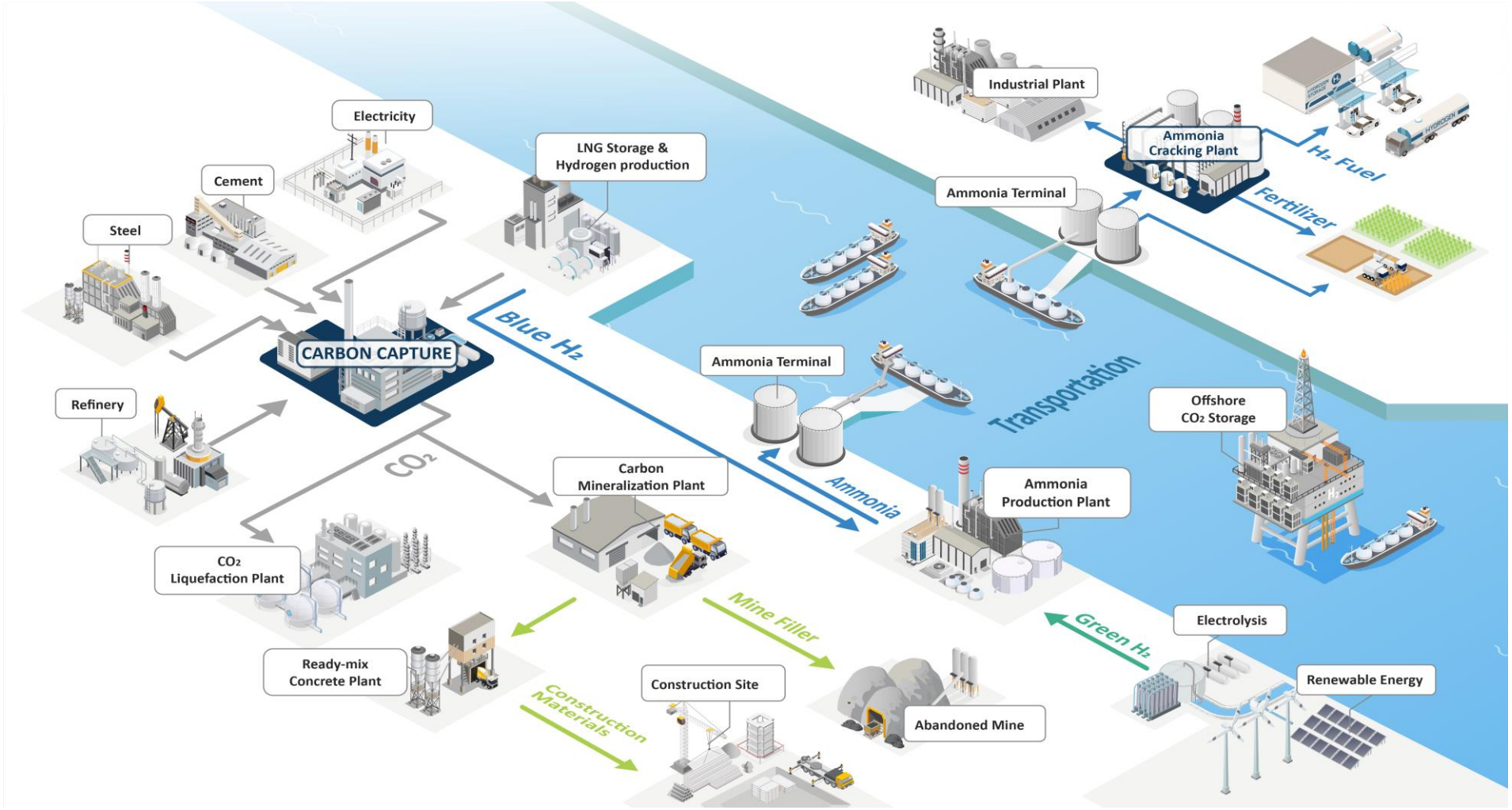
- **By combing through the various demands from customers around the world, CARBONCO successfully secures its own optimal engineering standardized model (CO_2 Concentration x Capacity) to abridge the duration and diminish the costs.**



- **CARBONCO provides key technology solutions covering the entire hydrogen/ammonia value chain for the production and sale of clean energy.**



- **Proposes an overall value chain for the hydrogen/ammonia business, incorporating CCUS technologies based on its extensive expertise and lessons learned from previous experiences.**
- **Assumes the role of an off-taker and distributor for clean hydrogen/ammonia, leveraging its proprietary ammonia cracking technology and established distribution network in Asia.**

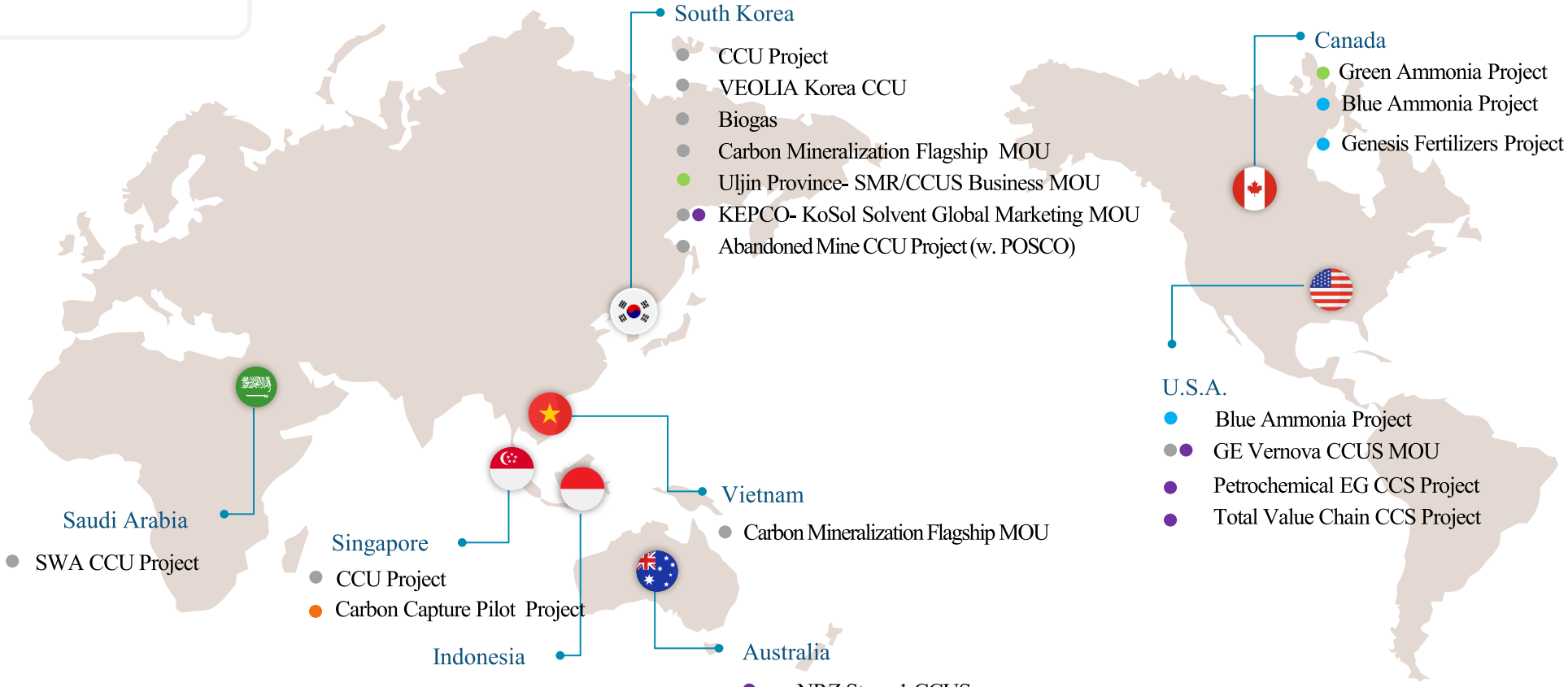


Global Ongoing Project /Partnership

Type: CCU · CC · CCS · Green Hydrogen/Ammonia · Blue Hydrogen/Ammonia

Major Ongoing · Potential Projects

MOU Partnership



South Korea

- CCU Project
- VEOLIA Korea CCU
- Biogas
- Carbon Mineralization Flagship MOU
- Uljin Province- SMR/CCUS Business MOU
- KEPCO- KoSol Solvent Global Marketing MOU
- Abandoned Mine CCU Project (w. POSCO)

Canada

- Green Ammonia Project
- Blue Ammonia Project
- Genesis Fertilizers Project

U.S.A.

- Blue Ammonia Project
- GE Vernova CCUS MOU
- Petrochemical EG CCS Project
- Total Value Chain CCS Project

Saudi Arabia

- SWA CCU Project

Vietnam

- Carbon Mineralization Flagship MOU

Singapore

- CCU Project
- Carbon Capture Pilot Project

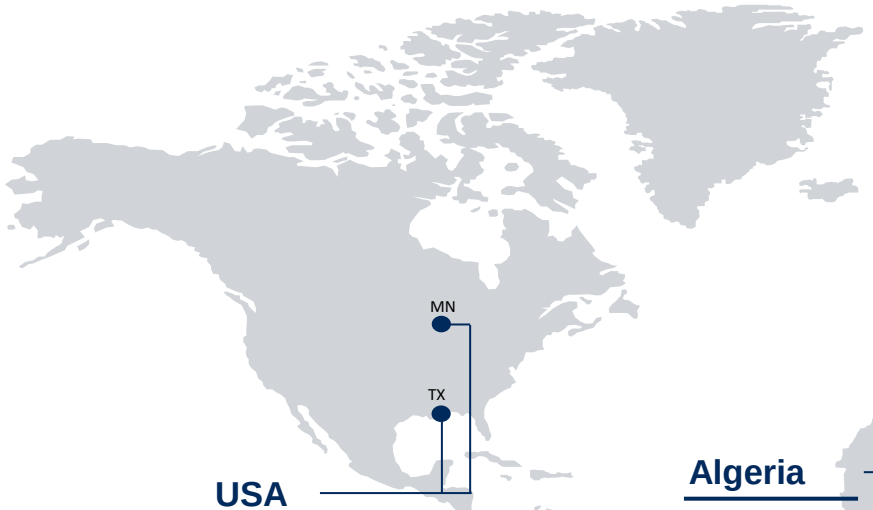
Indonesia

- Blue Ammonia Project
- GE-bp-PLN-JAWA1 CCS Project
- Steel Mill CCS F/S (w. POSCO)

Australia

- NRZ Stage 1 CCUS
- NRZ CCS Stage 2
- South Australia Hydrogen Development MOU
- Drivetrain Australia CCS Business MOU
- CIP Green Ammonia Project

Global Experience (incl. DL E&C)



Russia
- Kursk Fertilizer FEED
- Moscow Refinery - HCU
- EuroChem 8,000 t/d Methanol
- Omsk Refinery Modernization
- Vysotsky LNG
- Baltic Gas Complex PE_LAO

India
- Haldia PP/HDPE
- Mathura Refinery DHDT
- Panipat Refinery Hydrocracker

Pakistan
- Gulphur Hydropower

China
- BASF Chongqing MDI
- BASF Shanghai Integrated Isocyanate (IIP)
- BASF / YPC Integrated Petrochemical Project

Korea
- BASF Yeosu MDI / TDI
- HPC Polycarbonate
- YNCC No.2 NCC Revamping
- LG No.2 Complex L Project
- Daelim mPE Project
- Daelim EPO Revamping
- Hanbit SGR Nuclear Power Plant #5, #6
- S-OIL (Aramco) RUC
- Hyundai Oilbank Heavy Oil Upgrade Complex
- LG Chemical ABS
- S-OIL (Aramco) Shaheen TC2C / U&O

USA
- CPChem USGC-2 Project
- Formosa Sunshine PP FEED
- Niles CCPP Project (Owner)
- Lubrizol HRPB (Technology Licensing)
- Hankook Tire Plant

Algeria
- Kais CCPP Project

Egypt
- Midor Oil Refinery

Saudi Arabia
- Ma'aden Ammonia-II, III
- SAMAPCO CA-EDC
- SADARA Isocyanate
- CPChem NCP
- Jubail Export Refinery
- Yanbu Export Refinery
- Petrorabigh Petrochem Complex
- Saudi Kayan Petrochem Complex
- Kemya Elastomers
- Sahara PDH-PP Project
- Sabuco Butanol & Syngas

Kuwait
- LPG Train-4 Project
- KOC Telemetry System
- KNPC SHFP Project

Oman
- Sohar Refinery Improvement Project

Vietnam
- Omon 330MW Gas Fired Power Plant
- Thai Binh 2 1,200MW TPP

Philippines
- Petron Refinery Master Plan II
- JG Summit Petrochemical Complex
- San Buenaventura 500MW Coal Fired Power Plant

Australian
- NRZ, NRUP Ammonia / Urea / CCS

Malaysia
- Malaysia AN/MCN FEED Project
- LG-Petronas NBL (Latex) Project
- Petron ULSADO (Euro-5 Diesel) Project
- TNB Fasttrack 3A USC CFPP

Singapore
- Cariflex IR Latex Project
- New Pitch Gasification Project

Thailand
- Thai ABS Polystyrene
- THPP-2 Project
- NPC-1 Olefins Expansion
- Siam Polystyrene
- Thai Olefin Project

Indonesia
- ABS Industri Indonesia ABS
- PT. Polyprima Karateksa ABS
- EPS/SAN/ABS Compounding Project

DL E&C & CARBONCO and GE together to Develop Roadmap for Carbon Capture in Gas Power Plants in Asia and Oceania

CARBONCO Signed an MOU With Saudi Arabia's SWA, the World's Largest Seawater Desalination Institution, for the CCUS Project

CARBONCO and Genesis Fertilizers LP are working for capturing approximately 1 million tonnes of CO2 from Genesis Fertilizer facility

CARBONCO with GE Vernova, bp, PLN Nusantara, & Jawa1 to develop CCUS Value Chain Feasibility Study in Indonesia

DL E&C to Advance to Global Marketing Using Korea-Developed CCUS Technologies

Signed MOU with Jeju Energy Corporation, Gaoncell, and ThyssenKrupp to join Jeju Island Green Methanol Production Project

- **The 5-parties (GE-bp-CARBONCO-PLN-JWP) have assembled to identify the tangible opportunity to deploy the cutting-edge technology of carbon capture and for the contribution to step forward toward the Indonesian government and related entities' Net-Zero target.**

Key Milestones

- ***[July 2023]*** SOW Clarification
- ***[Aug. 2023]*** Potential Emitter & Government
- ***[Sep. 2023]*** MOU Signing Ceremony
- ***[July 2024]*** **Pre-F/S Complete** ✔
- ***[2025]*** F/S Complete
- ***[~2030]*** EPC & COD

GE Vernova, CARBONCO, bp, PLN Nusantara and Jawa 1 to develop CCUS feasibility study in Indonesia

By Energy Connects

Sep 11, 2023

- **CARBONCO and Genesis Fertilizers are working for implementing a solution capable of capturing approximately 1 million tonnes of CO2 annually from proposed Genesis Fertilizer facility, which would then be transported directly to a CO2 sequestration hub.**

Key Milestones

[Sep. 2024]	Award for Licensor
[Oct. 2024]	License Agreement
[Nov. 2024]	**FEED Commencement** ✔
[4Q. 2025]	FEED Complete
[2Q. 2026]	EPC Commencement
[3Q. 2029]	EPC & COD

End of Presentation

Inquiry : inquiry@carbonco.com